

APPLICATION CERTIFICATION FCC Part 15C

On Behalf of
HMC Holdings, LLC

BLEFOB
Model No.: FWR301

FCC ID: 2AP9FFWR301

Prepared for : HMC Holdings, LLC
Address : 1605 OLD ROUTE 18 STE 4-36, Wampum, Pennsylvania
16157, United States

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Report No. : ATE20191316
Date of Test : September 5-6, 2019
Date of Report : September 9, 2019

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Test Report Certification

Applicant : HMC Holdings, LLC
Manufacturer : HMC Holdings, LLC
EUT Description : BLEFOB
Model No. : FWR301
Trade Mark : n.a.

Measurement Procedure Used:

FCC Rules and Regulations Part 15 Subpart C Section 15.247 ANSI C63.10: 2013

The EUT was tested according to DTS test procedure of August 24, 2018 KDB558074 D01 DTS Meas Guidance v05 for compliance to FCC 47CFR 15.247 requirements

The device described above is tested by Shenzhen Accurate Technology Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C Section 15.247 limits. The measurement results are contained in this test report and Shenzhen Accurate Technology Co., Ltd. is assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the Equipment Under Test (EUT) is to be technically compliant with the FCC requirements.

This report applies to above tested sample only. This report shall not be reproduced in part without written approval of Shenzhen Accurate Technology Co., Ltd.

Date of Test : September 5-6, 2019

Date of Report: September 9, 2019

Prepared by :

(Bob Wang, Engineer)

Approved & Authorized Signer :

(Sean Liu, Manager)

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

Model Number : FWR301
 Bluetooth version : V4.2 (BLE 1Mbps+2Mbps+250kHz)
 Frequency Range : 2402MHz-2480MHz
 Number of Channels : 40
 Antenna Gain(Max) : -2dBi
 Antenna type : Chip Antenna
 Modulation mode : GFSK
 Power supply : DC 3V
 Trade Mark : n.a.
 Applicant : HMC Holdings, LLC
 Address : 1605 OLD ROUTE 18 STE 4-36, Wampum, Pennsylvania
 16157, United States
 Manufacturer : HMC Holdings, LLC
 Address : 1605 OLD ROUTE 18 STE 4-36, Wampum, Pennsylvania
 16157, United States

1.2. Carrier Frequency of Channels

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

1.3.Special Accessory and Auxiliary Equipment

PC	Manufacturer: LENOVO M/N: 4290-RT8 S/N: R9-FW93G 11/08
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1.4.Description of Test Facility

EMC Lab	: Recognition of accreditation by Federal Communications Commission (FCC) The Designation Number is CN1189 The Registration Number is 708358 Listed by Innovation, Science and Economic Development Canada (ISED) The Registration Number is 5077A-2 Accredited by China National Accreditation Service for Conformity Assessment (CNAS) The Registration Number is CNAS L3193 Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 4297.01
Name of Firm	: Shenzhen Accurate Technology Co., Ltd.
Site Location	: 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China

1.5.Measurement Uncertainty

Radiated emission expanded uncertainty (9kHz-30MHz)	: U=2.66dB, k=2
Radiated emission expanded uncertainty (30MHz-1000MHz)	: U=4.28dB, k=2
Radiated emission expanded uncertainty (1G-18GHz)	: U=4.98dB, k=2
Radiated emission expanded uncertainty (18G-26.5GHz)	: U=5.06dB, k=2
Conduction Emission Expanded Uncertainty (Mains ports, 9kHz-30MHz)	: U=2.72dB, k=2
Conduction Emission Expanded Uncertainty (Telecommunication ports, 150kHz-30MHz)	: U=2.94dB, k=2
Power disturbance Expanded Uncertainty	: U=2.92dB, k=2
Harmonic current expanded uncertainty	: U=0.512%, k=2

2. MEASURING DEVICE AND TEST EQUIPMENT

Table 1: List of Test and Measurement Equipment

Kind of equipment	Manufacturer	Type	S/N	Calibrated dates	Cal. Interval
EMI Test Receiver	Rohde&Schwarz	ESCS30	100307	Jan. 05, 2019	One Year
EMI Test Receiver	Rohde&Schwarz	ESR	101817	Jan. 05, 2019	One Year
Spectrum Analyzer	Rohde&Schwarz	FSV-40	101495	Jan. 05, 2019	One Year
Pre-Amplifier	Rohde&Schwarz	CBLU118354 0-01	3791	Jan. 05, 2019	One Year
Loop Antenna	Schwarzbeck	FMZB1516	1516131	Jan. 05, 2019	One Year
Bilog Antenna	Schwarzbeck	VULB9163	9163-323	Jan. 05, 2019	One Year
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-655	Jan. 05, 2019	One Year
Horn Antenna	Schwarzbeck	BBHA9170	9170-359	Jan. 05, 2019	One Year
LISN	Schwarzbeck	NSLK8126	8126431	Jan. 05, 2019	One Year
Highpass Filter	Wainwright Instruments	WHKX3.6/18 G-10SS	N/A	Jan. 05, 2019	One Year
Band Reject Filter	Wainwright Instruments	WRCG2400/2 485-2375/2510 -60/11SS	N/A	Jan. 05, 2019	One Year
RF Coaxial Cable (Conducted Emission)	SUHNER	N-2m	No.2	Jan. 05, 2019	One Year
RF Coaxial Cable (Radiated Emission)	RESENBERGER	N-12m	No.11	Jan. 05, 2019	One Year
RF Coaxial Cable (Radiated Emission)	RESENBERGER	N-0.5m	No.12	Jan. 05, 2019	One Year
RF Coaxial Cable (Radiated Emission)	SUHNER	N-2m	No.13	Jan. 05, 2019	One Year
RF Coaxial Cable (Radiated Emission)	SUHNER	N-0.5m	No.15	Jan. 05, 2019	One Year
RF Coaxial Cable (Radiated Emission)	SUHNER	N-2m	No.16	Jan. 05, 2019	One Year
RF Coaxial Cable (Radiated Emission)	RESENBERGER	N-6m	No.17	Jan. 05, 2019	One Year
Conducted Emission Measurement Software: ES-K1 V1.71					
Radiated Emission Measurement Software: EZ EMC V1.1.4.2					

3. OPERATION OF EUT DURING TESTING

3.1.Operating Mode

The mode is used: **Transmitting mode**

Low Channel: 2402MHz

Middle Channel: 2440MHz

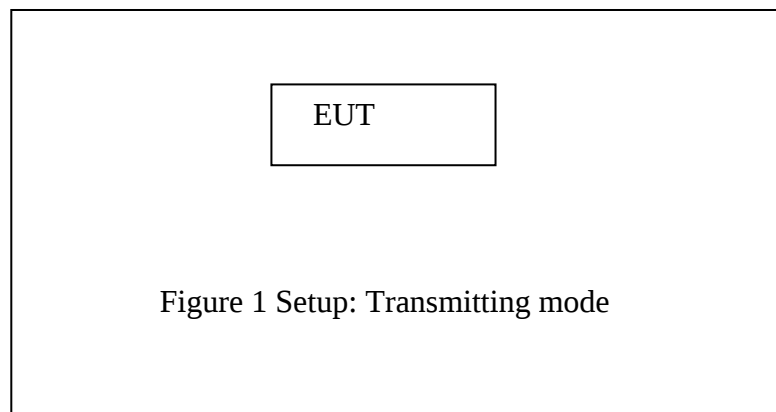
High Channel: 2480MHz

Note: The equipment under test (EUT) was tested under new battery.

The Bluetooth has been tested under continuous transmission mode.

Its duty cycle setting is greater than 98%.

3.2.Configuration and peripherals



4. TEST PROCEDURES AND RESULTS

FCC Rules	Description of Test	Result
Section 15.247(a)(2)	6dB Bandwidth Test	Compliant
Section 15.247(b)(3)	Maximum Peak Output Power Test	Compliant
Section 15.247(e)	Power Spectral Density Test	Compliant
Section 15.247(d)	Band Edge Compliance Test	Compliant
Section 15.247(d) Section 15.209	Radiated Spurious Emission Test	Compliant
Section 15.207	AC Power Line Conducted Emission Test	N/A
Section 15.203	Antenna Requirement	Compliant

Note: The power supply mode of the EUT is DC 3V, According to the FCC standard's requirements, conducted emission is not applicable.

5. 6DB BANDWIDTH TEST

5.1. Block Diagram of Test Setup



5.2. The Requirement For Section 15.247(a)(2)

Section 15.247(a)(2): Systems using digital modulation techniques may operate in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.3. EUT Configuration on Test

The equipment is installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

5.4. Operating Condition of EUT

5.4.1. Setup the EUT and simulator as shown as Section 5.1.

5.4.2. Turn on the power of all equipment.

5.4.3. Let the EUT work in TX modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2440MHz, and 2480MHz TX frequency to transmit.

5.5. Test Procedure

5.5.1. The transmitter output was connected to the spectrum analyzer through a low loss cable.

5.5.2. Set RBW of spectrum analyzer to 100 kHz and VBW to 300 kHz.

5.5.3. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.

5.6. Test Result

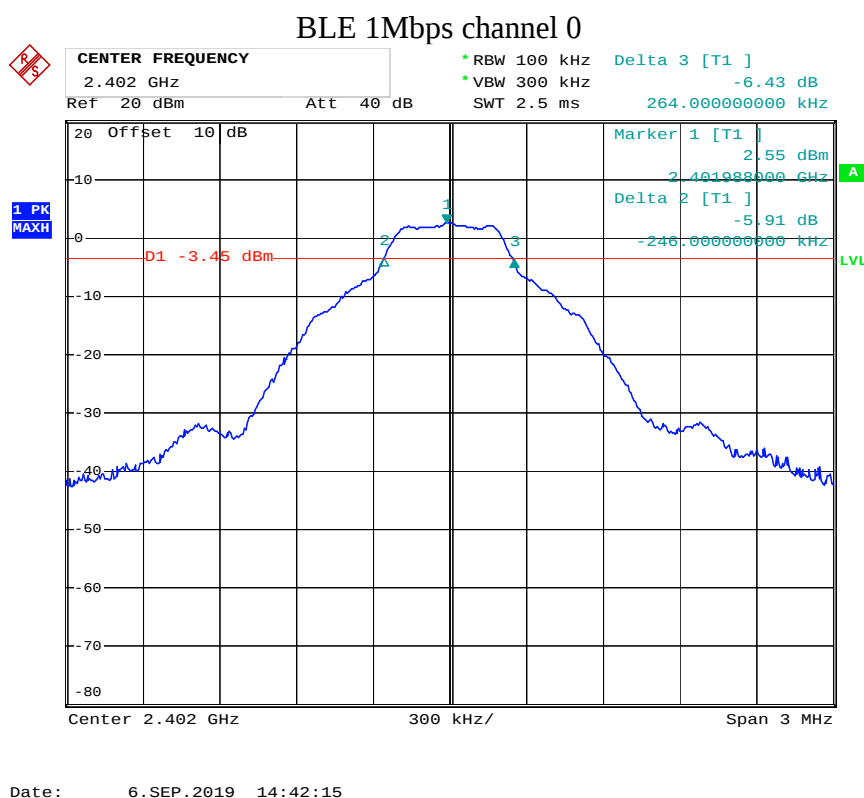
BLE 1Mbps

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit(MHz)	Result
0	2402	0.510	0.5	Pass
19	2440	0.504	0.5	Pass
39	2480	0.504	0.5	Pass

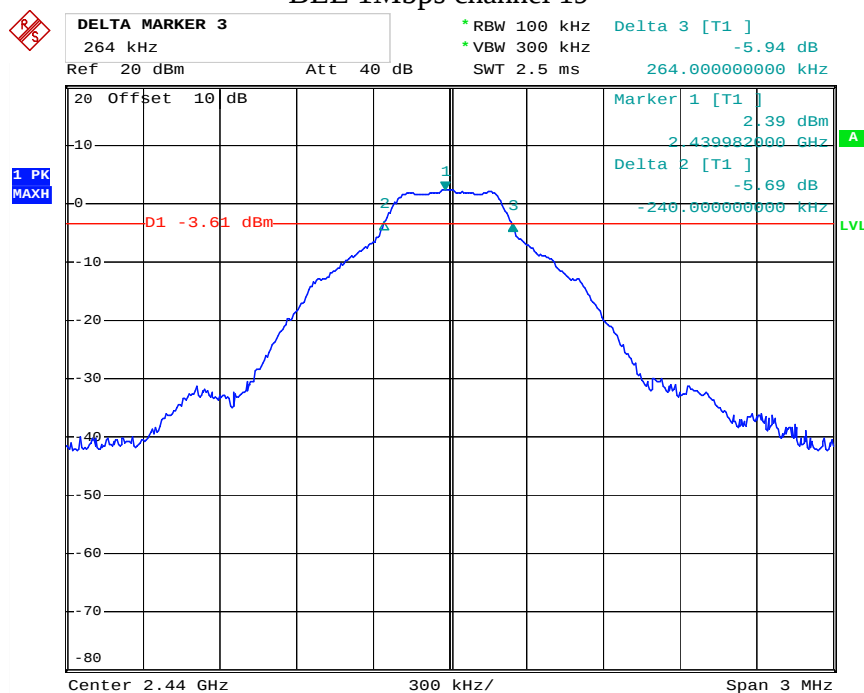
BLE 2Mbps

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit(MHz)	Result
0	2402	0.900	0.5	Pass
19	2440	0.906	0.5	Pass
39	2480	0.906	0.5	Pass

The spectrum analyzer plots are attached as below.

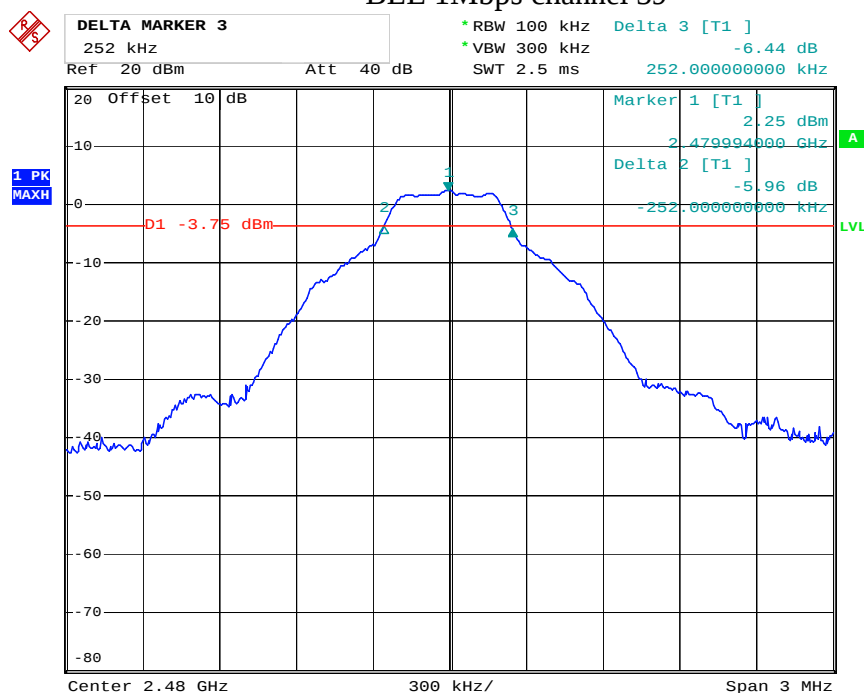


BLE 1Mbps channel 19



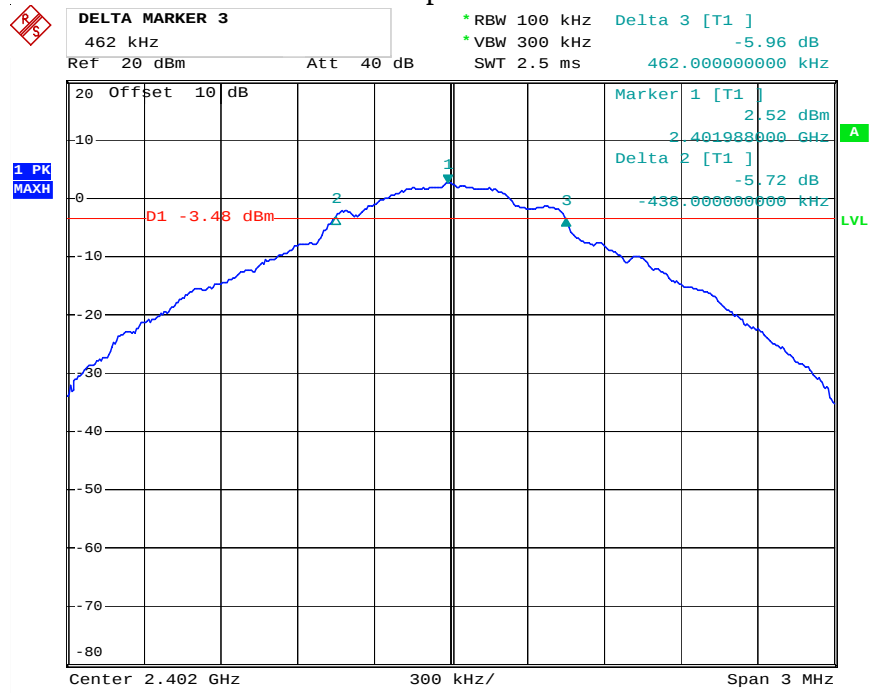
Date: 6.SEP.2019 14:47:18

BLE 1Mbps channel 39



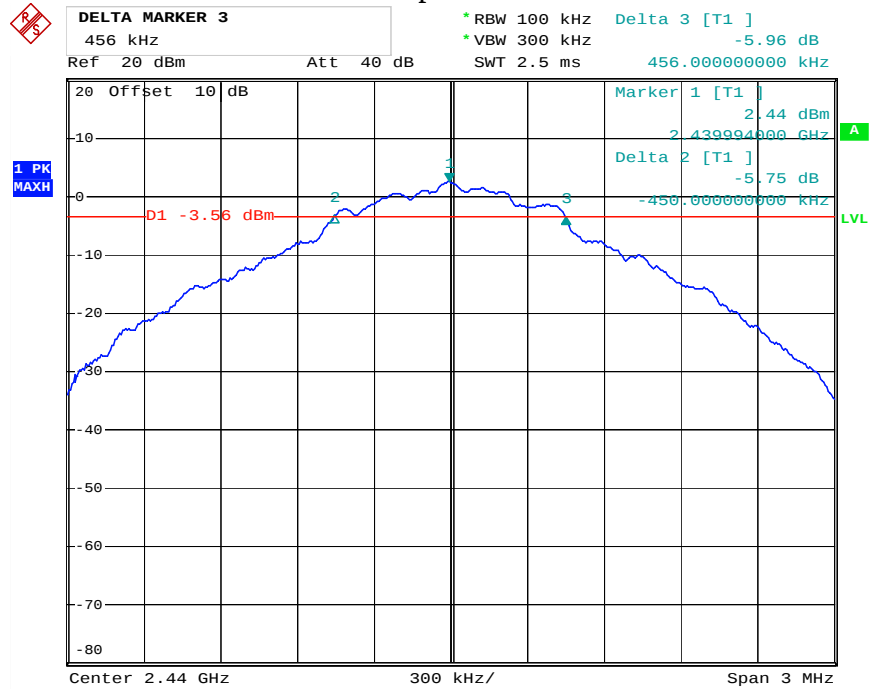
Date: 6.SEP.2019 14:46:03

BLE 2Mbps channel 0



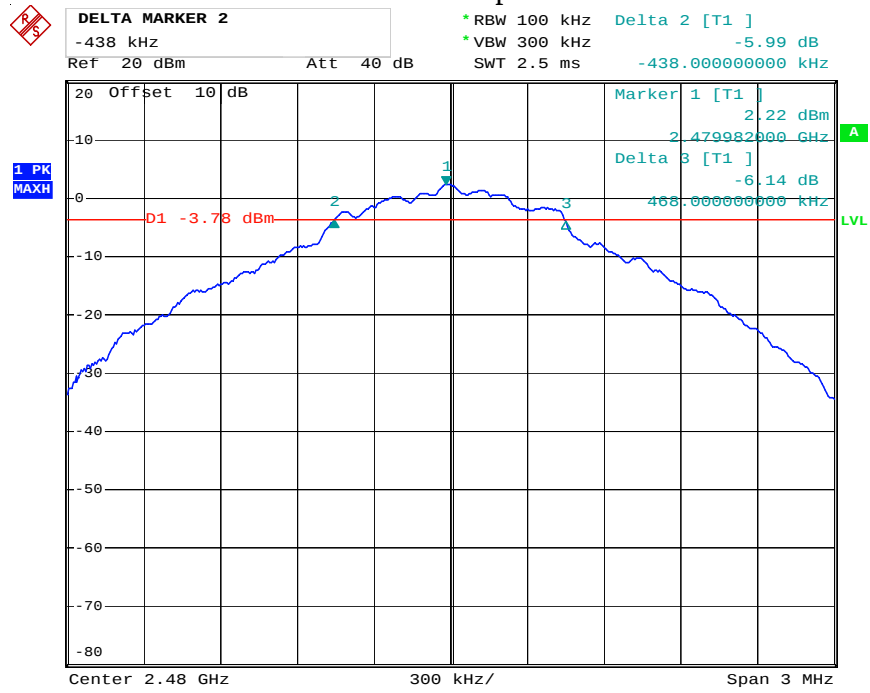
Date: 6.SEP.2019 14:49:16

BLE 1Mbps channel 19



Date: 6.SEP.2019 14:50:59

BLE 1Mbps channel 39



Date: 6.SEP.2019 14:52:10

6. MAXIMUM PEAK OUTPUT POWER TEST

6.1. Block Diagram of Test Setup



6.2. The Requirement For Section 15.247(b)(3)

Section 15.247(b)(3): For systems using digital modulation in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands: 1 Watt.

6.3. EUT Configuration on Test

The equipment are installed on the emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

6.4. Operating Condition of EUT

6.4.1. Setup the EUT and simulator as shown as Section 6.1.

6.4.2. Turn on the power of all equipment.

6.4.3. Let the EUT work in TX modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2440MHz, and 2480MHz TX frequency to transmit.

6.5. Test Procedure

6.5.1. The transmitter output was connected to the spectrum analyzer through a low loss cable.

6.5.2. Set RBW of spectrum analyzer to 1 MHz and VBW to 3MHz(BLE 1Mbps).

6.5.3. Set RBW of spectrum analyzer to 3 MHz and VBW to 10MHz(BLE 2MHz).

6.5.4. Measurement the maximum peak output power.

6.6.Test Result

BLE 1Mbps

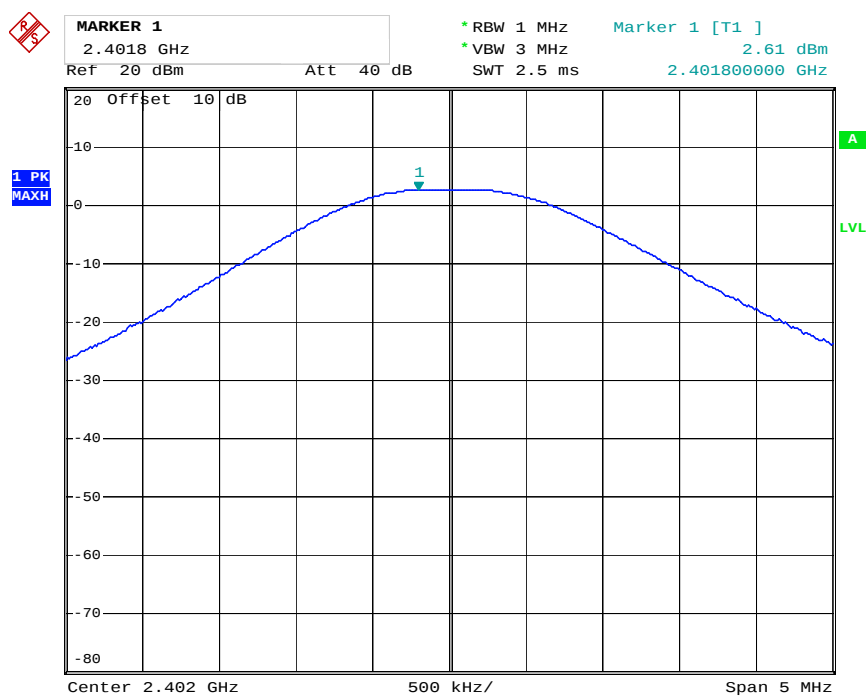
Channel	Frequency (MHz)	Peak Power Output (dBm)	Peak Power Limit (dBm)	Result
0	2402	2.61	30	Pass
19	2440	2.54	30	Pass
39	2480	2.41	30	Pass

BLE 2Mbps

Channel	Frequency (MHz)	Peak Power Output (dBm)	Peak Power Limit (dBm)	Result
0	2402	2.81	30	Pass
19	2440	2.72	30	Pass
39	2480	2.53	30	Pass

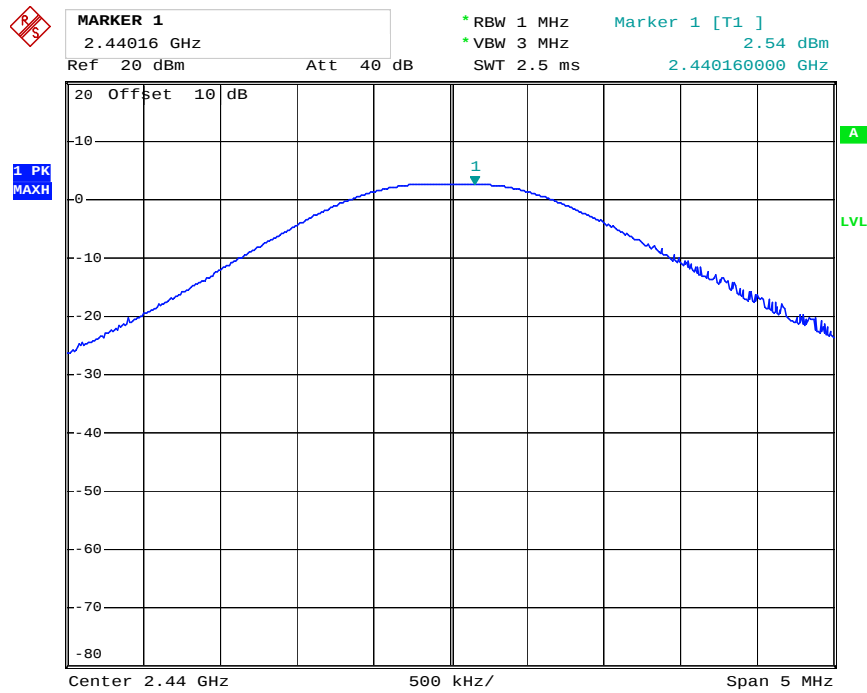
The spectrum analyzer plots are attached as below.

BLE 1Mbps channel 0



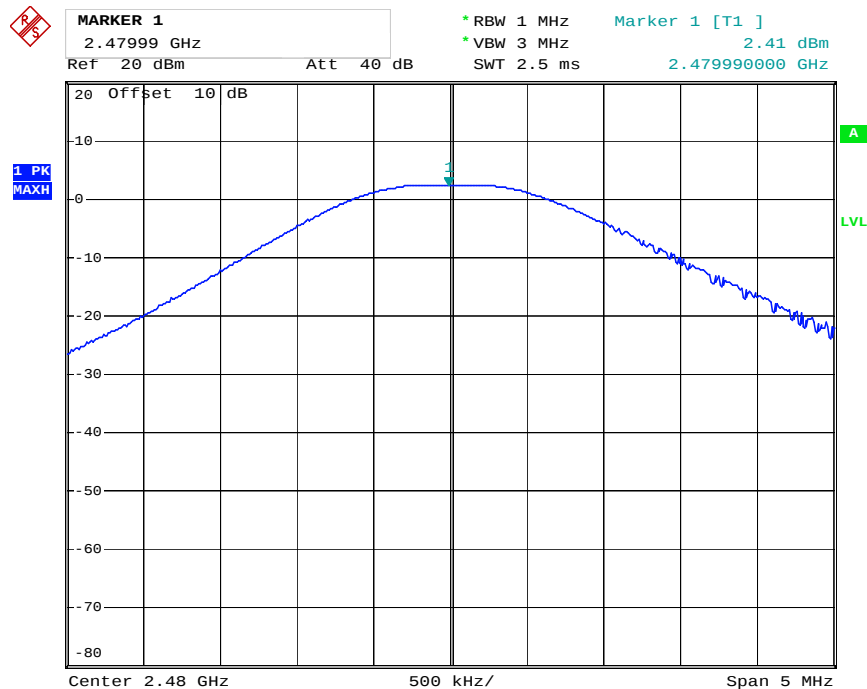
Date: 6.SEP.2019 14:55:55

BLE 1Mbps channel 19



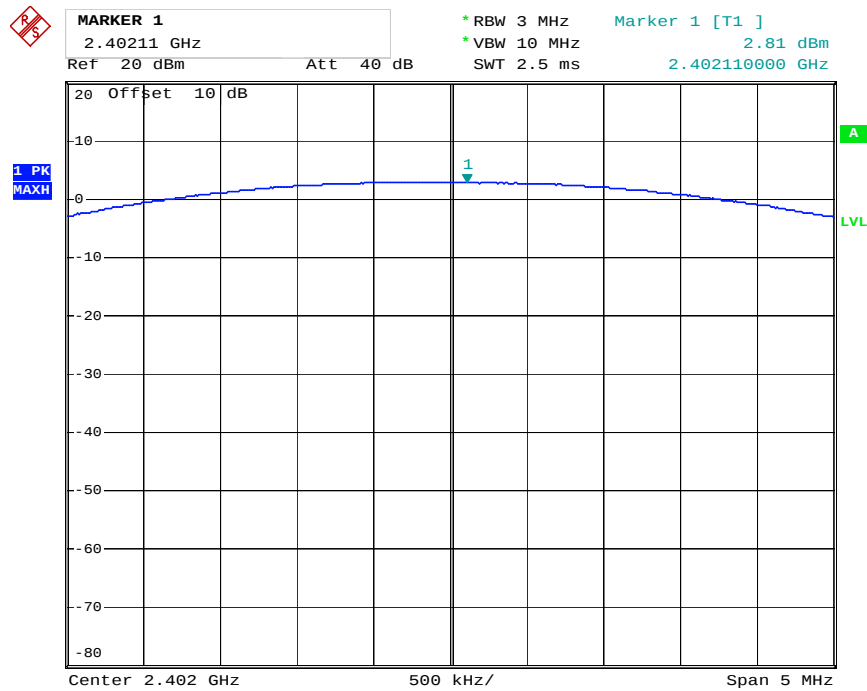
Date: 6.SEP.2019 14:56:29

BLE 1Mbps channel 39



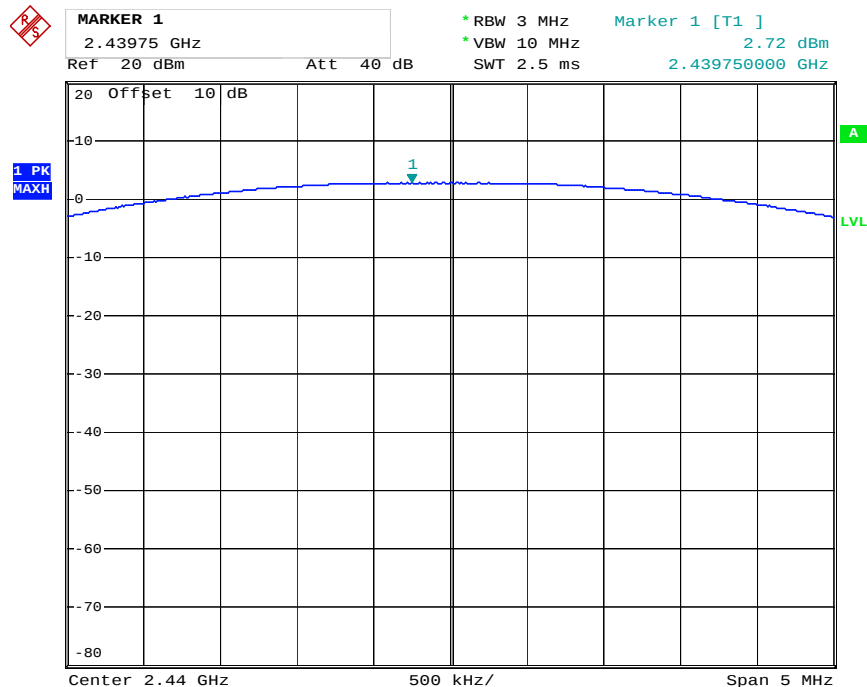
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BLE 2Mbps channel 0



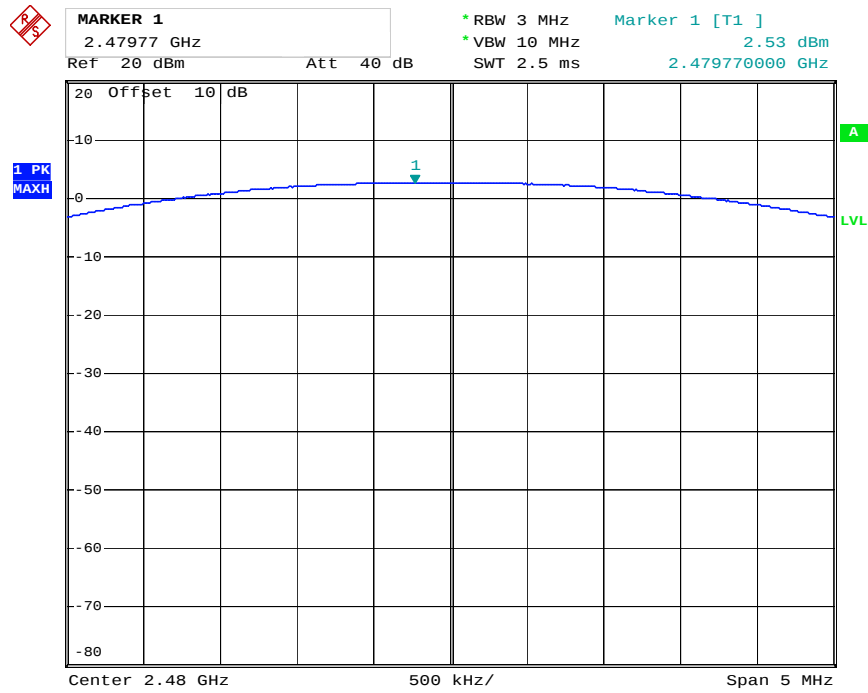
Date: 6.SEP.2019 14:54:38

BLE 2Mbps channel 19



Date: 6.SEP.2019 14:54:08

BLE 2Mbps channel 39



Date: 6.SEP.2019 14:53:25

7. POWER SPECTRAL DENSITY TEST

7.1. Block Diagram of Test Setup



7.2. The Requirement For Section 15.247(e)

Section 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.

7.3. EUT Configuration on Test

The equipment are installed on the emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

7.4. Operating Condition of EUT

7.4.1. Setup the EUT and simulator as shown as Section 7.1.

7.4.2. Turn on the power of all equipment.

7.4.3. Let the EUT work in TX modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2440MHz, and 2480MHz TX frequency to transmit.

7.5. Test Procedure

7.5.1. The transmitter output was connected to the spectrum analyzer through a low loss cable.

7.5.2. Measurement Procedure PKPSD:

7.5.3. This procedure must be used if maximum peak conducted output power was used to demonstrate compliance to the fundamental output power limit, and is optional if the maximum (average) conducted output power was used to demonstrate compliance.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{RBW}$.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3kHz) and repeat.

7.5.4. Measurement the maximum power spectral density.

7.6. Test Result

BLE 1Mbps

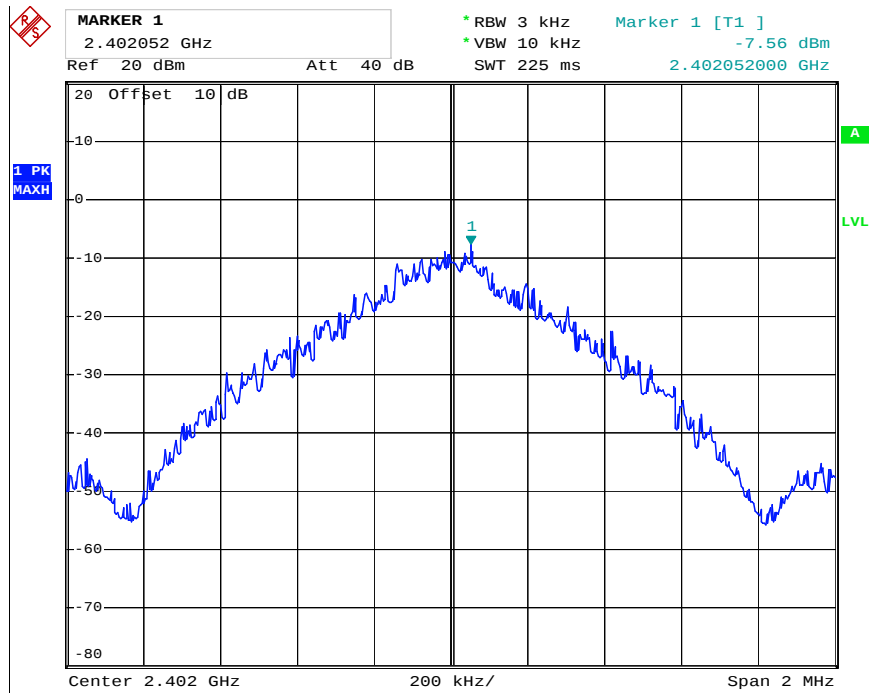
Channel	Frequency (MHz)	PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
0	2402	-7.56	8	Pass
19	2440	-7.66	8	Pass
39	2480	-7.73	8	Pass

BLE 2Mbps

Channel	Frequency (MHz)	PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
0	2402	-10.18	8	Pass
19	2440	-10.37	8	Pass
39	2480	-10.46	8	Pass

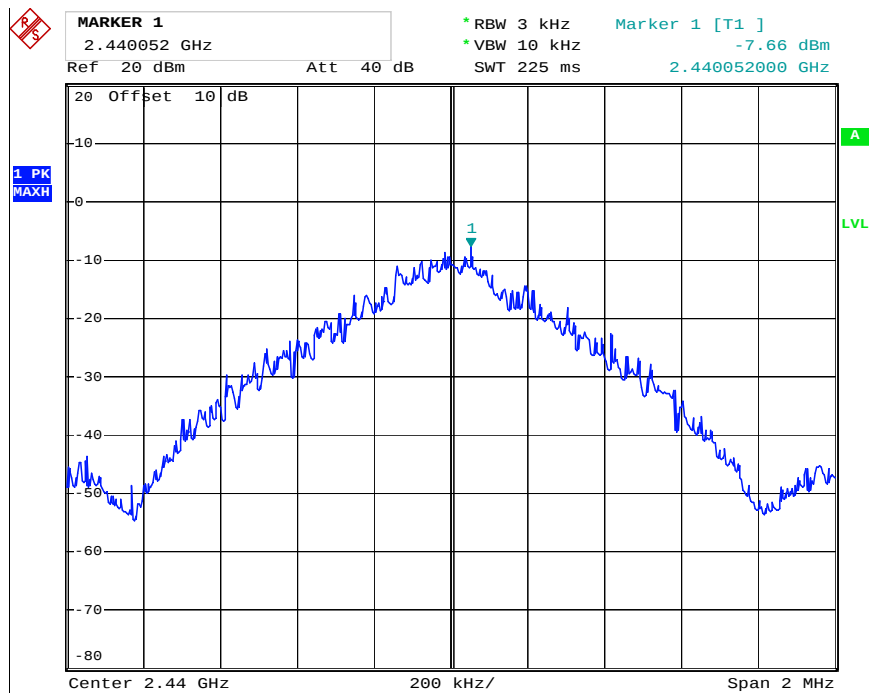
The spectrum analyzer plots are attached as below.

BLE 1Mbps channel 0



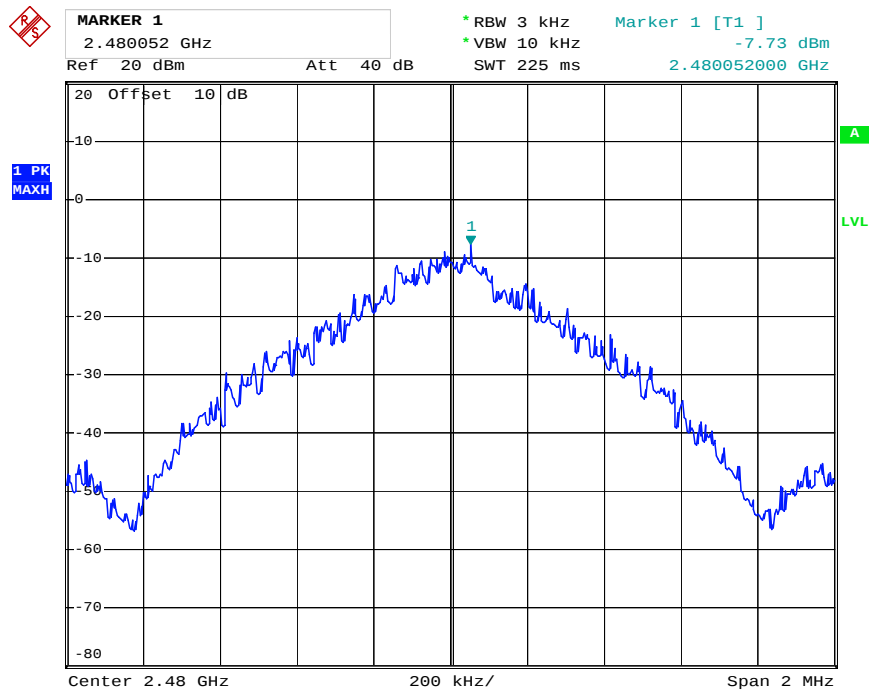
Date: 6.SEP.2019 15:01:15

BLE 1Mbps channel 19



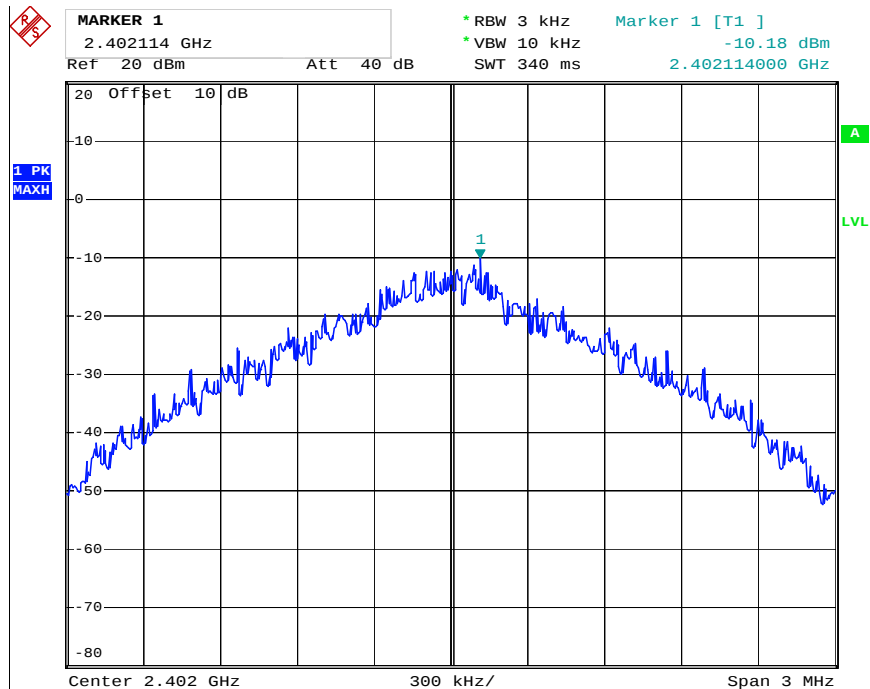
Date: 6.SEP.2019 15:00:48

BLE 1Mbps channel 39



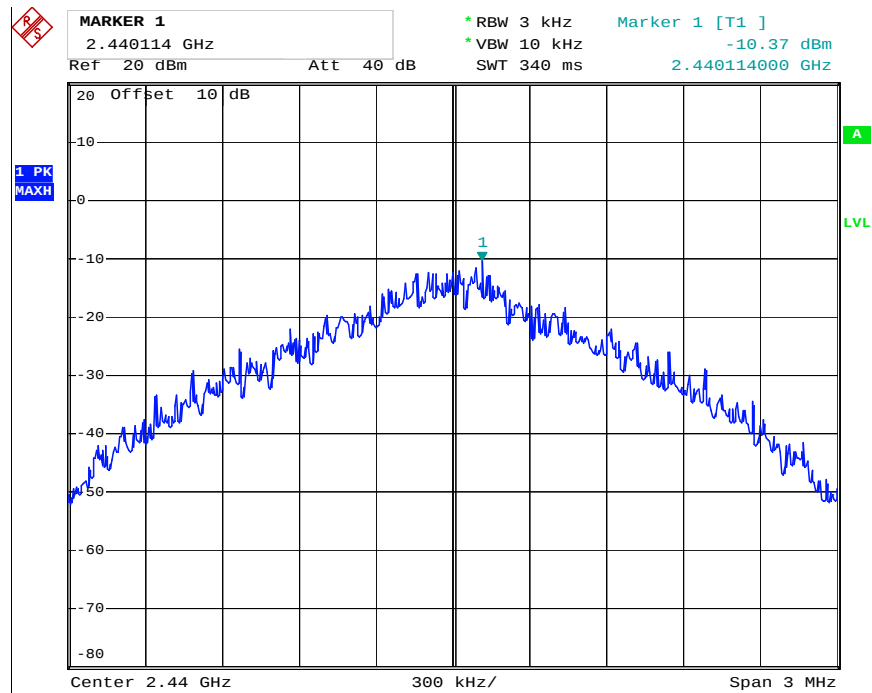
Date: 6.SEP.2019 14:58:34

BLE 2Mbps channel 0



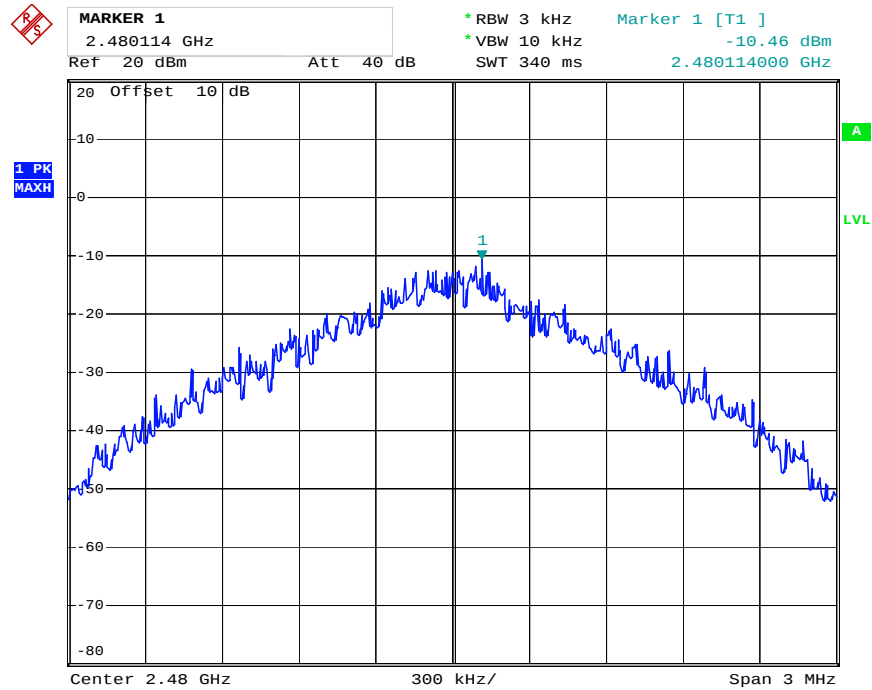
Date: 6.SEP.2019 15:02:30

BLE 2Mbps channel 19



Date: 6.SEP.2019 15:03:09

BLE 2Mbps channel 39



Date: 6.SEP.2019 15:03:29

8. BAND EDGE COMPLIANCE TEST

8.1. Block Diagram of Test Setup



8.2. The Requirement For Section 15.247(d)

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

8.3. EUT Configuration on Test

The equipment are installed on the emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

8.4. Operating Condition of EUT

8.4.1. Setup the EUT and simulator as shown as Section 8.1.

8.4.2. Turn on the power of all equipment.

8.4.3. Let the EUT work in TX modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2480MHz TX frequency to transmit.

8.5. Test Procedure

Conducted Band Edge:

8.5.1. The transmitter output was connected to the spectrum analyzer via a low loss cable.

8.5.2. Set RBW of spectrum analyzer to 100 kHz and VBW to 300 kHz.

Radiate Band Edge:

8.5.3. The EUT is placed on a turntable, which is 0.1m above the ground plane and worked at highest radiated power.

8.5.4. The turntable was rotated for 360 degrees to determine the position of maximum emission level.

8.5.5. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.

8.5.6. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:

8.5.7. RBW=1MHz, VBW=1MHz

8.5.8. The band edges was measured and recorded.

Note: All modes of operation were investigated and the worst case (GFSK (BEL 1 Mbps)) emissions are reported.

8.6. Test Result

Conducted Band Edge Result

BLE 1Mbps

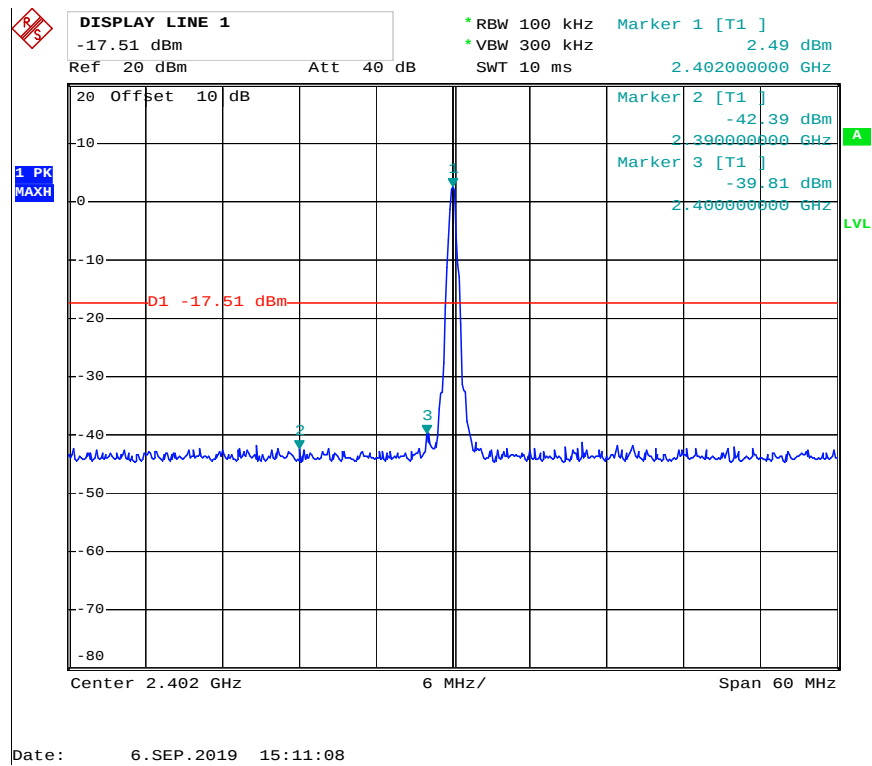
Channel	Frequency	Delta peak to band emission	Limit(dBc)	Result
0	2.402GHz	37.32	> 20	Pass
39	2.480GHz	41.47	> 20	Pass

BLE 2Mbps

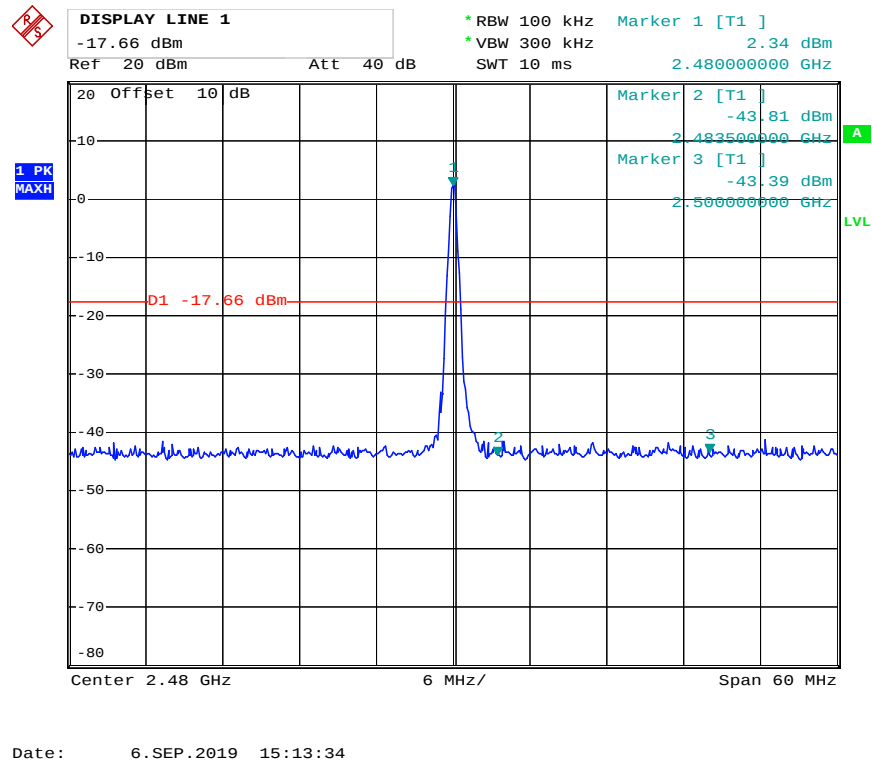
Channel	Frequency	Delta peak to band emission	Limit(dBc)	Result
0	2.402GHz	32.40	> 20	Pass
39	2.480GHz	40.64	> 20	Pass

The spectrum analyzer plots are attached as below.

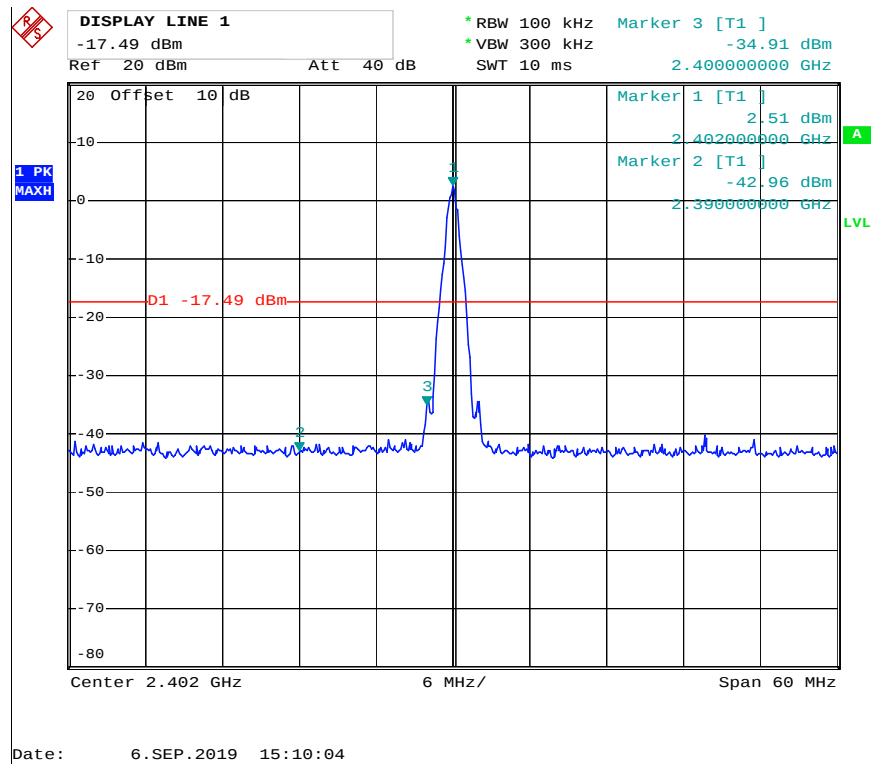
BLE 1Mbps channel 0



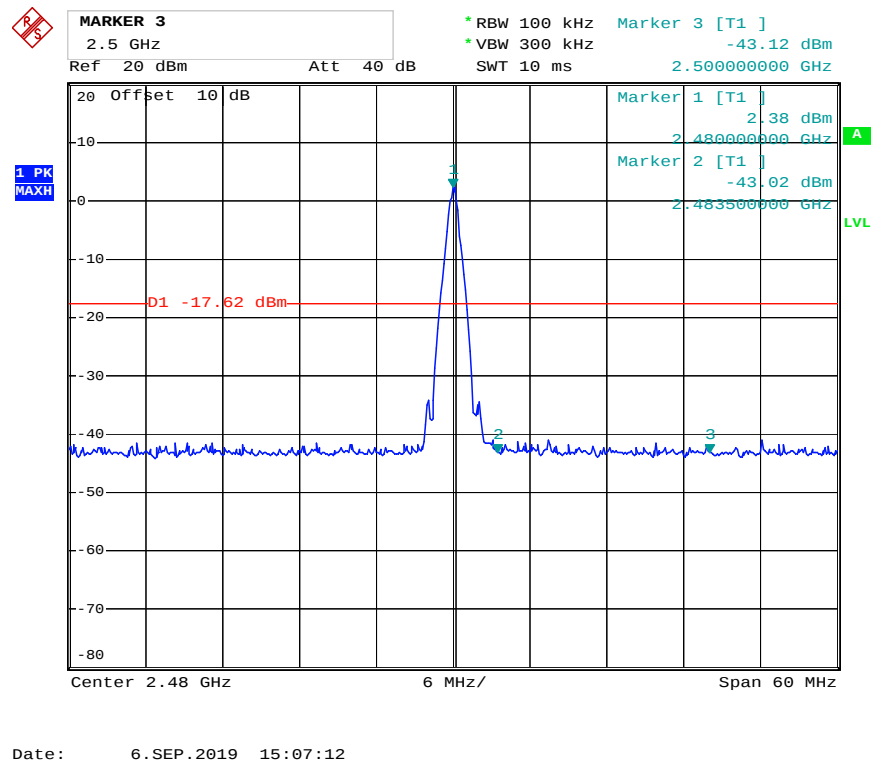
BLE 1Mbps channel 39



BLE 2Mbps channel 0



BLE 2Mbps channel 39



Radiated Band Edge Result (BLE 1Mbps)



ACCURATE TECHNOLOGY CO., LTD.

F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 2# Chamber

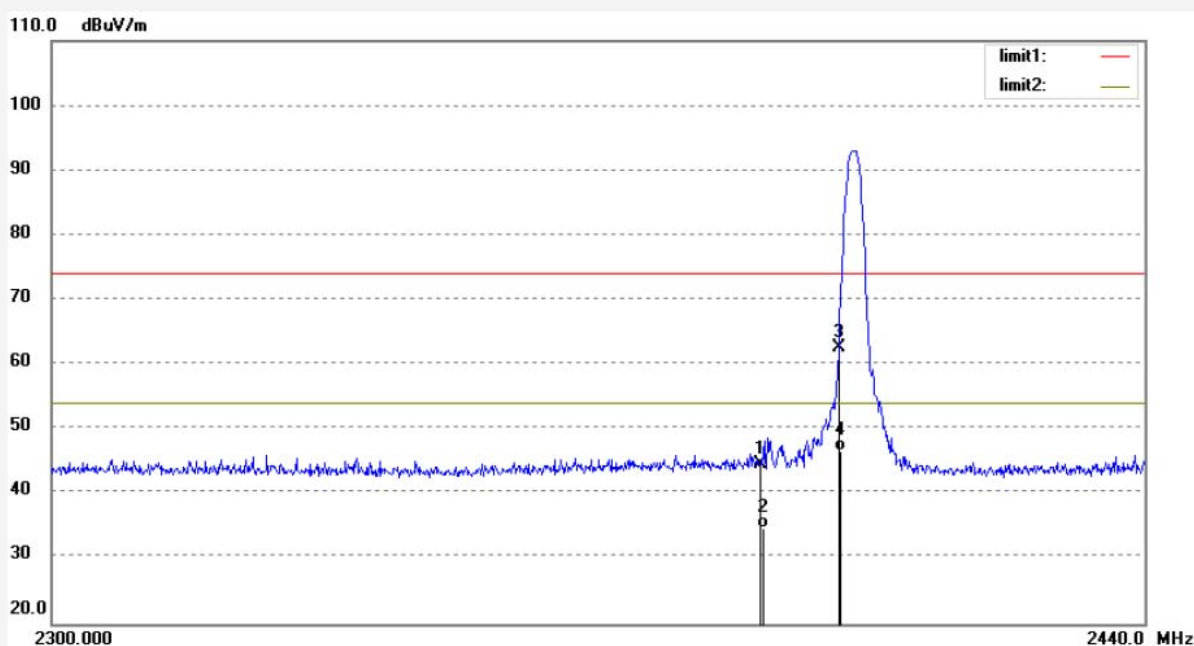
Tel:+86-0755-26503290

Fax:+86-0755-26503396

Job No.: ble #11
Standard: FCC PK
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: BLEFOB
Mode: TX 2402MHz
Model: FWR301
Manufacturer: HMC Holdings LLC

Polarization: Horizontal
Power Source: DC 3V
Date: 19/09/05/
Time: 9/39/11
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191319



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2390.000	43.92	0.79	44.71	74.00	-29.29	peak			
2	2390.000	33.91	0.79	34.70	54.00	-19.30	AVG			
3	2400.000	61.74	0.88	62.62	74.00	-11.38	peak			
4	2400.000	45.72	0.88	46.60	54.00	-7.40	AVG			



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Site: 2# Chamber

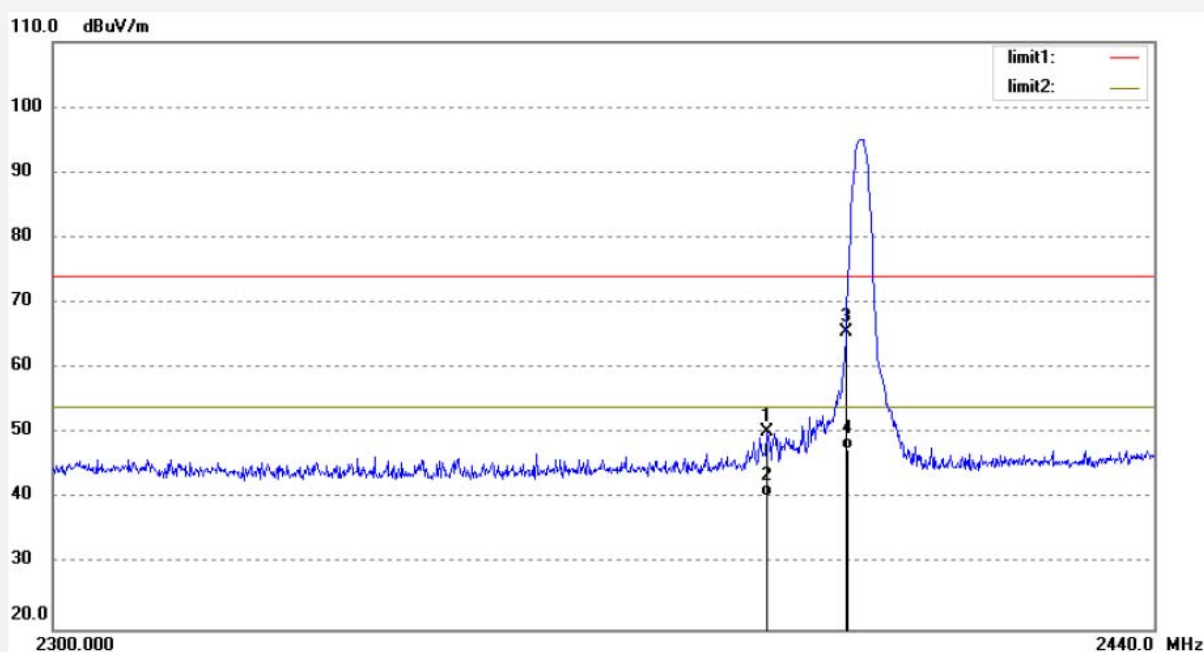
Tel:+86-0755-26503290

Fax:+86-0755-26503396

Job No.: ble #10
Standard: FCC PK
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: BLEFOB
Mode: TX 2402MHz
Model: FWR301
Manufacturer: HMC Holdings LLC

Polarization: Vertical
Power Source: DC 3V
Date: 19/09/05/
Time: 9/38/14
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191319

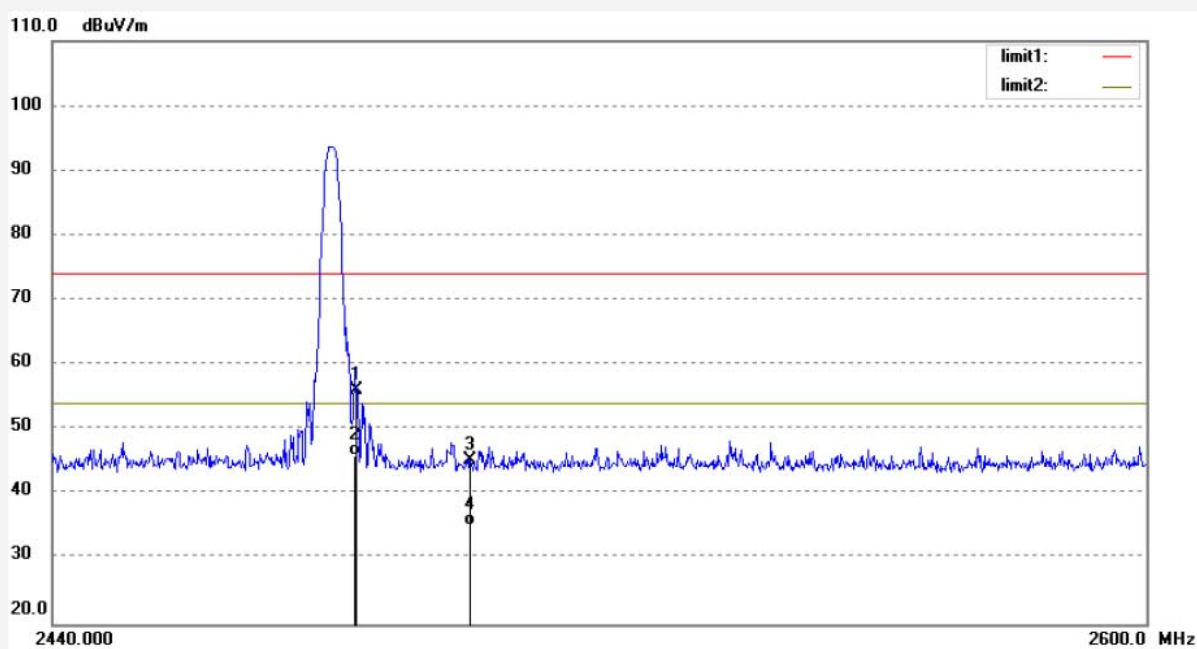


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2390.000	49.54	0.79	50.33	74.00	-23.67	peak			
2	2390.000	39.51	0.79	40.30	54.00	-13.70	AVG			
3	2400.000	64.73	0.88	65.61	74.00	-8.39	peak			
4	2400.000	46.72	0.88	47.60	54.00	-6.40	AVG			

Job No.: ble #9
Standard: FCC PK
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: BLEFOB
Mode: TX 2480MHz
Model: FWR301
Manufacturer: HMC Holdings LLC

Polarization: Vertical
Power Source: DC 3V
Date: 19/09/05/
Time: 9/36/14
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191319

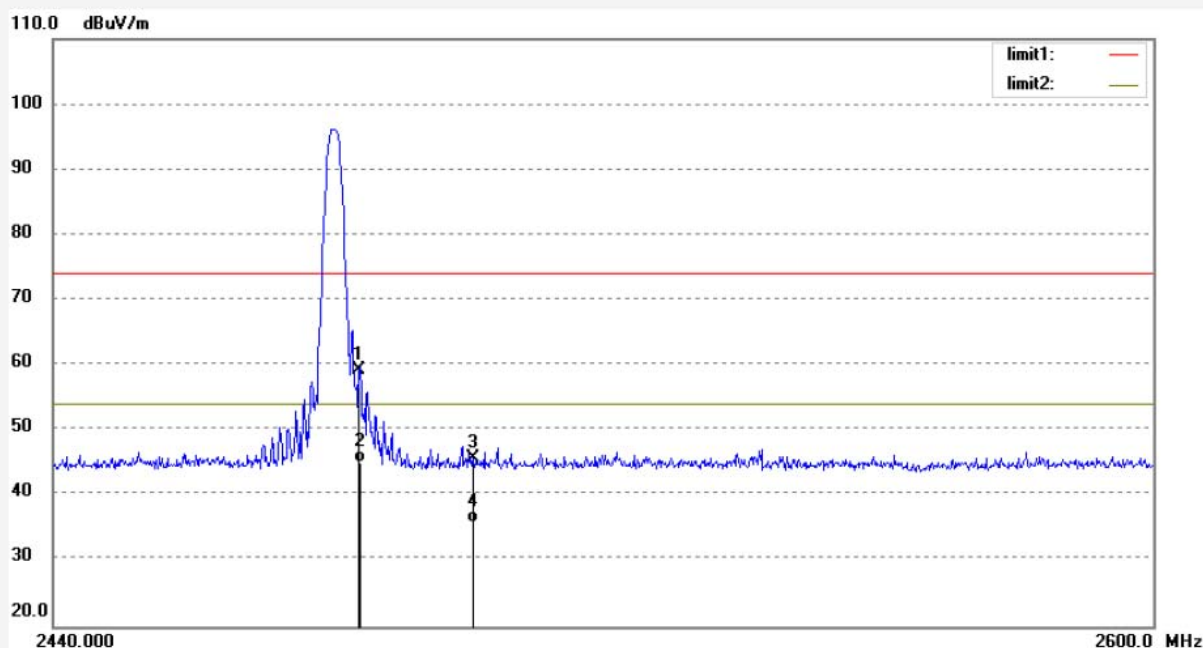


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2483.500	54.96	1.10	56.06	74.00	-17.94	peak			
2	2483.500	44.90	1.10	46.00	54.00	-8.00	AVG			
3	2500.000	44.20	1.10	45.30	74.00	-28.70	peak			
4	2500.000	34.20	1.10	35.30	54.00	-18.70	AVG			

Job No.: ble #8
Standard: FCC PK
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: BLEFOB
Mode: TX 2480MHz
Model: FWR301
Manufacturer: HMC Holdings LLC

Polarization: Horizontal
Power Source: DC 3V
Date: 19/09/05/
Time: 9/35/32
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191319



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2483.500	58.09	1.10	59.19	74.00	-14.81	peak			
2	2483.500	44.00	1.10	45.10	54.00	-8.90	AVG			
3	2500.000	44.70	1.10	45.80	74.00	-28.20	peak			
4	2500.000	34.70	1.10	35.80	54.00	-18.20	AVG			

Note:

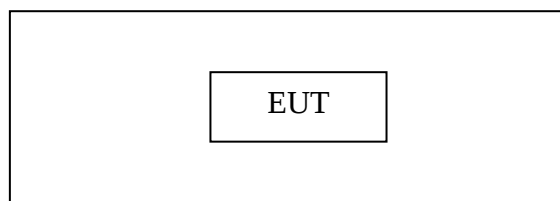
1. Emissions attenuated more than 20 dB below the permissible value are not reported.
2. The field strength is calculated by adding the antenna factor, high pass filter loss(if used) and cable loss, and subtracting the amplifier gain(if any)from the measured reading. The basic equation calculation is as follows:

$$\text{Result} = \text{Reading} + \text{Corrected Factor}$$

9. RADIATED SPURIOUS EMISSION TEST

9.1. Block Diagram of Test Setup

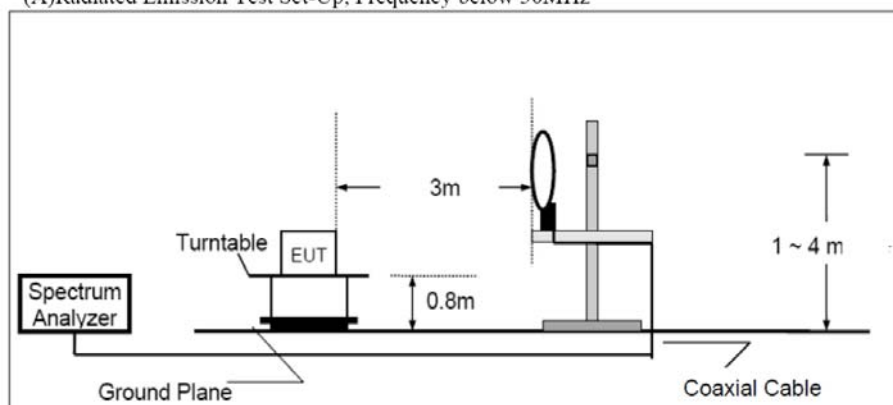
9.1.1. Block diagram of connection between the EUT and peripherals



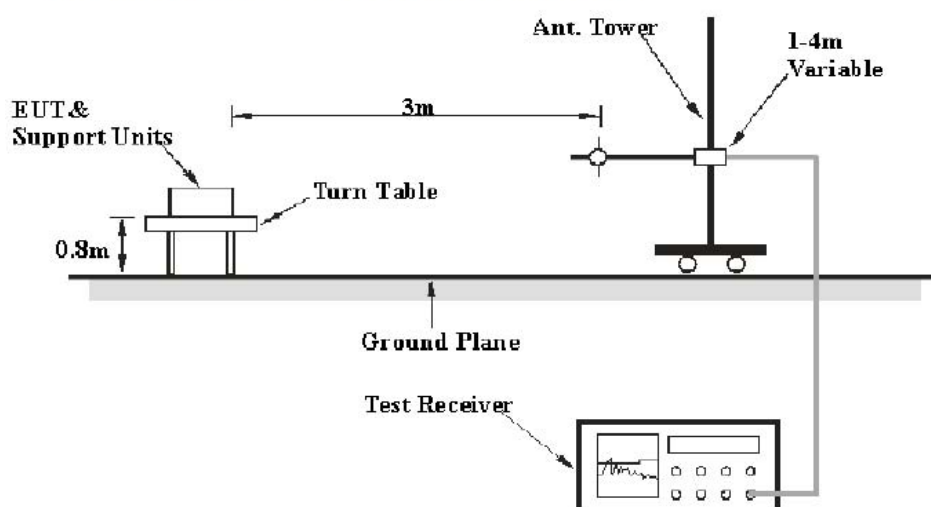
Setup: Transmitting mode

9.1.2. Semi-Anechoic Chamber Test Setup Diagram

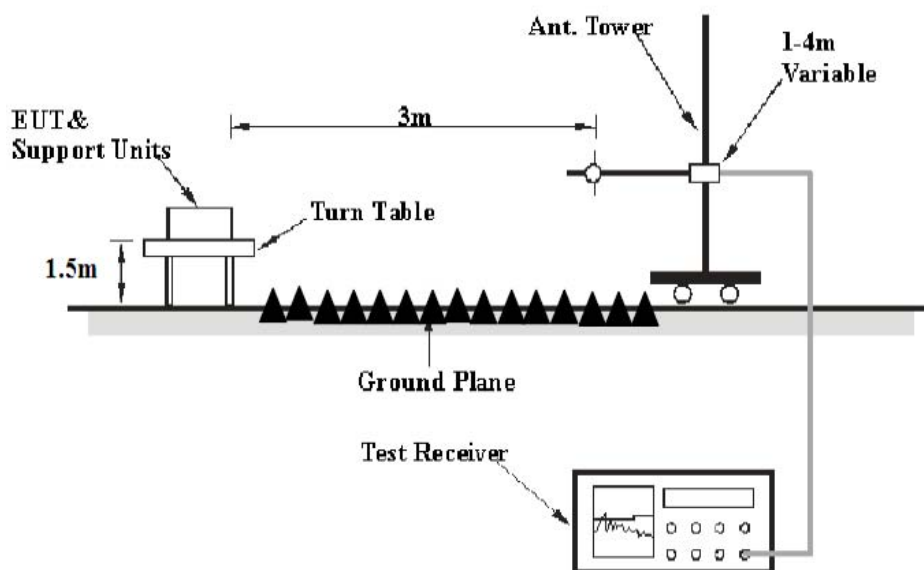
(A) Radiated Emission Test Set-Up, Frequency below 30MHz



(B) Radiated Emission Test Set-Up, Frequency 30MHz-1GHz



(C) Radiated Emission Test Set-Up, Frequency above 1GHz



9.2.The Limit For Section 15.247(d)

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

9.3. Restricted bands of operation

9.3.1.FCC Part 15.205 Restricted bands of operation

(a) Except as shown in paragraph (d) of this section, Only spurious emissions are permitted in any of the frequency bands listed below:

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	2690-2900	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			

¹Until February 1, 1999, this restricted band shall be 0.490-0.510

²Above 38.6

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

9.4.Configuration of EUT on Test

The equipment are installed on Radiated Emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

9.5. Operating Condition of EUT

9.5.1. Setup the EUT and simulator as shown as Section 9.1.

9.5.2. Turn on the power of all equipment.

9.5.3. Let the EUT work in TX modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2440MHz, and 2480MHz TX frequency to transmit.

9.6. Test Procedure

The EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground (Below 1GHz). The EUT and its simulators are placed on a turntable, which is 1.5 meter high above ground (Above 1GHz). The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bi-log antenna) is used as receiving antenna. Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission levels, all of the EUT location must be manipulated according to ANSI C63.10:2013 on radiated emission measurement. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.

The bandwidth of test receiver is set at 9 kHz in below 30MHz. and set at 120 kHz in 30-1000MHz, and 1MHz in above 1000MHz.

The final measurement in band 9-90 kHz, 110-490 kHz and above 1000MHz is performed with Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector. The field strength is calculated by adding the antenna factor, and cable loss, and subtracting the amplifier gain from the measured reading.

9.7.Data Sample

Frequency (MHz)	Reading (dB μ v)	Factor (dB/m)	Result (dB μ v/m)	Limit (dB μ v/m)	Margin (dB)	Remark
X.XX	43.85	-22.22	21.63	43.5	-21.87	QP

Frequency(MHz) = Emission frequency in MHz

Reading(dB μ v) = Uncorrected Analyzer/Receiver reading

Factor (dB/m) = Antenna factor + Cable Loss – Amplifier gain

Result(dB μ v/m) = Reading(dB μ v) + Factor(dB/m)

Limit (dB μ v/m) = Limit stated in standard

Margin (dB) = Result(dB μ v/m) - Limit (dB μ v/m)

QP = Quasi-peak Reading

Calculation Formula:

Margin(dB) = Result (dB μ V/m)–Limit(dB μ V/m)

Result(dB μ V/m)= Reading(dB μ V)+ Factor(dB/m)

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the limit.

9.8.Test Result

Pass.

Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 3th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

The measurements greater than 20dB below the limit from 9kHz to 30MHz and 18 to 26.5GHz.

The spectrum analyzer plots are attached as below.

Note: All modes of operation were investigated and the worst case (GFSK (BEL 1Mbps)) emissions are reported.

Below 1GHz



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Job No.: ble #12

Standard: FCC Class B 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 23 C / 48 %

EUT: BLEFOB

Mode: TX 2402MHz

Model: FWR301

Manufacturer: HMC Holdings LLC

Polarization: Horizontal

Power Source: DC 3V

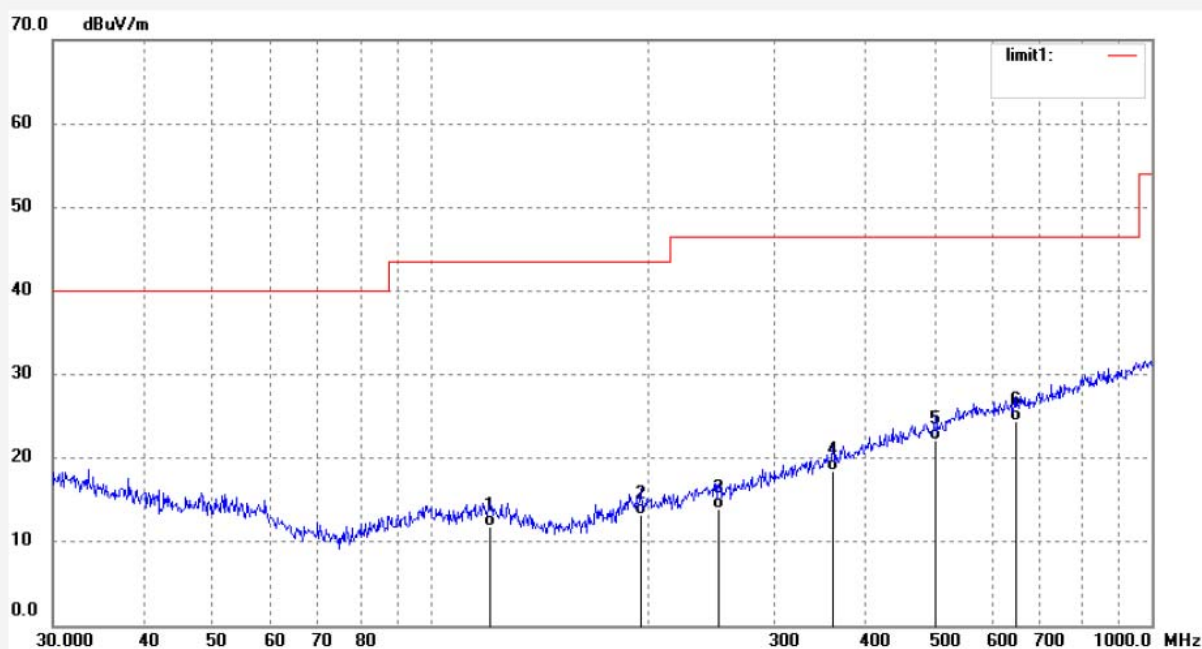
Date: 2019/09/06

Time: 14:28:52

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191319



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	121.1231	24.99	-13.19	11.80	43.50	-31.70	QP	200	156	
2	195.8220	25.60	-12.30	13.30	43.50	-30.20	QP	200	186	
3	251.1804	24.44	-10.54	13.90	46.50	-32.60	QP	200	193	
4	361.7139	25.66	-7.26	18.40	46.50	-28.10	QP	200	215	
5	501.1790	26.54	-4.34	22.20	46.50	-24.30	QP	200	245	
6	647.3856	26.24	-1.84	24.40	46.50	-22.10	QP	200	263	



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Fax:+86-0755-26503396

Job No.: ble #13

Standard: FCC Class B 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 23 C / 48 %

EUT: BLEFOB

Mode: TX 2402MHz

Model: FWR301

Manufacturer: HMC Holdings LLC

Polarization: Vertical

Power Source: DC 3V

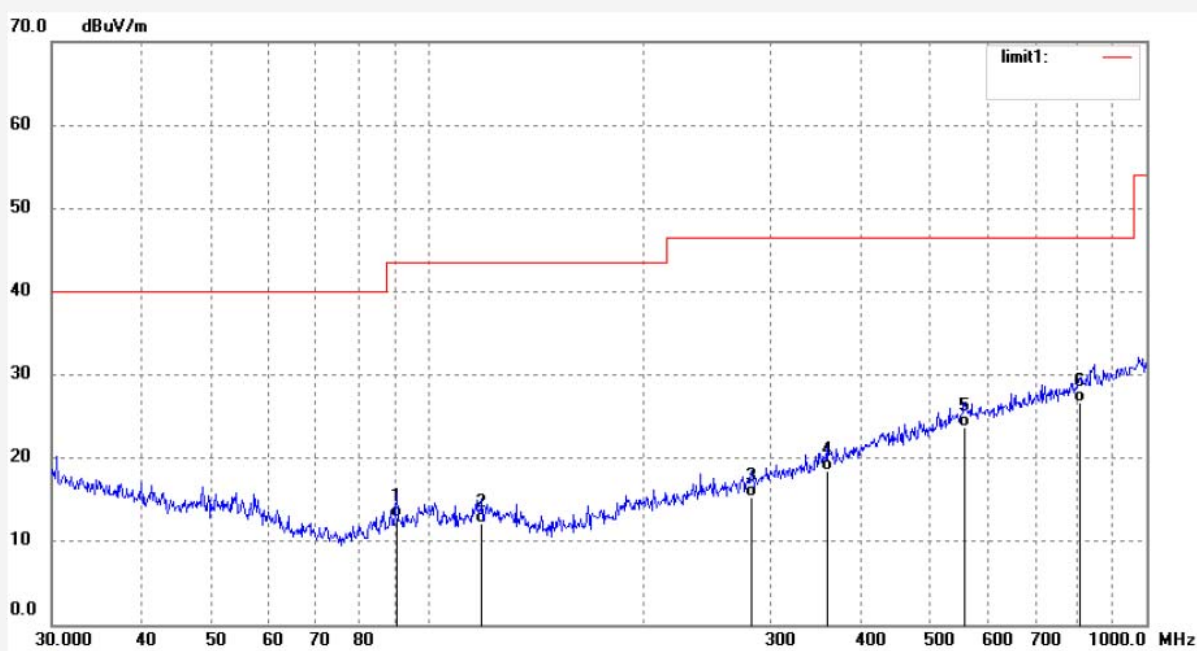
Date: 2019/09/06

Time: 14:30:06

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191319



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	90.5374	27.88	-14.98	12.90	43.50	-30.60	QP	100	103	
2	119.0180	25.16	-13.06	12.10	43.50	-31.40	QP	100	145	
3	281.9945	24.93	-9.53	15.40	46.50	-31.10	QP	100	175	
4	359.1859	25.78	-7.28	18.50	46.50	-28.00	QP	100	186	
5	558.7301	26.62	-2.92	23.70	46.50	-22.80	QP	100	201	
6	807.4290	25.75	0.95	26.70	46.50	-19.80	QP	100	286	



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Job No.: ble #14

Standard: FCC Class B 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 23 C / 48 %

EUT: BLEFOB

Mode: TX 2440MHz

Model: FWR301

Manufacturer: HMC Holdings LLC

Polarization: Vertical

Power Source: DC 3V

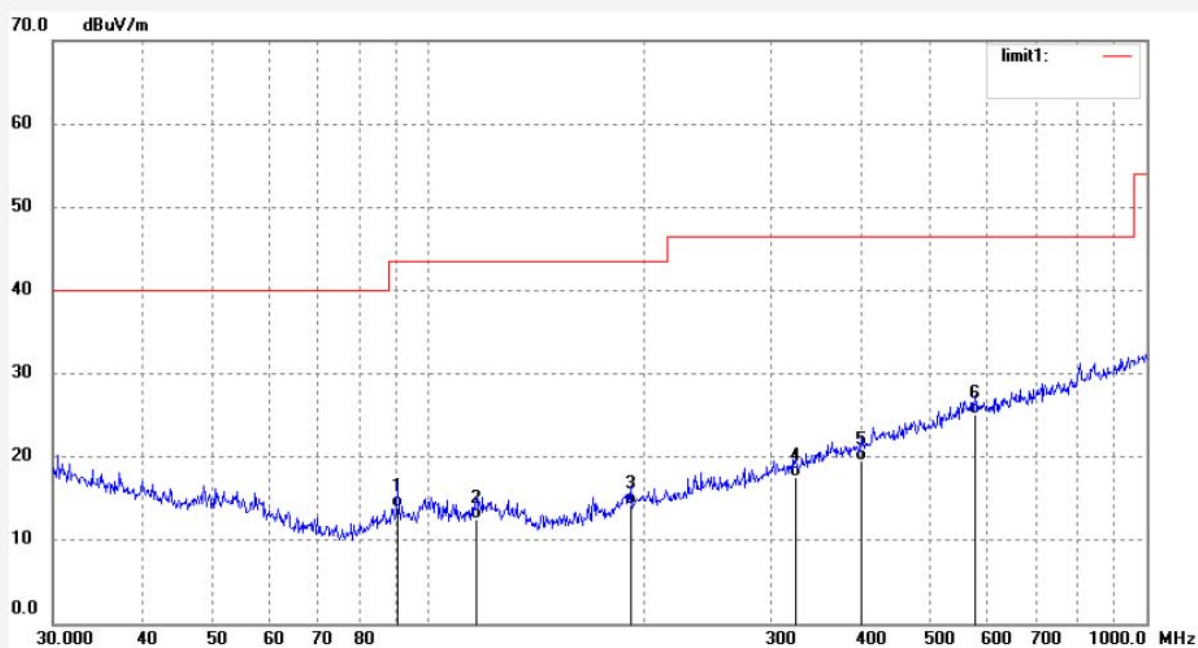
Date: 2019/09/06

Time: 14:32:10

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191319



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	90.5374	28.98	-14.98	14.00	43.50	-29.50	QP	100	136	
2	116.5401	25.66	-13.06	12.60	43.50	-30.90	QP	100	156	
3	191.0738	26.74	-12.44	14.30	43.50	-29.20	QP	100	168	
4	324.4561	25.86	-8.26	17.60	46.50	-28.90	QP	100	196	
5	400.4319	25.92	-6.42	19.50	46.50	-27.00	QP	100	204	
6	576.6443	27.70	-2.60	25.10	46.50	-21.40	QP	100	286	



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Report No.: ATE20191319

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Site: 2# Chamber

Tel:+86-0755-26503290

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Job No.: ble #15

Standard: FCC Class B 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 23 C / 48 %

EUT: BLEFOB

Mode: TX 2440MHz

Model: FWR301

Manufacturer: HMC Holdings LLC

Polarization: Horizontal

Power Source: DC 3V

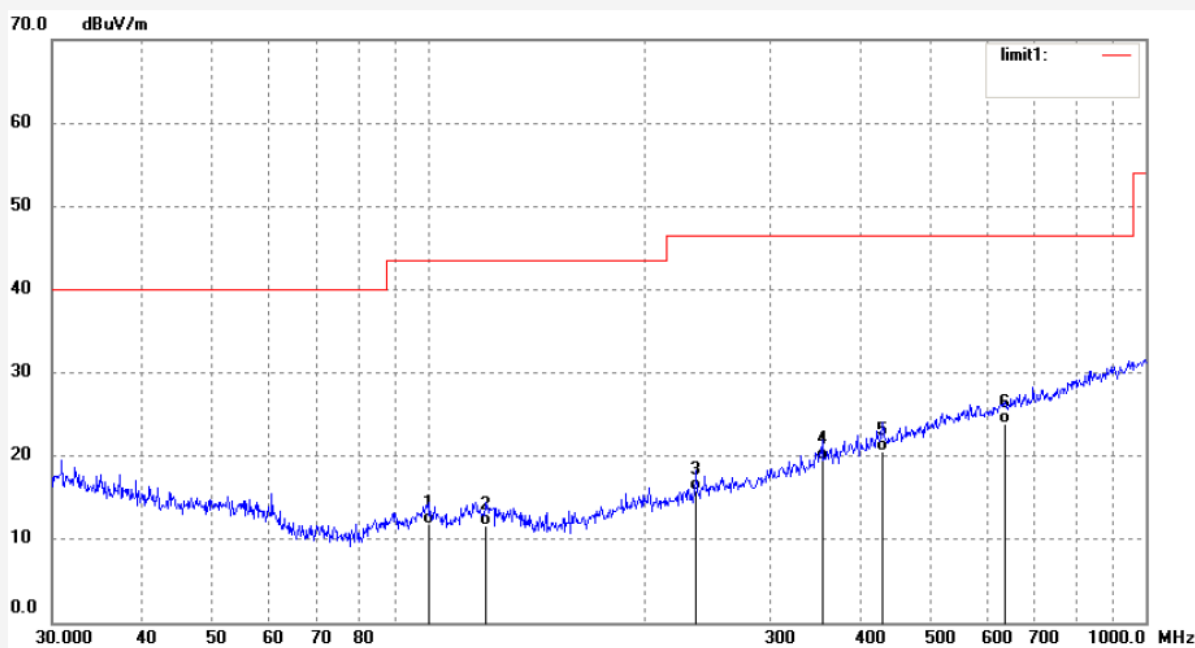
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Time: 14:34:08

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191319



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	100.2286	24.99	-13.09	11.90	43.50	-31.60	QP	200	115	
2	120.6991	24.83	-13.13	11.70	43.50	-31.80	QP	200	163	
3	236.6447	26.67	-10.77	15.90	46.50	-30.60	QP	200	186	
4	354.1831	26.88	-7.38	19.50	46.50	-27.00	QP	200	198	
5	429.5228	26.14	-5.64	20.50	46.50	-26.00	QP	200	219	
6	633.9073	25.84	-1.94	23.90	46.50	-22.60	QP	200	263	



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Job No.: ble #16

Standard: FCC Class B 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 23 C / 48 %

EUT: BLEFOB

Mode: TX 2480MHz

Model: FWR301

Manufacturer: HMC Holdings LLC

Polarization: Horizontal

Power Source: DC 3V

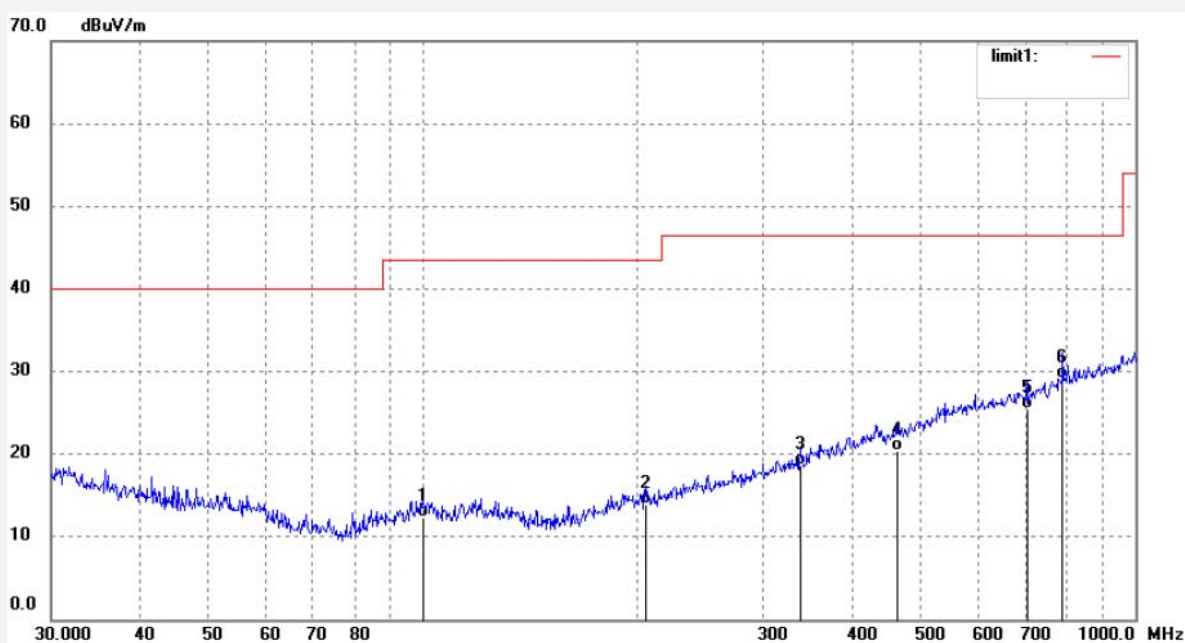
Date: 2019/09/06

Time: 14:36:12

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191319



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	99.8777	25.42	-13.09	12.33	43.50	-31.17	QP	200	103	
2	204.9551	26.01	-12.11	13.90	43.50	-29.60	QP	200	125	
3	338.4001	26.51	-7.81	18.70	46.50	-27.80	QP	200	163	
4	462.3455	25.55	-5.15	20.40	46.50	-26.10	QP	200	198	
5	704.2261	26.46	-0.96	25.50	46.50	-21.00	QP	200	245	
6	790.6188	28.47	0.63	29.10	46.50	-17.40	QP	200	316	



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Job No.: ble #17

Standard: FCC Class B 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 23 C / 48 %

EUT: BLEFOB

Mode: TX 2480MHz

Model: FWR301

Manufacturer: HMC Holdings LLC

Polarization: Vertical

Power Source: DC 3V

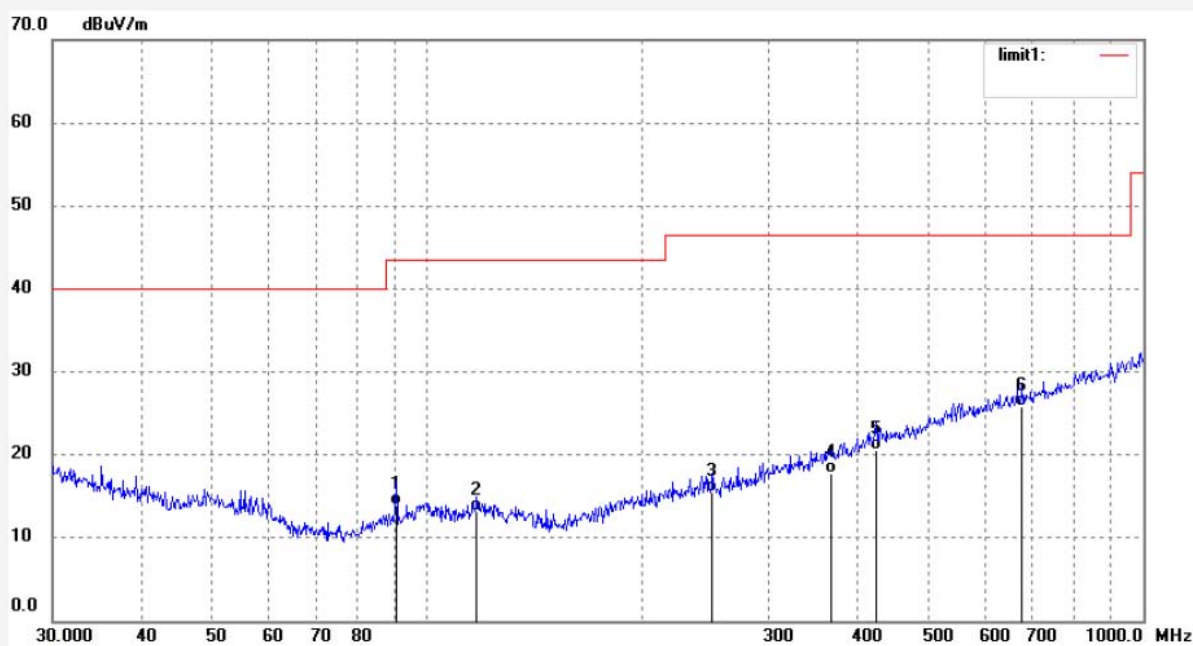
Date: 2019/09/06

Time: 14:38:05

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191319



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	90.5374	28.88	-14.98	13.90	43.50	-29.60	QP	100	125	
2	117.3603	26.27	-13.07	13.20	43.50	-30.30	QP	100	156	
3	250.3012	26.04	-10.54	15.50	46.50	-31.00	QP	100	178	
4	366.8231	24.99	-7.19	17.80	46.50	-28.70	QP	100	196	
5	423.5403	26.35	-5.75	20.60	46.50	-25.90	QP	100	214	
6	677.5798	27.17	-1.37	25.80	46.50	-20.70	QP	100	302	

Above 1GHz



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Site: 2# Chamber

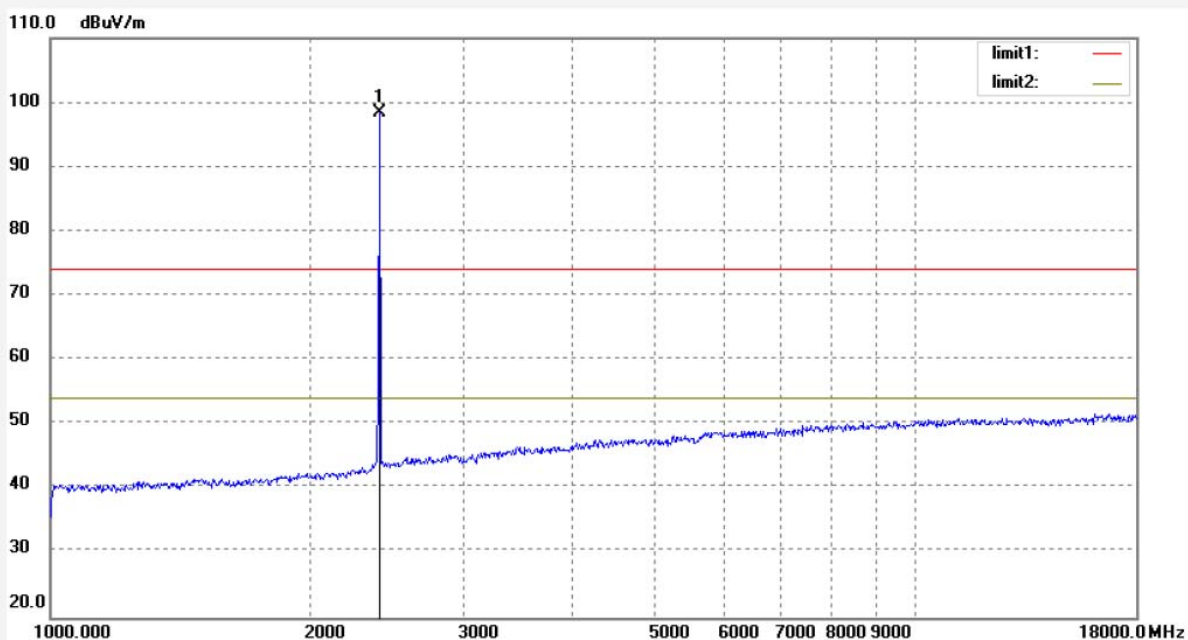
Tel:+86-0755-26503290

Fax:+86-0755-26503396

Job No.: ble #1
Standard: FCC PK
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: BLEFOB
Mode: TX 2402MHz
Model: FWR301
Manufacturer: HMC Holdings LLC

Polarization: Horizontal
Power Source: DC 3V
Date: 19/09/05/
Time: 9/24/17
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191319

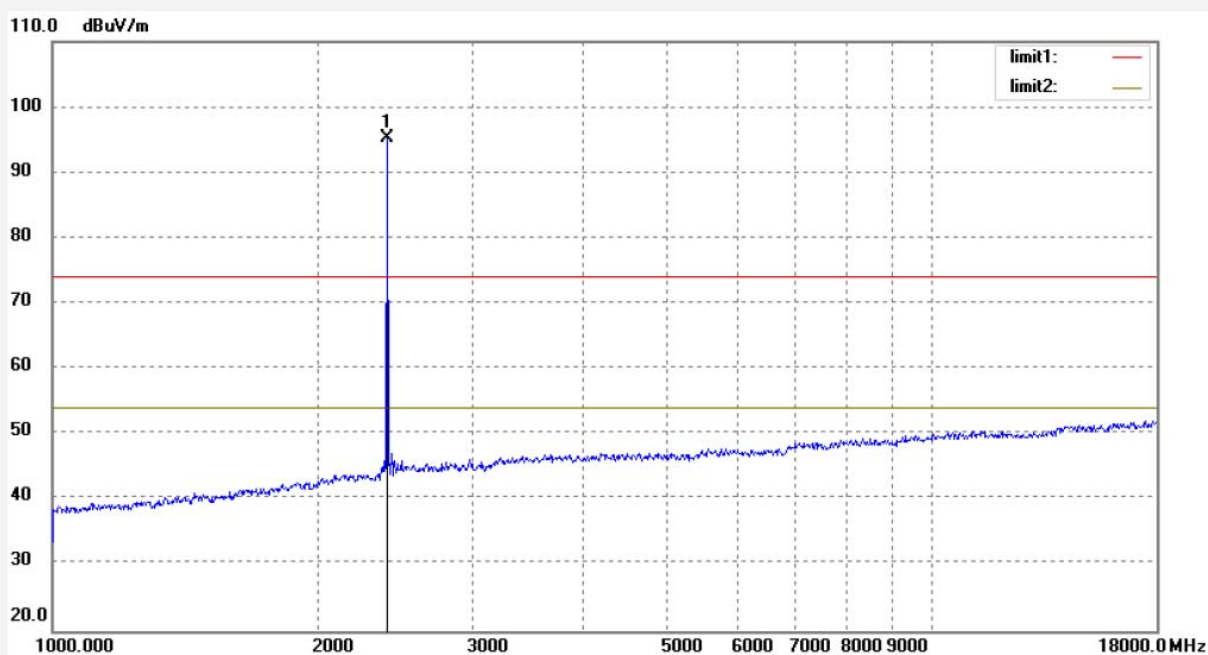


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2402.000	97.47	0.88	98.35			peak			

Job No.: ble #2
Standard: FCC PK
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: BLEFOB
Mode: TX 2402MHz
Model: FWR301
Manufacturer: HMC Holdings LLC

Polarization: Vertical
Power Source: DC 3V
Date: 19/09/05/
Time: 9/26/28
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191319



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2402.000	94.47	0.88	95.35			peak			



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F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 2# Chamber

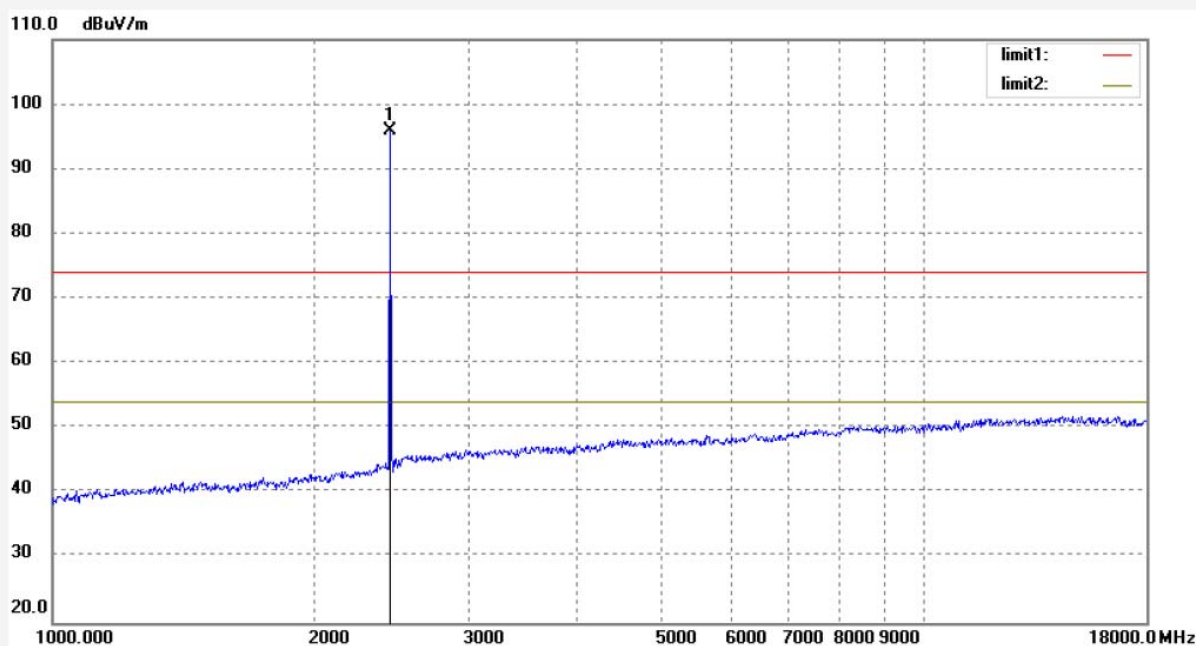
Tel:+86-0755-26503290

Fax:+86-0755-26503396

Job No.: ble #3
Standard: FCC PK
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: BLEFOB
Mode: TX 2440MHz
Model: FWR301
Manufacturer: HMC Holdings LLC

Polarization: Vertical
Power Source: DC 3V
Date: 19/09/05/
Time: 9/28/22
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191319



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2440.000	94.88	1.03	95.91			peak			



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Job No.: ble #4

Standard: FCC PK

Test item: Radiation Test

Temp.(C)/Hum.(%) 23 C / 48 %

EUT: BLEFOB

Mode: TX 2440MHz

Model: FWR301

Manufacturer: HMC Holdings LLC

Polarization: Horizontal

Power Source: DC 3V

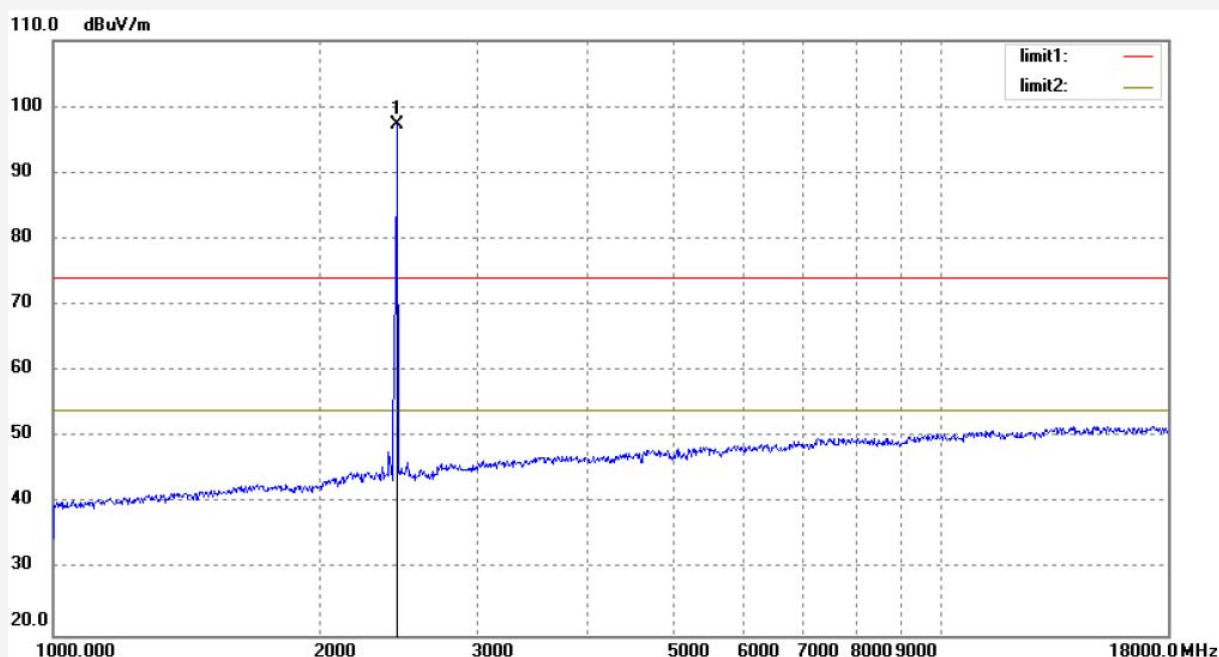
Date: 19/09/05/

Time: 9/30/28

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191319



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2440.000	96.19	1.03	97.22			peak			

Job No.: ble #5

Standard: FCC PK

Test item: Radiation Test

Temp.(C)/Hum.(%) 23 C / 48 %

EUT: BLEFOB

Mode: TX 2480MHz

Model: FWR301

Manufacturer: HMC Holdings LLC

Polarization: Horizontal

Power Source: DC 3V

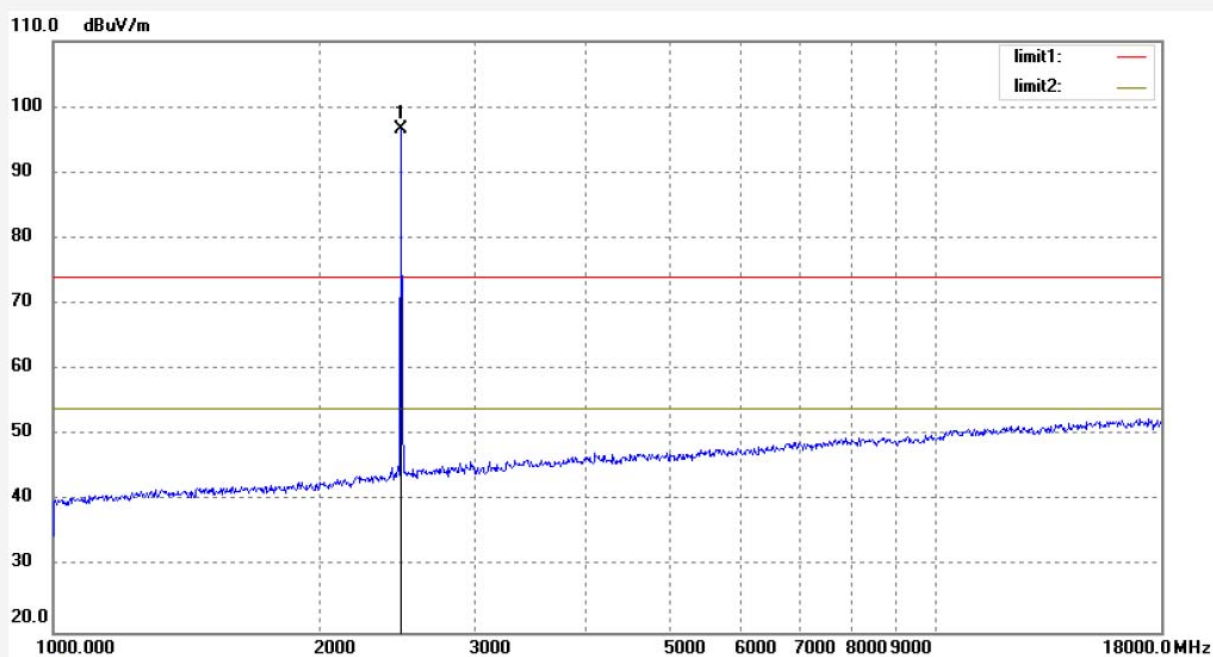
Date: 19/09/05/

Time: 9/32/59

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191319



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2480.000	95.58	1.09	96.67			peak			



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Site: 2# Chamber

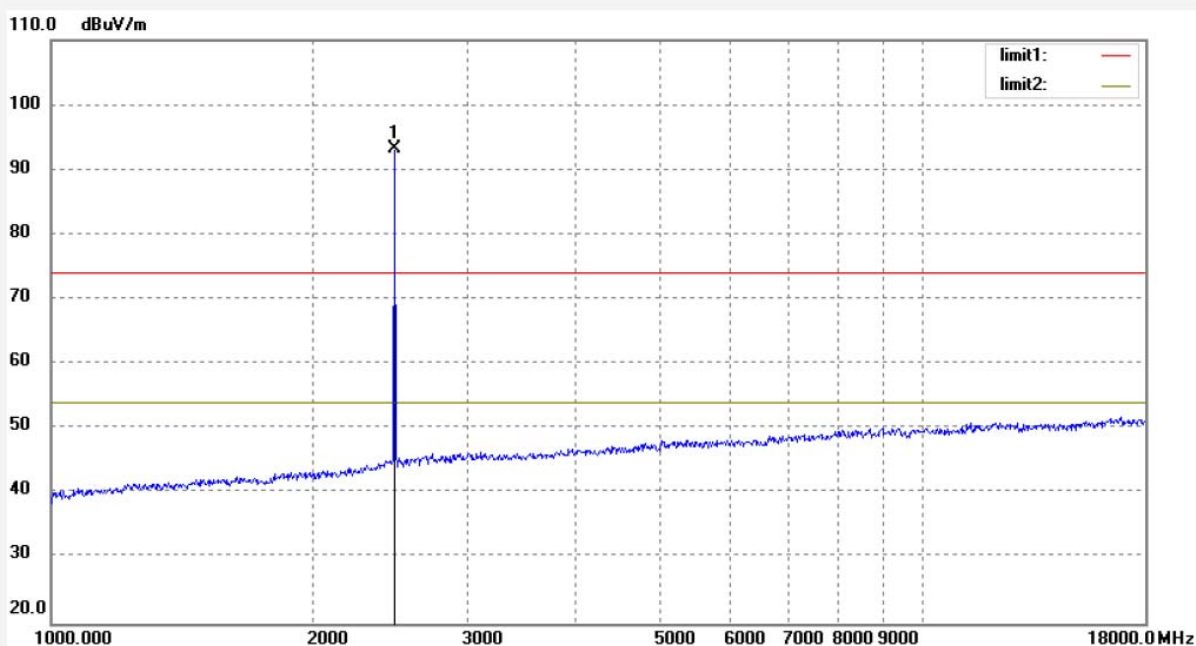
Tel:+86-0755-26503290

Fax:+86-0755-26503396

Job No.: ble #6
Standard: FCC PK
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: BLEFOB
Mode: TX 2480MHz
Model: FWR301
Manufacturer: HMC Holdings LLC

Polarization: Vertical
Power Source: DC 3V
Date: 19/09/05/
Time: 9/34/03
Engineer Signature:
Distance: 3m

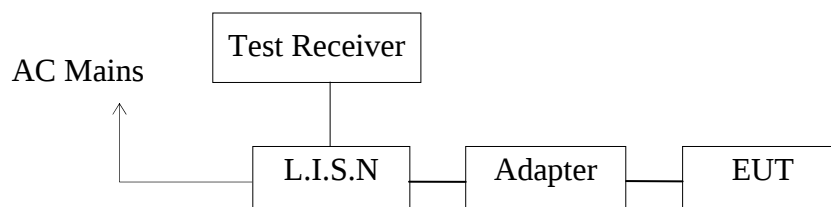
Note: Report NO.:ATE20191319



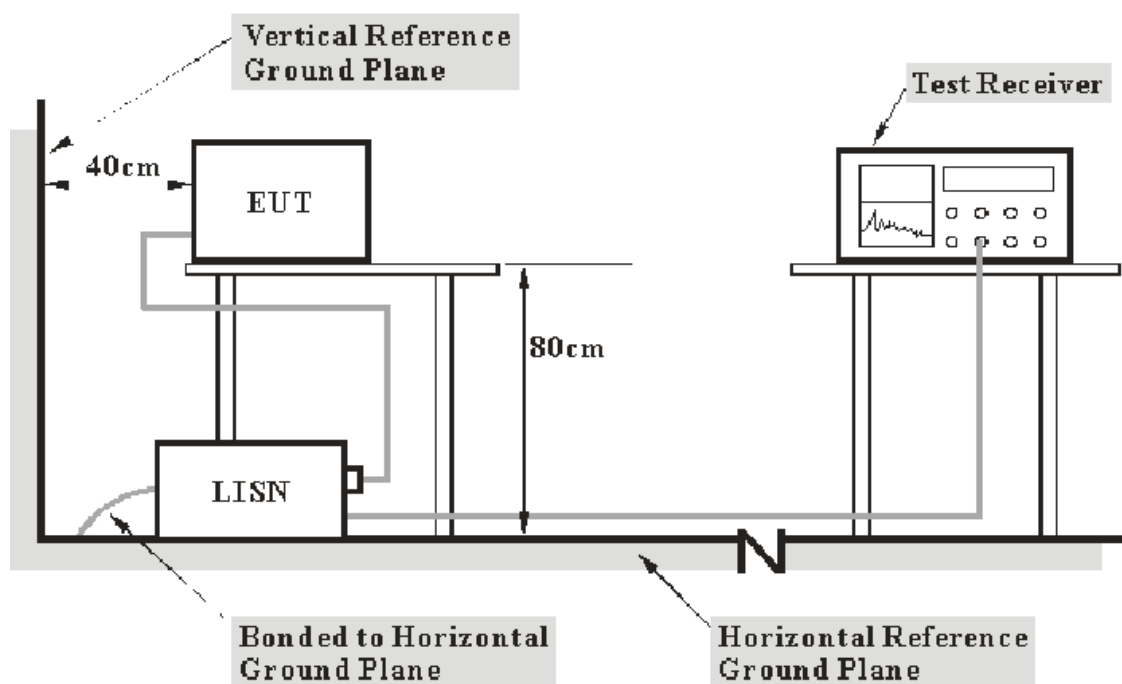
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2480.000	92.17	1.09	93.26			peak			

10. POWER LINE CONDUCTED EMISSION TEST

10.1. Block Diagram of Test Setup



10.2. Test System Setup



- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

10.3.Test Limits

Frequency (MHz)	Limit dB(μ V)	
	Quasi-peak Level	Average Level
0.15 - 0.50	66.0 – 56.0 *	56.0 – 46.0 *
0.50 - 5.00	56.0	46.0
5.00 - 30.00	60.0	50.0
NOTE1: The lower limit shall apply at the transition frequencies. NOTE2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.		

10.4.Configuration of EUT on Test

The equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner, which tends to maximize its emission characteristics in a normal application.

10.5.Operating Condition of EUT

10.5.1.Setup the EUT and simulator as shown as Section 10.1.

10.5.2.Turn on the power of all equipment.

10.5.3.Let the EUT work in test mode and measure it.

10.6.Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC lines are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10: 2013 on Conducted Emission Measurement.

The bandwidth of test receiver is set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

10.7.Data Sample

Frequency (MHz)	Transducer value (dB)	QuasiPeak Level (dBμV)	Average Level (dBμV)	QuasiPeak Limit (dBμV)	Average Limit (dBμV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)
X.XX	10.5	51.1	34.2	56.0	46.0	4.9	11.8	Pass

Frequency(MHz) = Emission frequency in MHz

Transducer value(dB) = Insertion loss of LISN + Cable Loss

Level(dBμV) = Quasi-peak Reading/Average Reading + Transducer value

Limit (dBμV) = Limit stated in standard

Calculation Formula:

Margin = Limit (dBμV) - Level (dBμV)

10.8.Result:

N/A

Note: The EUT is powered by battery(DC 3V). Therefore, the test is not applicable and skipped.

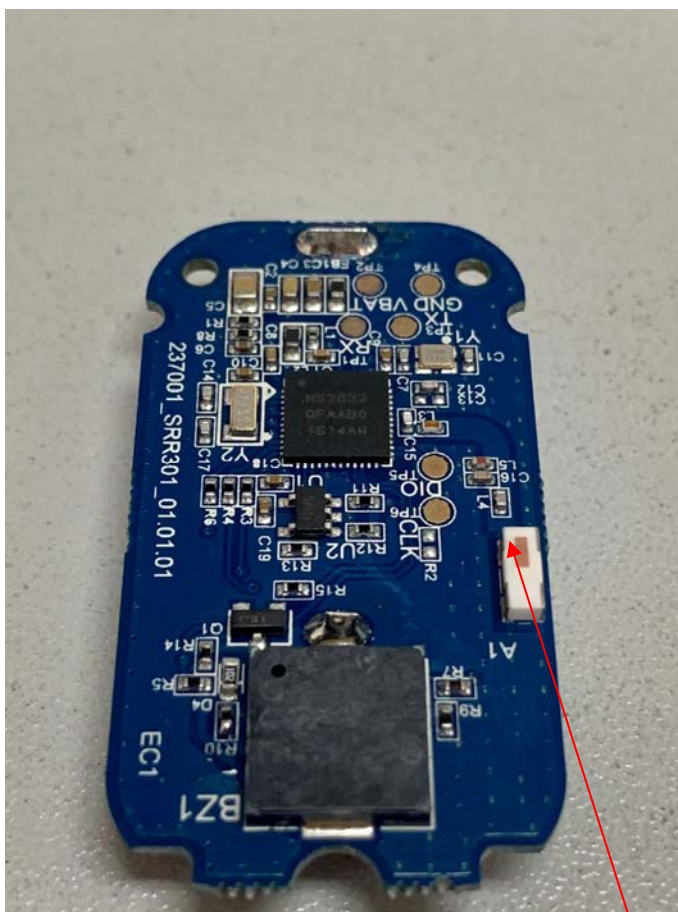
11.ANTENNA REQUIREMENT

11.1.The Requirement

According to 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.

11.2.Antenna Construction

Device is equipped with permanent attached antenna, which isn't displaced by other antenna. The Max Antenna gain of EUT is -2dBi. Therefore, the equipment complies with the antenna requirement of Section 15.203.



Antenna

***** End of Test Report *****