

APPLICATION CERTIFICATION FCC Part 15C

On Behalf of
HMC Holdings, LLC

FWCPU

Model No.: FWC-301

FCC ID: 2AP9FFWC301

Prepared for : HMC Holdings, LLC
Address : 1605 OLD Route, 18 STE 4-36, Wampum, PA-16157, USA

Prepared by : Shenzhen Accurate Technology Co., Ltd.
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Report No. : ATE20191277
Date of Test : Aug. 20, 2019-Aug. 27, 2019
Date of Report : Aug. 28, 2019

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Test Report Certification

Applicant : HMC Holdings, LLC
 Address : 1605 OLD Route, 18 STE 4-36, Wampum, PA-16157, USA
 Manufacturer : HMC Holdings, LLC
 Address : 1605 OLD Route, 18 STE 4-36, Wampum, PA-16157, USA
 Product : FWCPU
 Model No. : FWC-301
 Trade name : 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 April 02, 2019 KDB558074 D01 DTS Meas Guidance v05r02 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 : Aug. 20, 2019-Aug. 27, 2019

Date of Report: Aug. 28, 2019

Prepared by :



 (Tim Zhang, Engineer)

Approved & Authorized Signer :


 (Sean Liu, Manager)

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	FWCPU
Model Number	:	FWC-301
Bluetooth version	:	BT V4.0 LE Mode
Frequency Range	:	2402MHz-2480MHz
Number of Channels	:	40
Antenna Gain	:	4dBi
Antenna type	:	Chip Antenna
Power Supply	:	DC 4.5-10V
Modulation mode	:	GFSK
Applicant	:	HMC Holdings, LLC.
Address	:	1605 OLD Route, 18 STE 4-36, Wampum, PA-16157, USA
Manufacturer	:	HMC Holdings, LLC.
Address	:	1605 OLD Route, 18 STE 4-36, Wampum, PA-16157, USA
Date of sample received	:	Aug. 20, 2018
Date of Test	:	Aug. 20, 2019-Aug. 27, 2019

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

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

Conducted Emission Expanded Uncertainty (Mains ports, 9kHz-30MHz)	= 2.72dB, k=2
Radiated emission expanded uncertainty (9kHz-30MHz)	= 2.66dB, k=2
Radiated emission expanded uncertainty (30MHz-1000MHz)	= 4.28dB, k=2
Radiated emission expanded uncertainty (1G-18GHz)	= 4.98dB, k=2
Radiated emission expanded uncertainty (18G-26.5GHz)	= 5.06dB, k=2

2. MEASURING DEVICE AND TEST EQUIPMENT

2.1.For Radiated Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analyzer	Agilent	E7405A	MY45115511	Jan.05, 2019	1 Year
2.	Spectrum Analyzer	Rohde&Schwarz	FSV40	101495	Jan.05, 2019	1 Year
3.	Test Receiver	Rohde&Schwarz	ESCS30	100307	Jan.05, 2019	1 Year
4.	Test Receiver	Rohde& Schwarz	ESPI	100396/003	Jan.05, 2019	1 Year
5.	Test Receiver	Rohde& Schwarz	ESPI	101526/003	Jan.05, 2019	1 Year
6.	Test Receiver	Rohde& Schwarz	ESR	101817	Jan.05, 2019	1 Year
7.	Bilog Antenna	Schwarzbeck	VULB9163	9163-194	Jan.05, 2019	1 Year
8.	Bilog Antenna	Schwarzbeck	VULB9163	9163-323	Jan.05, 2019	1 Year
9.	Log.-Per.Antenna	Schwarzbeck	VUSLP 9111B	9111B-074	Jan.05, 2019	1 Year
10.	Biconical Broad Band Antenna	Schwarzbeck	VHBB 9124+BBA 9106	9124-617	Jan.05, 2019	1 Year
11.	Loop Antenna	Schwarzbeck	FMZB1516	1516131	Jan.05, 2019	1 Year
12.	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-655	Jan.05, 2019	1 Year
13.	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1067	Jan.05, 2019	1 Year
14.	Vertical Active Monopole Antenna	Schwarzbeck	VAMP 9243	9243-370	Jan.05, 2019	1 Year
15.	RF Switching Unit+PreAMP	Compliance Direction	RSU-M2	38322	Jan.05, 2019	1 Year
16.	Pre-Amplifier	Agilent	8447D	294A10619	Jan.05, 2019	1 Year
17.	Pre-Amplifier	Rohde&Schwarz	CBLU11835 40-01	3791	Jan.05, 2019	1 Year
18.	50 Coaxial Switch	Anritsu Corp	MP59B	6200237248	Jan.05, 2019	1 Year
19.	50 Coaxial Switch	Anritsu Corp	MP59B	6200506474	Jan.05, 2019	1 Year
20.	RF Coaxial Cable	Schwarzbeck	N-5m	No.1	Jan.05, 2019	1 Year
21.	RF Coaxial Cable	Schwarzbeck	N-1m	No.6	Jan.05, 2019	1 Year
22.	RF Coaxial Cable	Schwarzbeck	N-1m	No.7	Jan.05, 2019	1 Year
23.	RF Coaxial Cable	SUHNER	N-3m	No.8	Jan.05, 2019	1 Year
24.	RF Coaxial Cable	RESENBERGER	N-3.5m	No.9	Jan.05, 2019	1 Year
25.	RF Coaxial Cable	SUHNER	N-6m	No.10	Jan.05, 2019	1 Year
26.	RF Coaxial Cable	RESENBERGER	N-12m	No.11	Jan.05, 2019	1 Year
27.	RF Coaxial Cable	RESENBERGER	N-0.5m	No.12	Jan.05, 2019	1 Year
28.	RF Coaxial Cable	SUHNER	N-2m	No.13	Jan.05, 2019	1 Year
29.	RF Coaxial Cable	SUHNER	N-0.5m	No.15	Jan.05, 2019	1 Year
30.	RF Coaxial Cable	SUHNER	N-2m	No.16	Jan.05, 2019	1 Year
31.	RF Coaxial Cable	RESENBERGER	N-6m	No.17	Jan.05, 2019	1 Year
Radiated Emission Measurement Software: EZ EMC V1.1.4.2						

2.2.The Equipment Used to Measure Conducted Disturbance (L.I.S.N)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCS30	100307	Jan.05, 2019	1 Year
2.	Test Receiver	Rohde & Schwarz	ESPI3	100396/003	Jan.05, 2019	1 Year
3.	Test Receiver	Rohde & Schwarz	ESPI3	101526/003	Jan.05, 2019	1 Year
4.	L.I.S.N.	Schwarzbeck	NLSK8126	8126431	Jan.05, 2019	1 Year
5.	L.I.S.N.	Rohde & Schwarz	ESH3-Z5	100305	Jan.05, 2019	1 Year
6.	L.I.S.N.	Rohde & Schwarz	ESH3-Z5	100310	Jan.05, 2019	1 Year
7.	L.I.S.N.	Rohde & Schwarz	ESH3-Z6	100132	Jan.05, 2019	1 Year
8.	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100305	Jan.05, 2019	1 Year
9.	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100312	Jan.05, 2019	1 Year
10.	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100815	Jan.05, 2019	1 Year
11.	50Ω Coaxial Switch	Anritsu Corp	MP59B	6200283936	Jan.05, 2019	1 Year
12.	50Ω Coaxial Switch	Anritsu Corp	MP59B	6200283933	Jan.05, 2019	1 Year
13.	50Ω Coaxial Switch	Anritsu Corp	MP59B	6200506474	Jan.05, 2019	1 Year
14.	VOLTAGE PROBE	Schwarzbeck	TK9416	N/A	Jan.05, 2019	1 Year
15.	RF CURRENT PROBE	Rohde & Schwarz	EZ-17	100048	Jan.05, 2019	1 Year
16.	8-Wire Impedance Stabilisation Network	Schwarzbeck	CAT5 8158	8158-0035	Jan.05, 2019	1 Year
17.	RF Coaxial Cable	SUHNER	N-2m	No.2	Jan.05, 2019	1 Year
18.	RF Coaxial Cable	SUHNER	N-2m	No.3	Jan.05, 2019	1 Year
19.	RF Coaxial Cable	SUHNER	N-2m	No.14	Jan.05, 2019	1 Year
Conducted Emission Measurement Software: ES-K1 V1.71						

3. OPERATION OF EUT DURING TESTING

3.1.Operating Mode

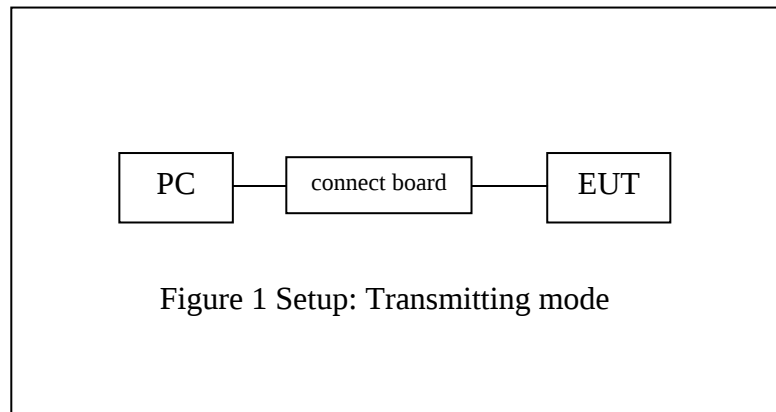
The mode is used: **BLE Transmitting mode**

Low Channel: 2402MHz

Middle Channel: 2440MHz

High Channel: 2480MHz

3.2.Configuration and peripherals



(EUT: FWCPU)

4. TEST PROCEDURES AND RESULTS

FCC Rules	Description of Test	Result
Section 15.247(a)(2)	6dB Bandwidth Test	Compliant
Section 15.247(e)	Power Spectral Density Test	Compliant
Section 15.247(b)(3)	Maximum Peak Output Power Test	Compliant
Section 15.247(d)	Band Edge Compliance Test	Compliant
Section 15.247(d) Section 15.209	Radiated Spurious Emission Test	Compliant
Section 15.247(d)	Conducted 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 4.5-10V, According to the FCC standard's requirements, conducted emission is not applicable.

5. 6DB BANDWIDTH MEASUREMENT

5.1. Block Diagram of Test Setup



(EUT: FWCPU)

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 Measurement

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.

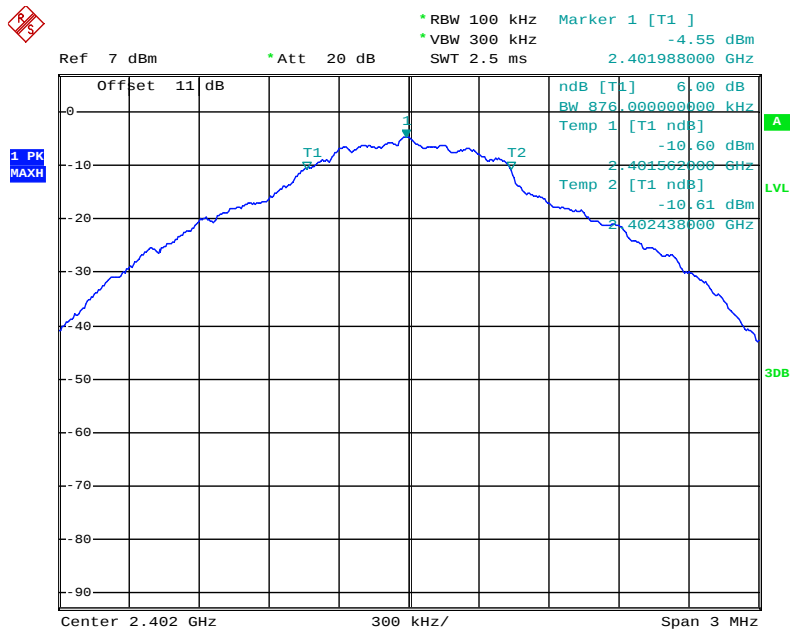
5.6.Test Result

The test data of BLE:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit(MHz)	PASS/FAIL
0	2402	0.876	0.5	PASS
19	2440	0.882	0.5	PASS
39	2480	0.888	0.5	PASS

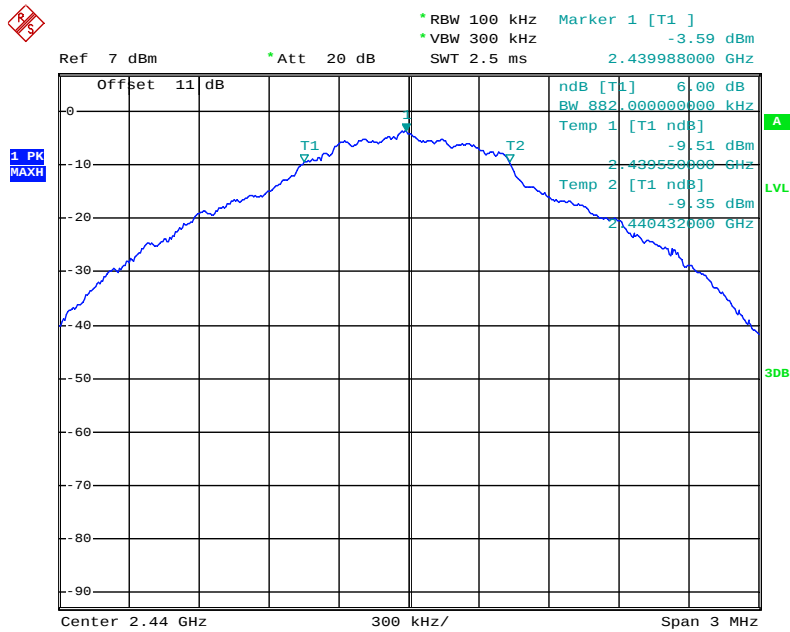
The spectrum analyzer plots are attached as below.

channel 0



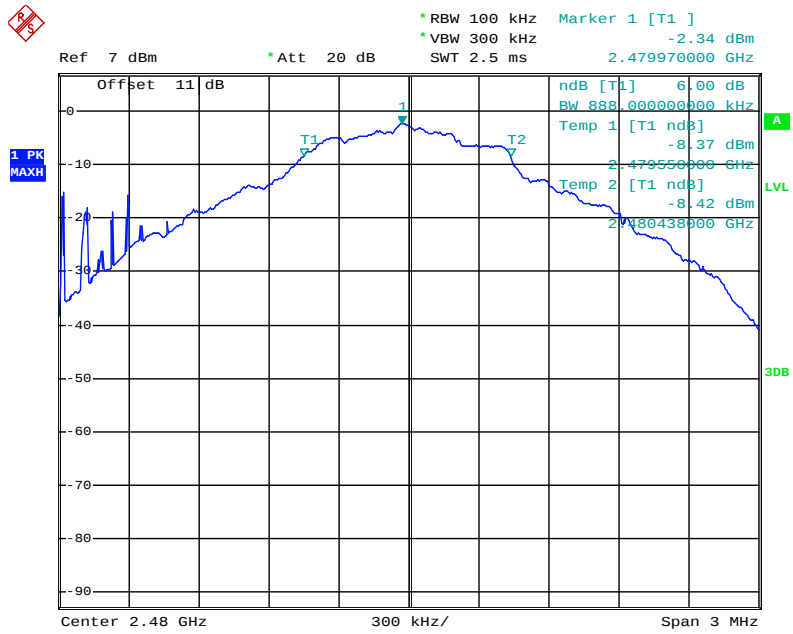
Date: 23.AUG.2019 15:33:02

channel 19



Date: 23.AUG.2019 15:44:08

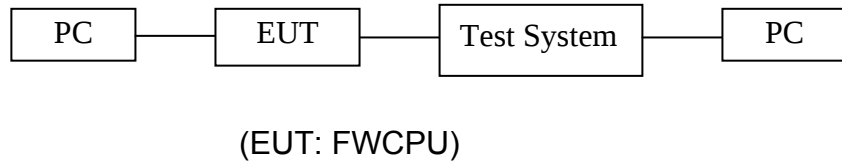
channel 39



Date: 23.AUG.2019 15:04:23

6. MAXIMUM PEAK OUTPUT POWER

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 Measurement

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.

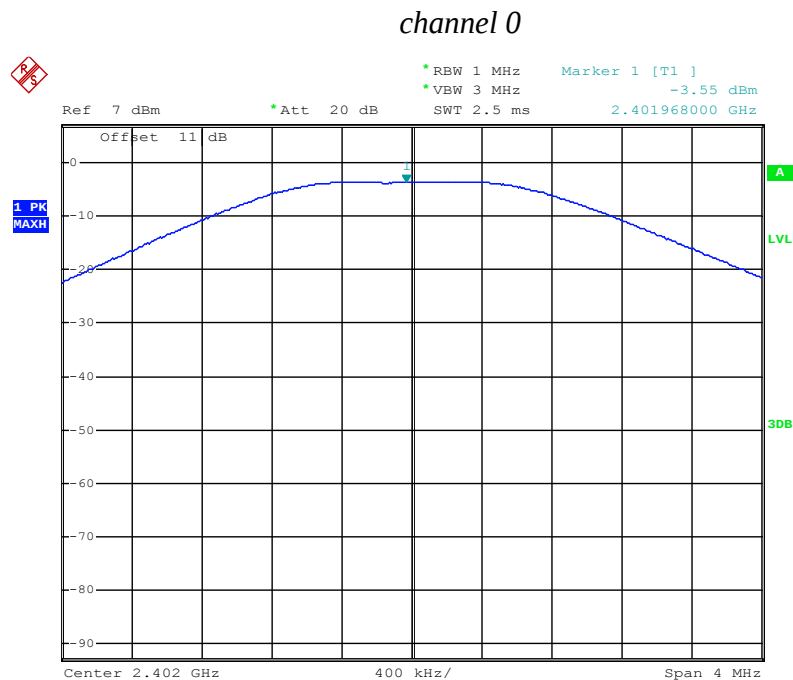
6.5.2. Set RBW of spectrum analyzer to 1 MHz and VBW to 3 MHz.

6.5.3. Measurement the maximum peak output power.

6.6.Test Result

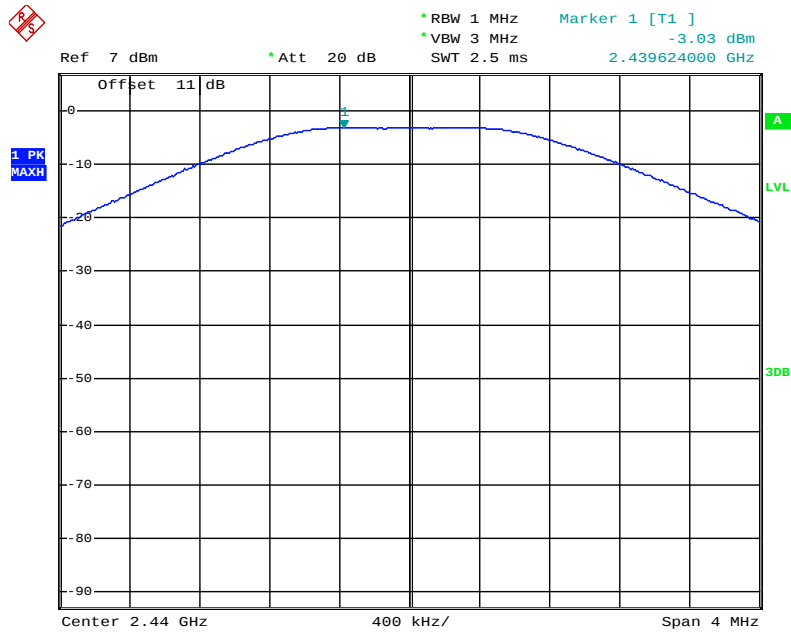
Channel	Frequency (MHz)	Peak Power Output (dBm)	Peak Power Limit (dBm)	Pass / Fail
0	2402	-3.55	30	PASS
19	2440	-3.03	30	PASS
39	2480	-2.34	30	PASS

The spectrum analyzer plots are attached as below.



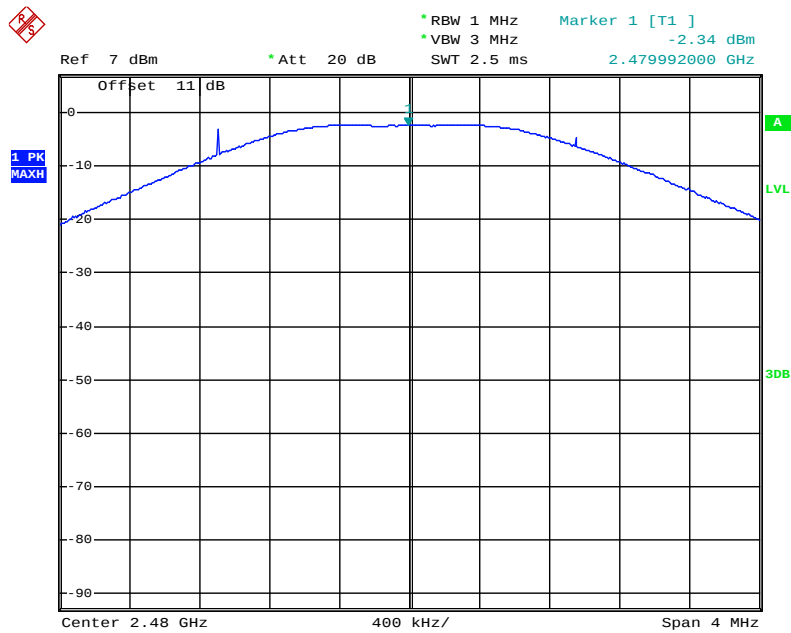
Date: 23.AUG.2019 15:34:49

channel 19



Date: 23.AUG.2019 15:42:41

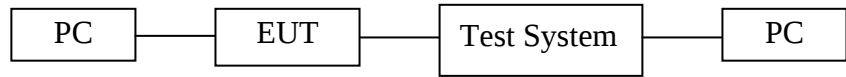
channel 39



Date: 23.AUG.2019 15:02:06

7. POWER SPECTRAL DENSITY MEASUREMENT

7.1. Block Diagram of Test Setup



(EUT: FWCPU)

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 Measurement

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.

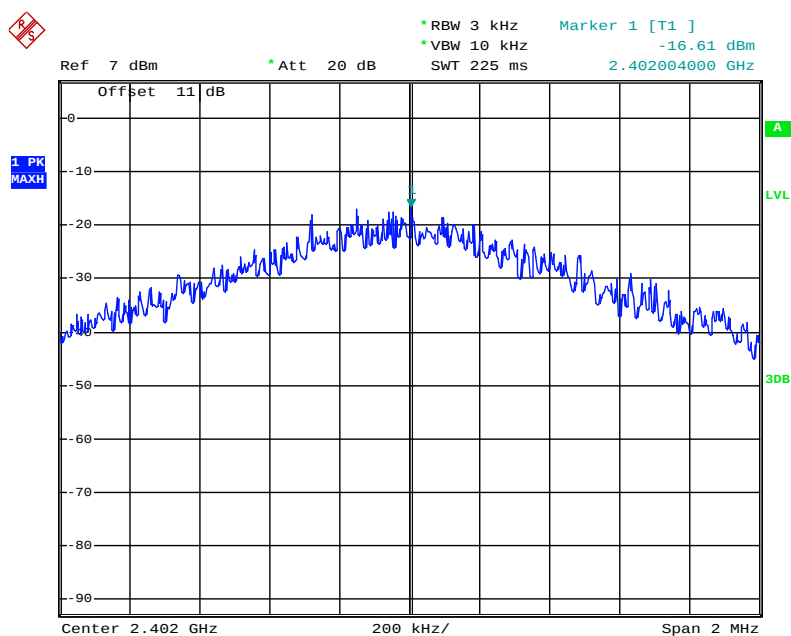
7.5.4. Measurement the maximum power spectral density.

7.6.Test Result

CHANNEL NUMBER	FREQUENCY (MHz)	PSD (dBm/3KHz)	LIMIT (dBm/3KHz)	PASS/FAIL
0	2402	-16.61	8	PASS
19	2440	-18.10	8	PASS
39	2480	-16.81	8	PASS

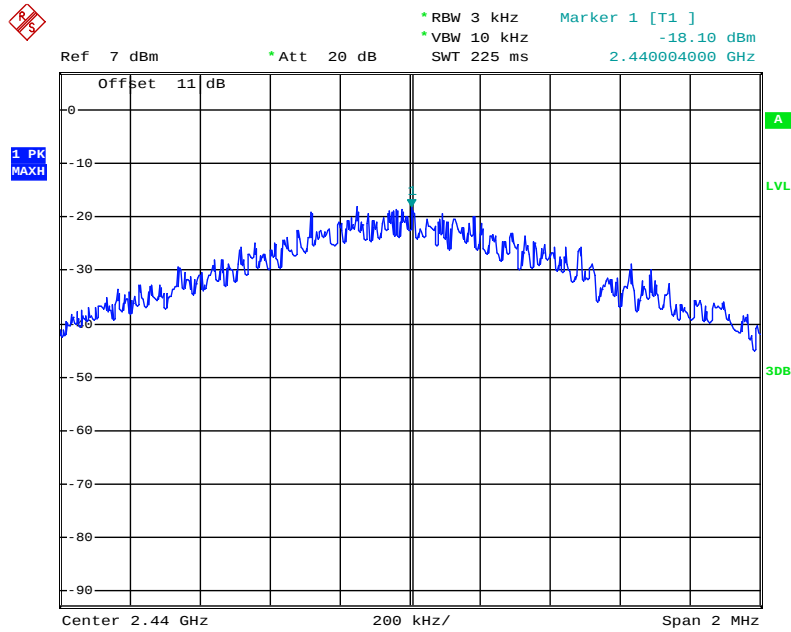
The spectrum analyzer plots are attached as below.

channel 0



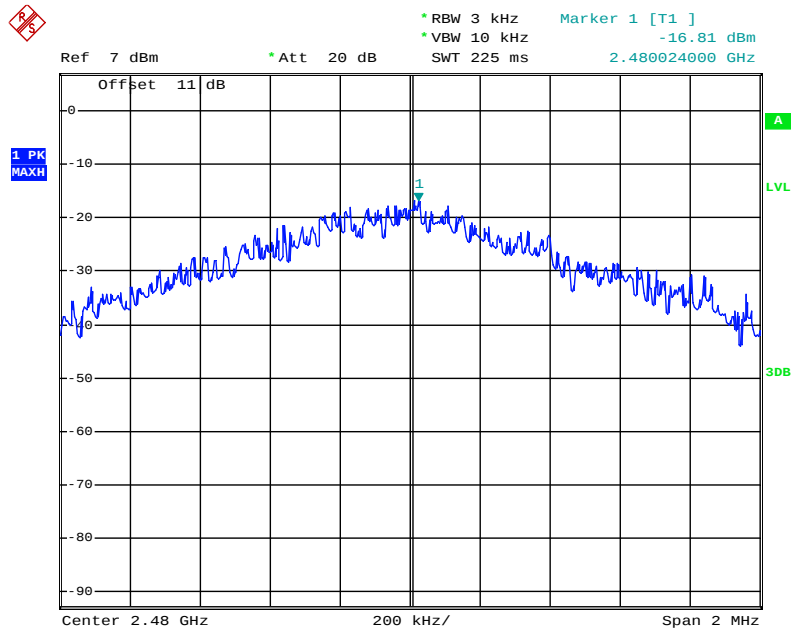
Date: 23.AUG.2019 15:39:06

channel 19



Date: 23.AUG.2019 15:41:43

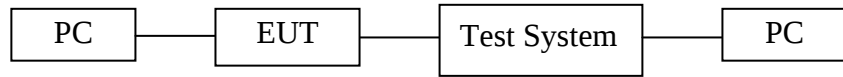
channel 39



Date: 23.AUG.2019 15:05:48

8. BAND EDGE COMPLIANCE TEST

8.1. Block Diagram of Test Setup



(EUT: FWCPU)

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 Measurement

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.

8.5.3. Radiate Band Edge:

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

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

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

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

8.5.8. RBW=1MHz, VBW=1MHz

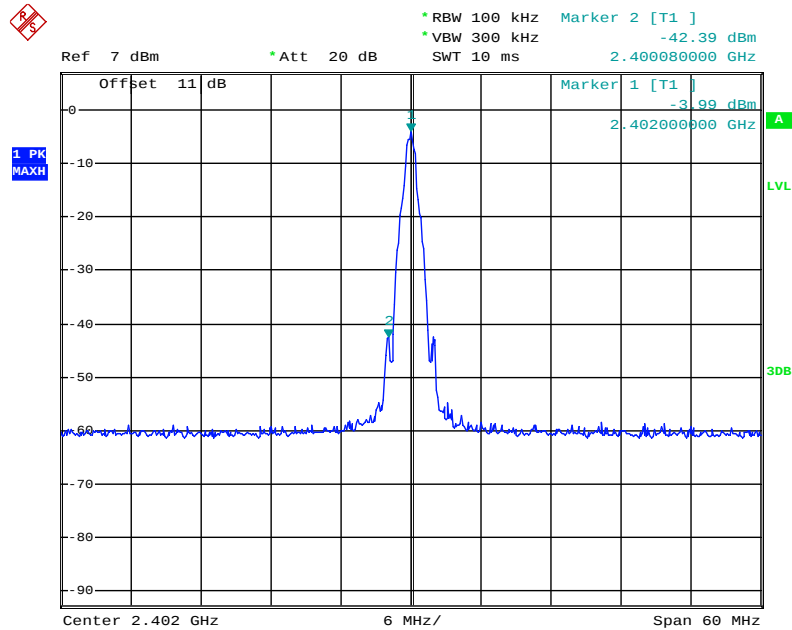
8.5.9. The band edges was measured and recorded.

8.6. Test Result

Pass

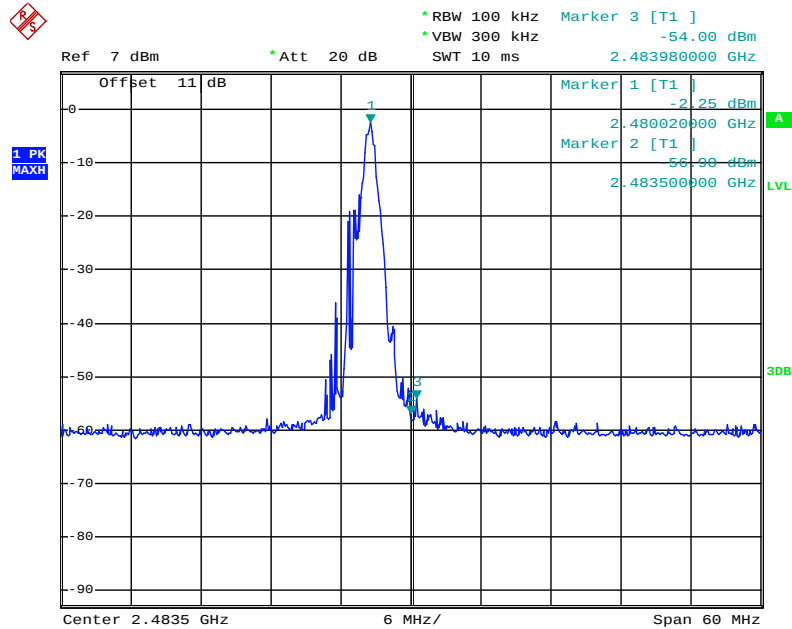
Frequency	Delta peak to band emission	Limit(dBc)
2.4GHz	38.40	20
2.48398GHz	51.75	20

channel 0



Date: 23.AUG.2019 15:36:46

channel 39



Date: 23.AUG.2019 15:07:47

Radiated Band Edge Result



ACCURATE TECHNOLOGY CO., LTD.

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

Site: 1# Chamber

Tel:+86-0755-26503290

Fax:+86-0755-26503396

Job No.: FRANK2019 #842

Standard: FCC 15.247

Test item: Radiation Test

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

EUT: FWCPU

Mode: TX 2402MHz

Model: FWC-301

Manufacturer: HMC Holdings, LLC

Polarization: Horizontal

Power Source: DC 6V

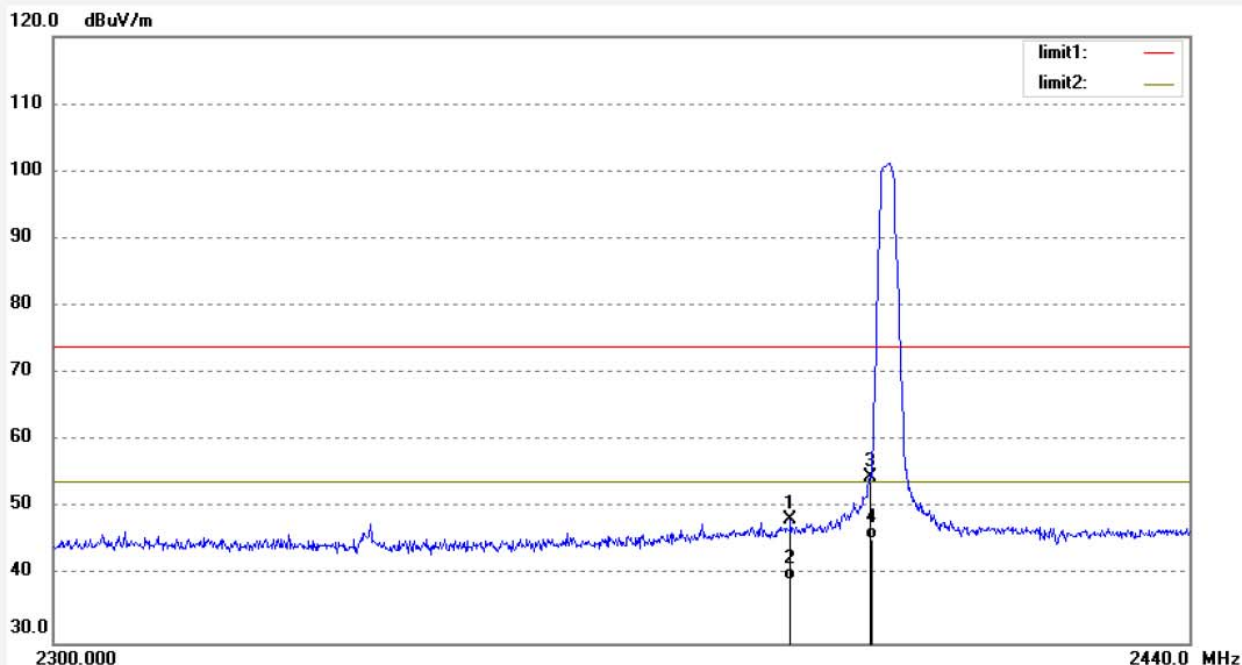
Date: 19/08/26/

Time: 9/30/12

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191277



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	47.52	0.79	48.31	74.00	-25.69	peak	200	148	
2	2390.000	38.45	0.79	39.24	54.00	-14.76	AVG	200	165	
3	2400.000	53.66	0.88	54.54	74.00	-19.46	peak	200	200	
4	2400.000	44.45	0.88	45.33	54.00	-8.67	AVG	200	103	

Job No.: FRANK2019 #843

Standard: FCC 15.247

Test item: Radiation Test

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

EUT: FWCPU

Mode: TX 2402MHz

Model: FWC-301

Manufacturer: HMC Holdings, LLC

Polarization: Vertical

Power Source: DC 6V

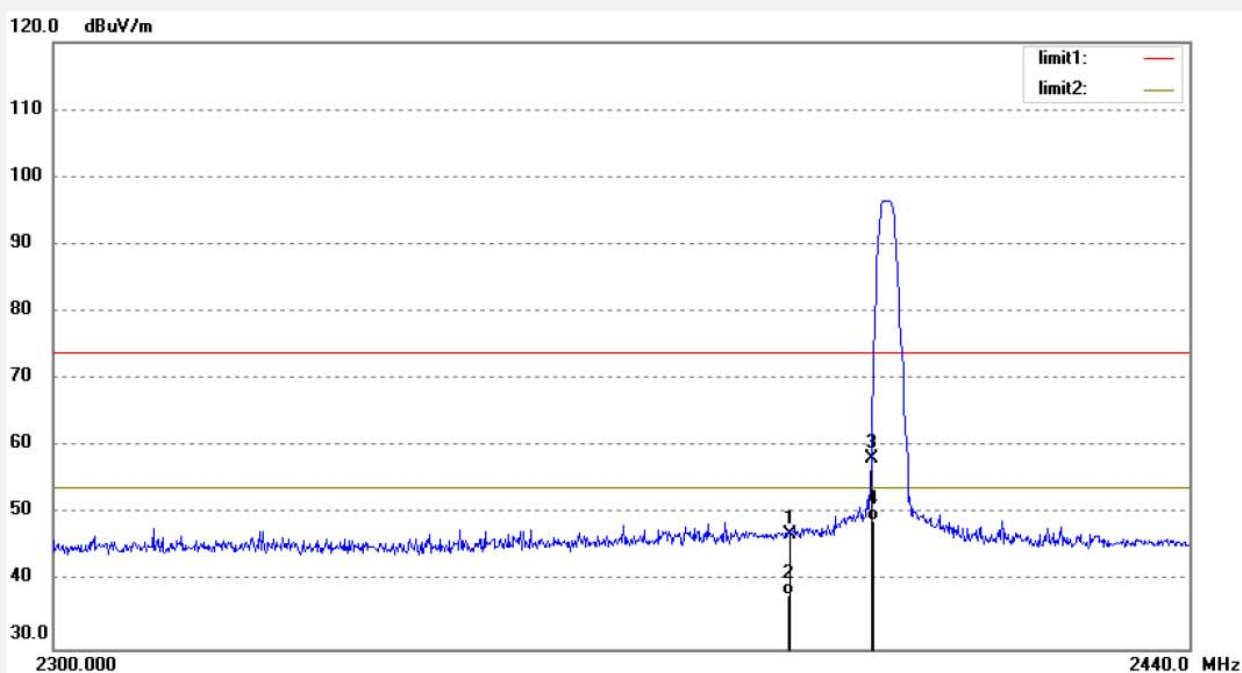
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Time: 9/32/20

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191277

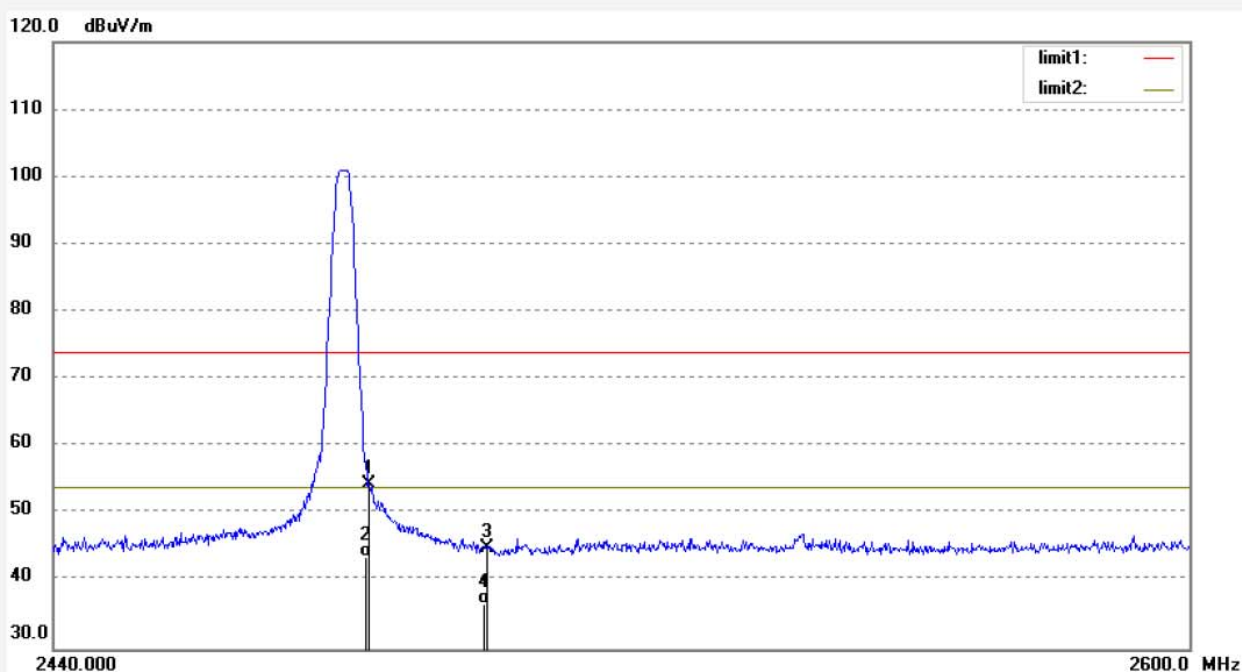


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2390.000	46.30	0.79	47.09	74.00	-26.91	peak	150	103	
2	2390.000	37.15	0.79	37.94	54.00	-16.06	AVG	150	201	
3	2400.000	57.30	0.88	58.18	74.00	-15.82	peak	150	199	
4	2400.000	48.15	0.88	49.03	54.00	-4.97	AVG	150	62	

Job No.: FRANK2019 #841
Standard: FCC 15.247
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: FWCPU
Mode: TX 2480MHz
Model: FWC-301
Manufacturer: HMC Holdings, LLC

Polarization: Horizontal
Power Source: DC 6V
Date: 19/08/26/
Time: 9/27/42
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191277

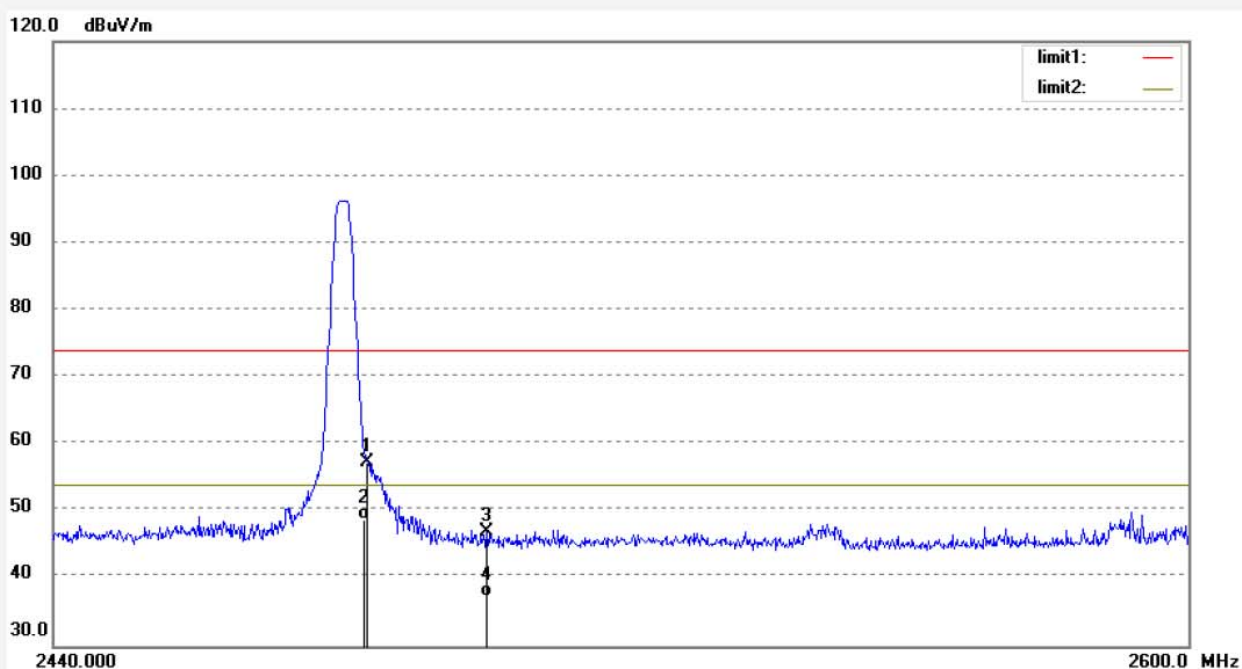


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2483.500	53.37	1.10	54.47	74.00	-19.53	peak	200	64	
2	2483.500	42.54	1.10	43.64	54.00	-10.36	AVG	200	116	
3	2500.000	43.90	1.10	45.00	74.00	-29.00	peak	200	210	
4	2500.000	35.48	1.10	36.58	54.00	-17.42	AVG	200	103	

Job No.: FRANK2019 #840
Standard: FCC 15.247
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: FWCPU
Mode: TX 2480MHz
Model: FWC-301
Manufacturer: HMC Holdings, LLC

Polarization: Vertical
Power Source: DC 6V
Date: 19/08/26/
Time: 9/26/31
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191277



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	56.17	1.10	57.27	74.00	-16.73	peak	150	92	
2	2483.500	47.64	1.10	48.74	54.00	-5.26	AVG	150	103	
3	2500.000	45.84	1.10	46.94	74.00	-27.06	peak	150	203	
4	2500.000	36.15	1.10	37.25	54.00	-16.75	AVG	150	159	

Note:

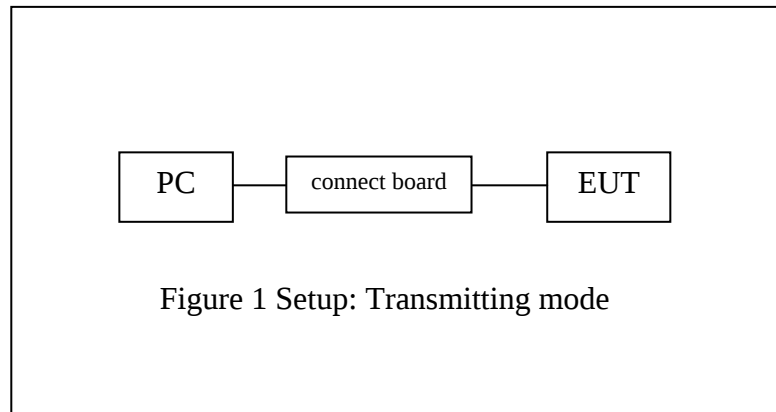
1. Emissions attenuated more than 20 dB below the permissible value are not reported.
2. The field strength is calculated by adding the antenna factor, high pass filter loss(if used) and cable loss, and subtracting the amplifier gain(if any)from the measured reading. The basic equation calculation is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

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

9. RADIATED SPURIOUS EMISSION TEST

9.1. Block Diagram of Test Setup

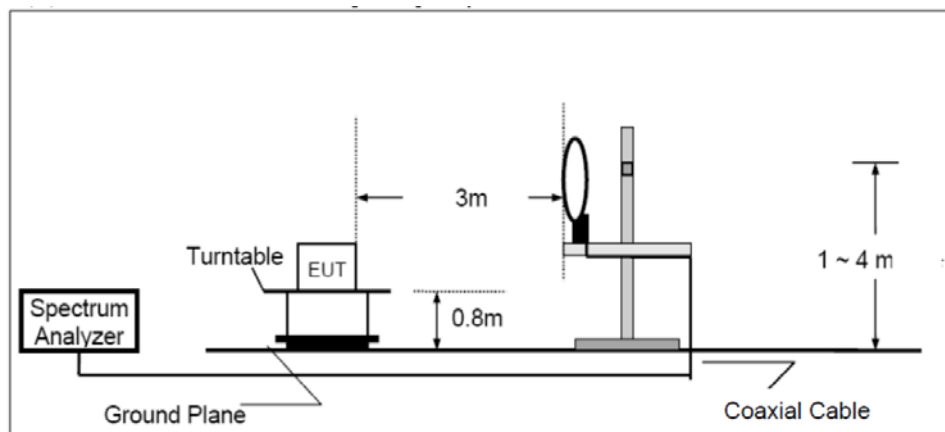
9.1.1. Block diagram of connection between the EUT and peripherals



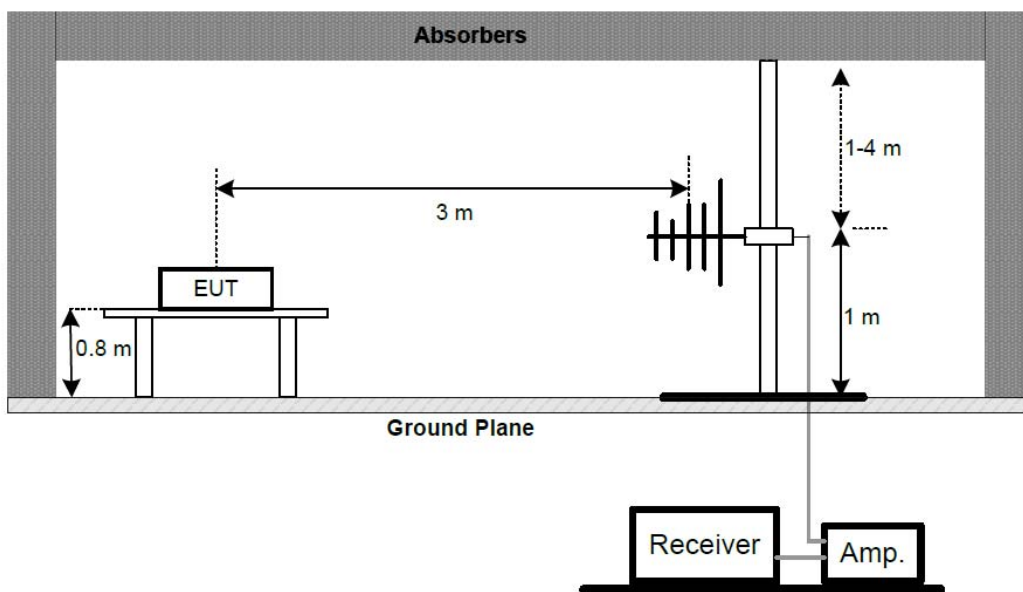
(EUT: FWCPU)

9.1.2. Semi-Anechoic Chamber Test Setup Diagram

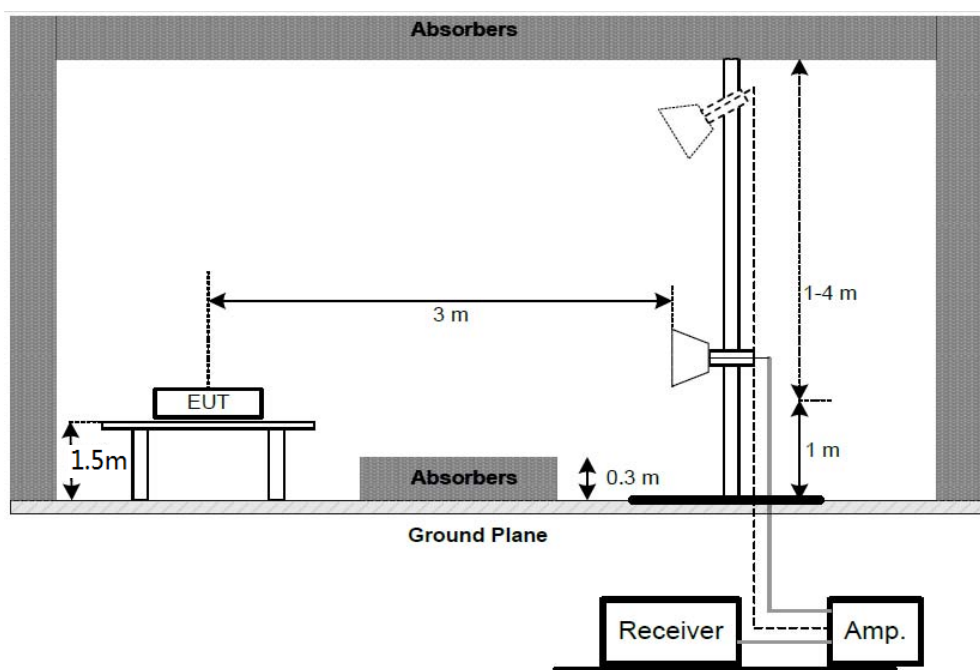
(A) Radiated Emission Test Set-Up, Frequency below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 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 Measurement

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. The EUT was tested in 3 orthogonal planes.

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 frequency range from 9 kHz to 25GHz is checked.

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. The basic equation calculation is as follows:

Result = Reading + Corrected Factor

Where Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

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	28.66	-15.19	13.47	40.0	-26.53	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.The Field Strength of Radiation Emission Measurement Results

PASS.

Note: 1. Emissions attenuated more than 20 dB below the permissible value are not reported.

2. *: Denotes restricted band of operation.

3. The radiation emissions from 9kHz-30MHz and 18-25GHz are not reported, because the test values lower than the limits of 20dB.

Below 1GHz

Job No.: FRANK2019 #199

Standard: FCC Class B 3M Radiated

Test item: Radiation Test

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

EUT: FWCPU

Mode: TX 2402MHz

Model: FWC-301

Manufacturer: HMC Holdings, LLC

Polarization: Horizontal

Power Source: DC 6V

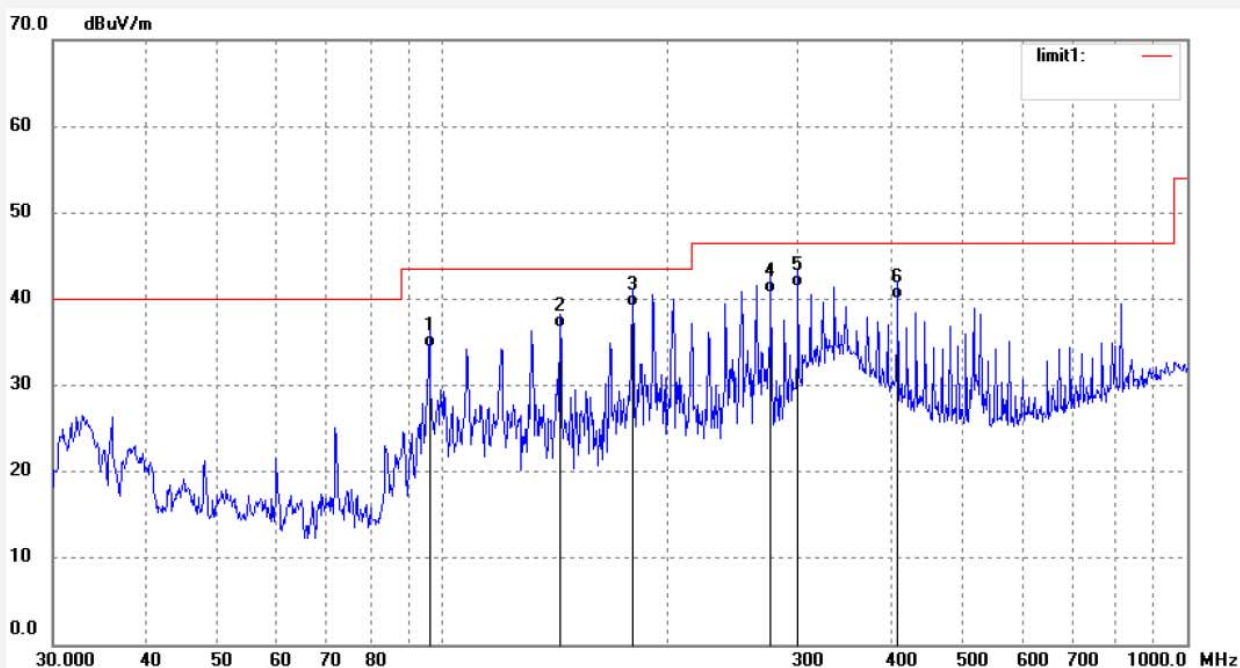
Date: 19/08/26/

Time: 17/07/41

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191277

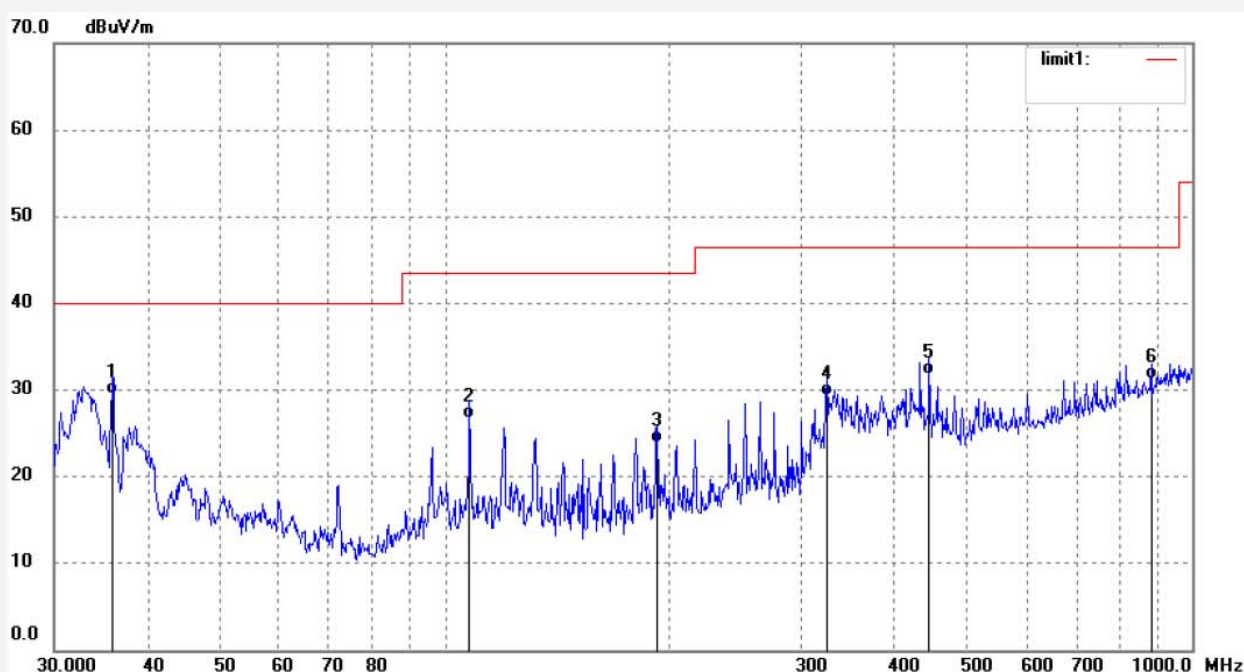


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	96.0986	48.77	-14.37	34.40	43.50	-9.10	QP	200	193	
2	143.8295	51.83	-15.11	36.72	43.50	-6.78	QP	200	221	
3	180.0165	52.50	-13.33	39.17	43.50	-4.33	QP	200	201	
4	276.1235	50.39	-9.70	40.69	46.50	-5.81	QP	200	93	
5	300.3672	50.48	-9.01	41.47	46.50	-5.03	QP	200	331	
6	408.9460	46.23	-6.21	40.02	46.50	-6.48	QP	200	201	

Job No.: FRANK2019 #198
Standard: FCC Class B 3M Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: FWCPU
Mode: TX 2402MHz
Model: FWC-301
Manufacturer: HMC Holdings, LLC

Polarization: Vertical
Power Source: DC 6V
Date: 19/08/26/
Time: 17/05/29
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191277



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	35.8746	40.12	-10.61	29.51	40.00	-10.49	QP	100	221	
2	107.8877	40.55	-13.84	26.71	43.50	-16.79	QP	100	321	
3	192.4186	36.28	-12.39	23.89	43.50	-19.61	QP	100	93	
4	324.4561	37.66	-8.26	29.40	46.50	-17.10	QP	100	204	
5	444.8514	37.16	-5.43	31.73	46.50	-14.77	QP	100	221	
6	881.4067	29.20	2.04	31.24	46.50	-15.26	QP	100	193	

Job No.: FRANK2019 #200

Standard: FCC Class B 3M Radiated

Test item: Radiation Test

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

EUT: FWCPU

Mode: TX 2440MHz

Model: FWC-301

Manufacturer: HMC Holdings, LLC

Polarization: Horizontal

Power Source: DC 6V

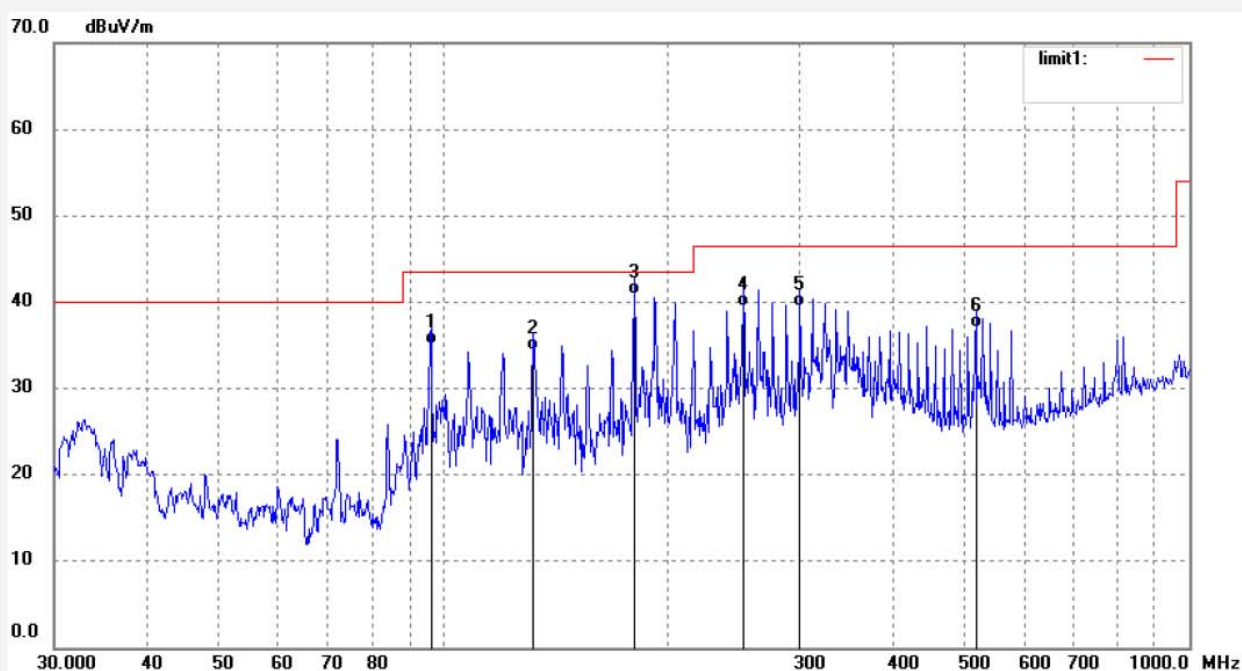
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Time: 17/09/38

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191277

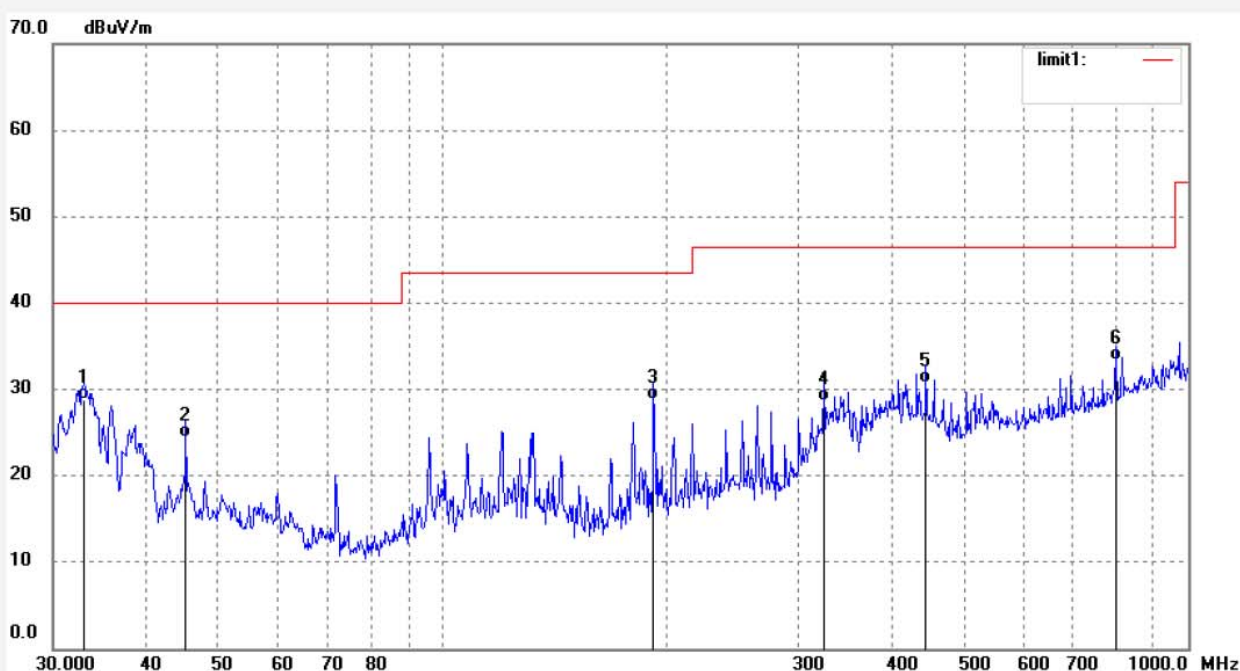


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	96.0986	49.47	-14.37	35.10	43.50	-8.40	QP	200	193	
2	131.7577	48.29	-13.84	34.45	43.50	-9.05	QP	200	221	
3	180.0165	54.12	-13.33	40.79	43.50	-2.71	QP	200	204	
4	252.0627	50.08	-10.54	39.54	46.50	-6.96	QP	200	98	
5	300.3672	48.46	-9.01	39.45	46.50	-7.05	QP	200	331	
6	517.2480	40.92	-3.91	37.01	46.50	-9.49	QP	200	201	

Job No.: FRANK2019 #201
Standard: FCC Class B 3M Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: FWCPU
Mode: TX 2440MHz
Model: FWC-301
Manufacturer: HMC Holdings, LLC

Polarization: Vertical
Power Source: DC 6V
Date: 19/08/26/
Time: 17/11/21
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191277



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	32.9791	38.96	-10.23	28.73	40.00	-11.27	QP	100	193	
2	45.2166	37.02	-12.62	24.40	40.00	-15.60	QP	100	22	
3	191.7450	41.21	-12.42	28.79	43.50	-14.71	QP	100	110	
4	324.4561	36.85	-8.26	28.59	46.50	-17.91	QP	100	96	
5	444.8514	36.17	-5.43	30.74	46.50	-15.76	QP	100	331	
6	798.9797	32.45	0.81	33.26	46.50	-13.24	QP	100	215	

Job No.: FRANK2019 #203

Standard: FCC Class B 3M Radiated

Test item: Radiation Test

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

EUT: FWCPU

Mode: TX 2480MHz

Model: FWC-301

Manufacturer: HMC Holdings, LLC

Polarization: Horizontal

Power Source: DC 6V

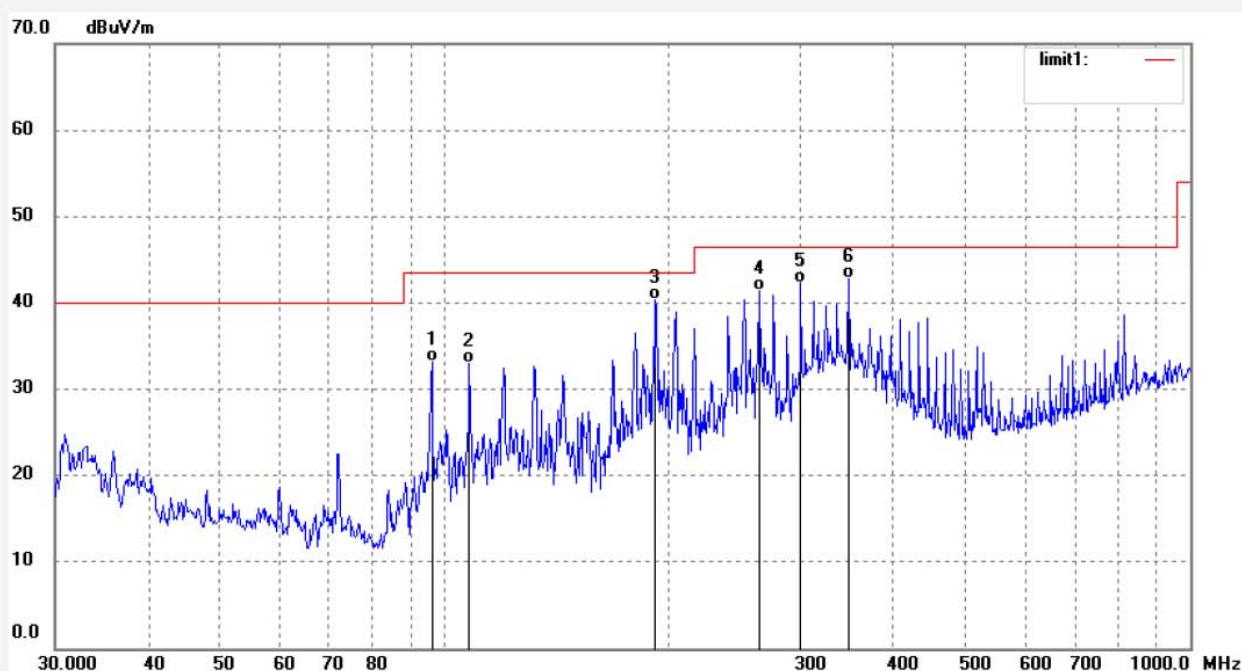
Date: 19/08/26/

Time: 17/13/26

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191277



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	96.0986	47.56	-14.37	33.19	43.50	-10.31	QP	200	119	
2	107.8876	46.78	-13.84	32.94	43.50	-10.56	QP	200	21	
3	191.7450	52.78	-12.42	40.36	43.50	-3.14	QP	200	337	
4	263.8190	51.66	-10.26	41.40	46.50	-5.10	QP	200	194	
5	300.3672	51.23	-9.01	42.22	46.50	-4.28	QP	200	52	
6	348.0274	50.27	-7.47	42.80	46.50	-3.70	QP	200	116	



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Site: 1# Chamber

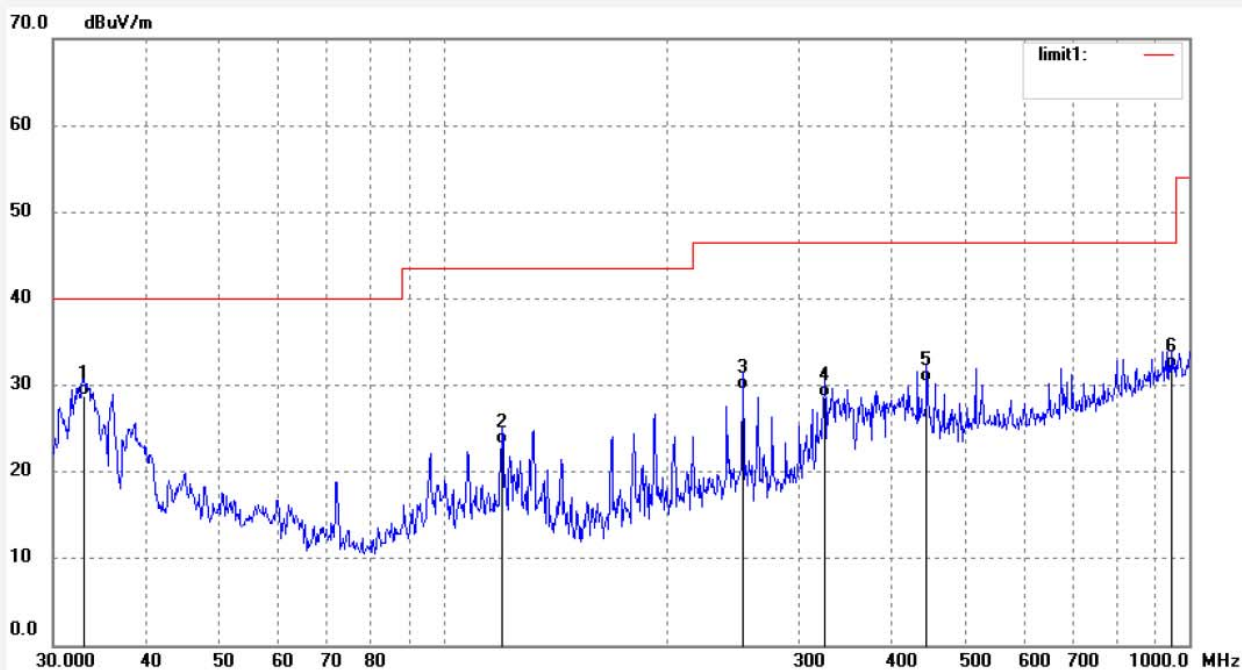
Tel:+86-0755-26503290

Fax:+86-0755-26503396

Job No.: FRANK2019 #202
Standard: FCC Class B 3M Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: FWCPU
Mode: TX 2480MHz
Model: FWC-301
Manufacturer: HMC Holdings, LLC

Polarization: Vertical
Power Source: DC 6V
Date: 19/08/26/
Time: 17/12/17
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191277



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	32.9791	38.98	-10.23	28.75	40.00	-11.25	QP	100	198	
2	119.8556	36.23	-13.06	23.17	43.50	-20.33	QP	100	55	
3	252.0627	40.11	-10.54	29.57	46.50	-16.93	QP	100	221	
4	324.4561	36.82	-8.26	28.56	46.50	-17.94	QP	100	101	
5	444.8514	35.72	-5.43	30.29	46.50	-16.21	QP	100	210	
6	948.7610	28.92	3.08	32.00	46.50	-14.50	QP	100	301	

Above 1GHz



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Fax:+86-0755-26503396

Job No.: FRANK2019 #209

Standard: FCC PK

Test item: Radiation Test

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

EUT: FWCPU

Mode: TX 2402MHz

Model: FWC-301

Manufacturer: HMC Holdings, LLC

Polarization: Horizontal

Power Source: DC 6V

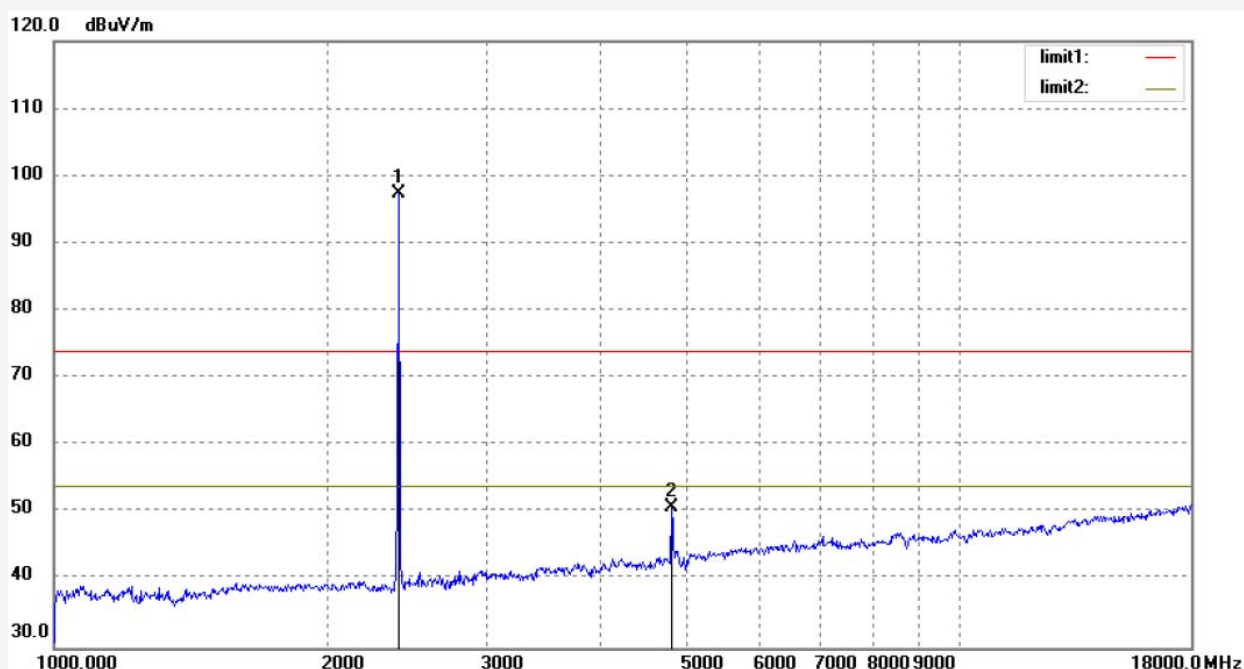
Date: 19/08/26/

Time: 17/25/20

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191277



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2402.153	96.40	0.88	97.28			peak	250	224	
2	4804.110	43.38	7.40	50.78	74.00	-23.22	peak	250	163	

Job No.: FRANK2019 #211

Standard: FCC PK

Test item: Radiation Test

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

EUT: FWCPU

Mode: TX 2402MHz

Model: FWC-301

Manufacturer: HMC Holdings, LLC

Polarization: Vertical

Power Source: DC 6V

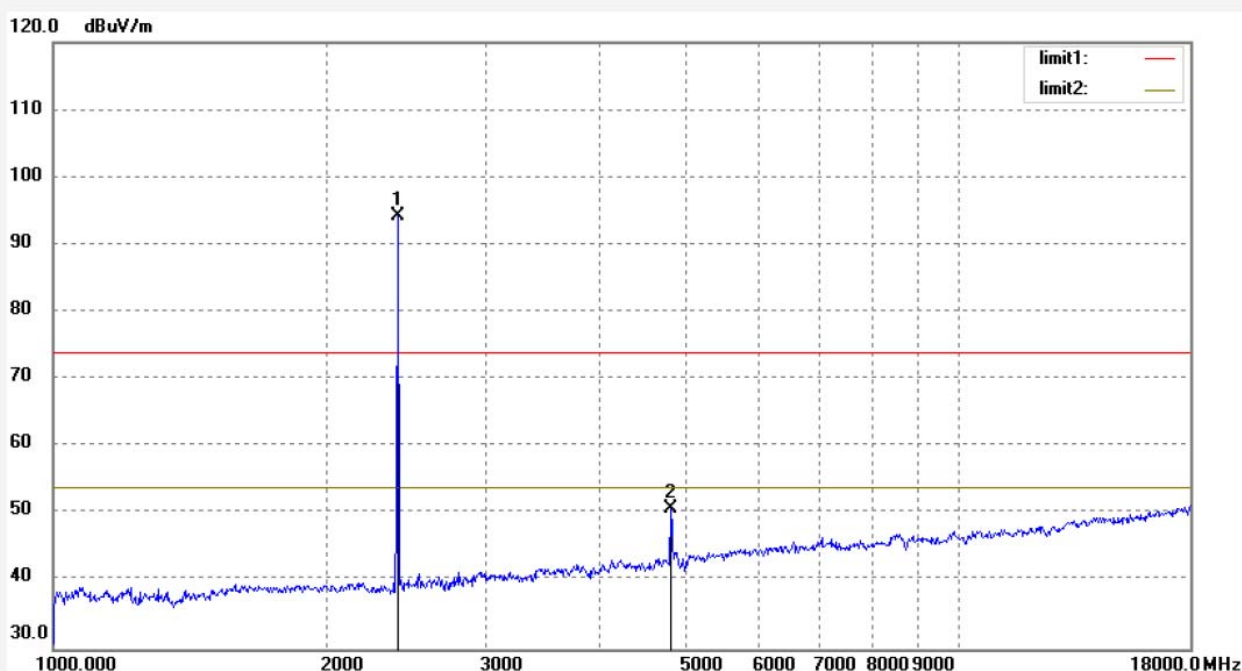
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Time: 17/25/20

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191277

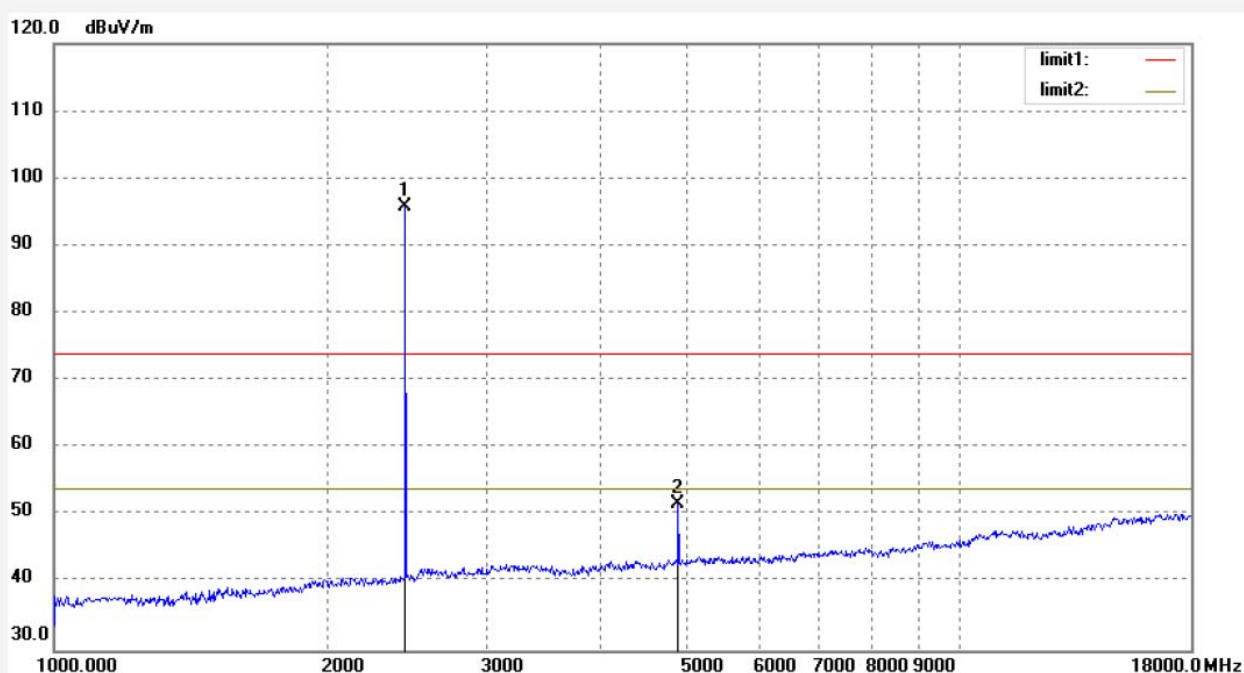


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2402.153	93.40	0.88	94.28			peak	150	301	
2	4804.110	43.38	7.40	50.78	74.00	-23.22	peak	150	142	

Job No.: FRANK2019 #213
Standard: FCC PK
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: FWCPU
Mode: TX 2440MHz
Model: FWC-301
Manufacturer: HMC Holdings, LLC

Polarization: Horizontal
Power Source: DC 6V
Date: 19/08/26/
Time: 17/25/24
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191277



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2442.151	94.74	1.06	95.80			peak	200	331	
2	4884.151	43.51	8.17	51.68	74.00	-22.32	peak	200	169	

Job No.: FRANK2019 #212

Standard: FCC PK

Test item: Radiation Test

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

EUT: FWCPU

Mode: TX 2440MHz

Model: FWC-301

Manufacturer: HMC Holdings, LLC

Polarization: Vertical

Power Source: DC 6V

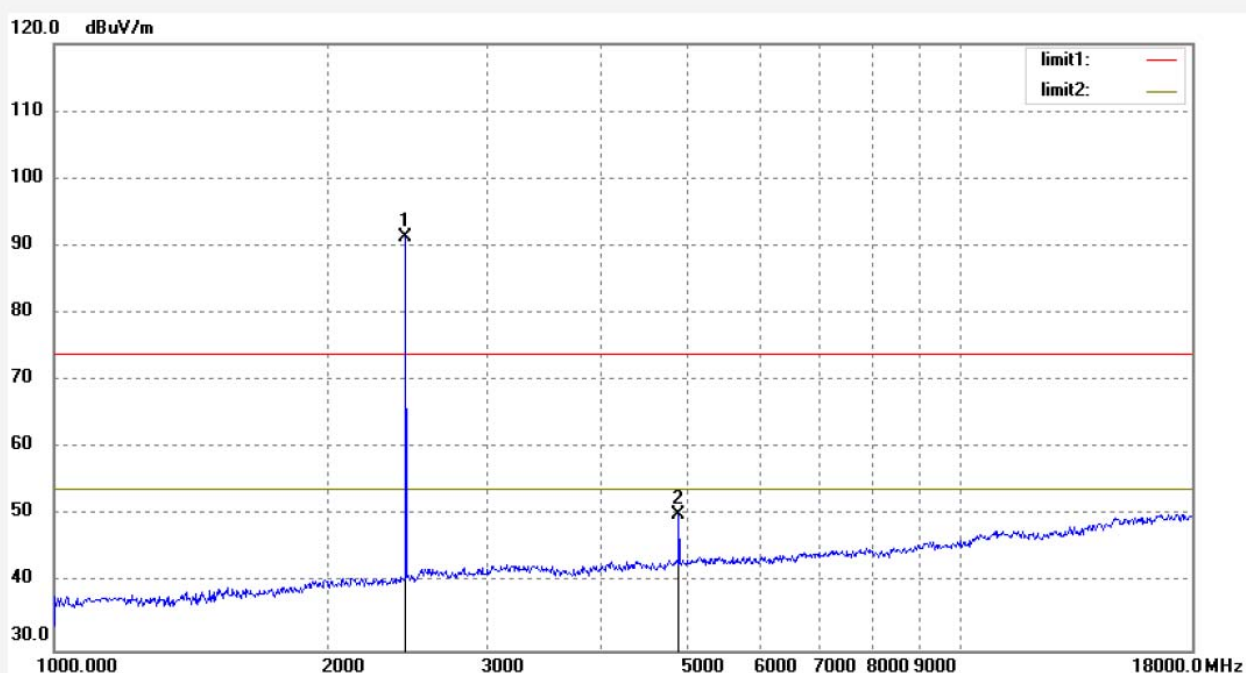
Date: 19/08/26/

Time: 17/25/24

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191277



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2442.151	90.24	1.06	91.30			peak	150	221	
2	4884.151	42.01	8.17	50.18	74.00	-23.82	peak	150	174	

Job No.: FRANK2019 #214

Standard: FCC PK

Test item: Radiation Test

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

EUT: FWCPU

Mode: TX 2480MHz

Model: FWC-301

Manufacturer: HMC Holdings, LLC

Polarization: Horizontal

Power Source: DC 6V

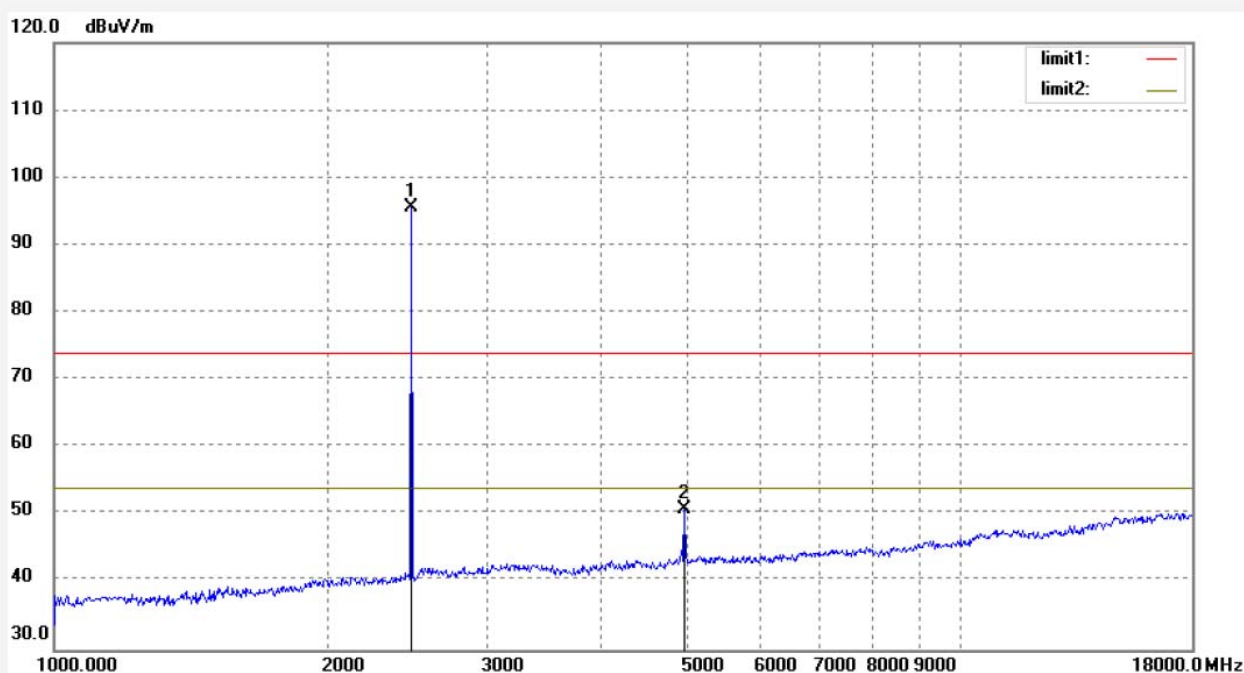
Date: 19/08/26/

Time: 17/25/24

Engineer Signature:

Distance: 3m

Note: Report NO.:ATE20191277

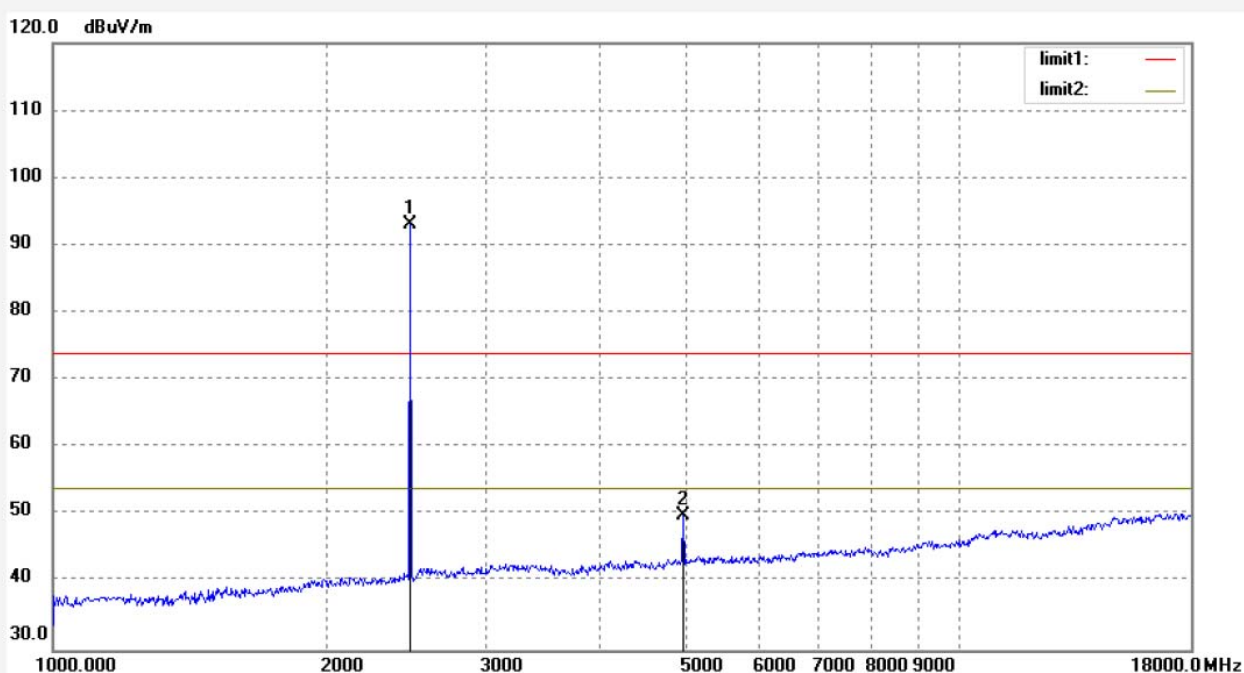


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2480.050	94.53	1.09	95.62			peak	200	196	
2	4960.107	42.25	8.58	50.83	74.00	-23.17	peak	250	312	

Job No.: FRANK2019 #215
Standard: FCC PK
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT: FWCPU
Mode: TX 2480MHz
Model: FWC-301
Manufacturer: HMC Holdings, LLC

Polarization: Vertical
Power Source: DC 6V
Date: 19/08/26/
Time: 17/25/24
Engineer Signature:
Distance: 3m

Note: Report NO.:ATE20191277



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2478.310	92.03	1.09	93.12	74.00	19.12	peak	150	221	
2	4959.307	41.25	8.58	49.83	74.00	-24.17	peak	150	169	

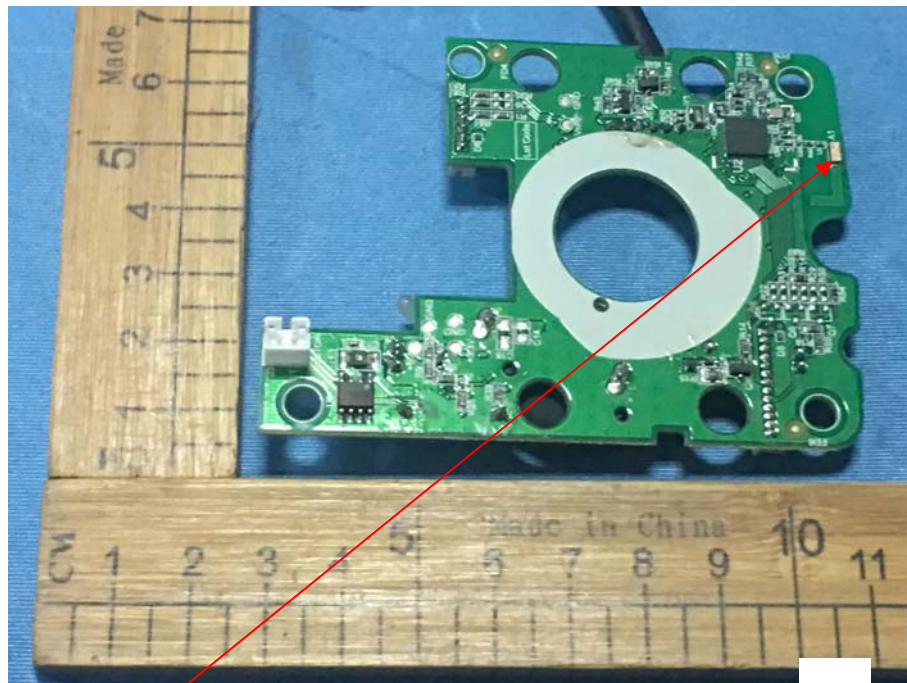
10. ANTENNA REQUIREMENT

10.1. 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.

10.2. Antenna Construction

The module must contain a permanently attached antenna, or contain a unique antenna connector, and be marketed and operated only with specific antenna(s), per Sections 15.203, 15.204(b), 15.204(c), 15.212(a), 2.929(b); The Antenna gain of EUT is 4dBi. Therefore, the equipment complies with the antenna requirement.



Antenna