RF Exposure Evaluation

Test report
On Behalf of
Shenzhen Feasycom Technology Co.,LTD
For
Bluetooth and Wi-Fi combo module
Model No.: FSC-BW236

FCC ID: 2AMWOFSC-BW236

Prepared for : **Shenzhen Feasycom Technology Co.,LTD**
Room 2004A, 20th Floor, Huichao Technology Building, Jinhai Road, Xixiang, Baoan District, Shenzhen, China 518102

Prepared By : **Shenzhen HUAK Testing Technology Co., Ltd.**
1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China

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Date of Report: **Nov. 04, 2020**

1 General Description of EUT

Product Name:	Bluetooth and Wi-Fi combo module			
Model/Type reference:	FSC-BW236			
Serial Model:	/			
Trade Mark:	Feasycom			
FCC ID	2AMWOFSC-BW236			
Hardware Version:	V1.2			
Software Version:	V2.2			
BLE				
Operation frequency:	2402MHz ~ 2480MHz			
Channel separation:	2MHz			
Data rate	1Mbit/s / 2Mbit/s			
Channel number:	40			
Modulation Technology:	GFSK			
Antenna Type:	PCB Antenna			
Antenna Gain:	0dBi			
Power Source	DC 3.3V from test board(5.0V)			
2.4GWIFI				
Operation frequency	802.11b/g/n20: 2412~2462 MHz 802.11n40: 2422~2452 MHz			
Number of Channels	802.11b/g/n20: 11CH			
Modulation Type	CCK/DSSS/OFDM			
Antenna type:	PCB Antenna			
Antenna gain:	0dBi			
5.2/5.8GWIFI				
Frequency Range :	Band	Mode	Operation frequency	Channels
	BAND I UNII-I	IEEE802.11a IEEE802.11acHT20 IEEE802.11ac HT40	5180-5240MHz 5180-5240MHz 5190-5230MHz	4 4 2
	BAND III UNII-3	IEEE802.11 a IEEE802.11 acHT20 IEEE802.11 acHT40	5745-5825 MHz 5745-5825 MHz 5755-5795 MHz	5 5 2
Modulation Technology:	OFDM			
Antenna Type:	PCB Antenna			

2 RF Exposure Compliance Requirement

2.1 Standard Requirement

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

F= Frequency in MHz Friis

Formula

Friis transmission formula: Pd = (Pout*G)/(4* Pi * R 2) Where

Pd = power density in mW/cm2

Pout = output power to antenna in mW

G =gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in cm

Pd id the limit of MPE . If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

3 EUT RF Exposure

Antenna Gain: 0Bi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is in linear scale. Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

For BLE:

BLE-1Mbit/s						
Channel	Maximum Peak Conducted Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power		Calculated value	Exclusion threshold
			(dBm)	(mW)		
Lowest (2402MHz)	7.076	7±1	8	6.310	0.0019	1.0
Middle (2440MHz)	6.592	7±1	8	6.310	0.0019	
Highest (2480MHz)	5.489	6±1	7	5.012	0.0015	
Conclusion: the calculated value <1.0, compliance with RF Exposure requirement						

BLE-2Mbit/s						
Channel	Maximum Peak Conducted Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power		Calculated value	Exclusion threshold
			(dBm)	(mW)		
Lowest (2402MHz)	7.558	7±1	8	6.310	0.0019	1.0
Middle (2440MHz)	7.024	7±1	8	6.310	0.0019	
Highest (2480MHz)	5.831	6±1	7	5.012	0.0015	
Conclusion: the calculated value <1.0, compliance with RF Exposure						

Remark: The Max Conducted Peak Output Power data refer to report Report No.: HK2010293163-1E

Value : Pd = ($P_{tune-up}$*G)/(4* Pi * R2)

For 2.4GWIFI

802.11b mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	15.20	15±1	16	39.811
Middle(2437MHz)	15.76	15±1	16	39.811
Highest(2462MHz)	16.05	16±1	17	50.119

802.11g mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	15.62	15±1	16	39.811
Middle(2437MHz)	15.90	15±1	16	39.811
Highest(2462MHz)	16.35	16±1	17	50.119

802.11n(HT20)mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	15.61	15±1	16	39.811
Middle(2437MHz)	15.91	15±1	16	39.811
Highest(2462MHz)	16.20	16±1	17	50.119

802.11n(HT40)mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	13.59	13±1	14	25.119
Middle(2437MHz)	13.65	13±1	14	25.119
Highest(2462MHz)	13.64	14±1	15	31.623

Worst case: 802.11g mode Lowest (2462MHz)
Using the maximum value of the test report

Maximum tune-up Power (mW)	**Antenna Gain (dBi)**	**Power Density at R =20m (mW/cm2)**	**Limit**	**Result**
50.119	0	0.00997	**1**	PASS

Remark: The Max Conducted Peak Output Power data refer to report Report No.: HK2010293163-2E
Value : Pd = (Pout*G)/(4* Pi * R2)=(50.119 *1)/(4*3.1416*20*20)= 0.00997mW/cm2

Conclusion: Compliance with RF Exposure requirement

For 5G WIFI

BAND 1					
Test channel		Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
a (20MHz)	5180	7.585	8±1	9	7.943
	5200	8.288	8±1	9	7.943
	5240	8.415	8±1	9	7.943
ac (20MHz)	5180	7.760	8±1	9	7.943
	5200	8.448	8±1	9	7.943
	5240	8.941	8±1	9	7.943
ac(40MHz)	5190	8.623	8±1	9	7.943
	5230	8.704	8±1	9	7.943

BAND 3					
Test channel		Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
a (20MHz)	5745	10.670	10±1	11	12.589
	5785	9.606	10±1	11	12.589
	5825	9.130	10±1	11	12.589
ac (20MHz)	5745	9.487	9±1	10	10
	5785	8.796	9±1	10	10
	5825	8.203	9±1	10	10
ac(40MHz)	5755	9.708	9±1	10	10
	5795	8.545	9±1	10	10

Worst case:band3-a mode
Using the maximum value of the test report

Maximum tune-up Power (mW)	**Antenna Gain (dBi)**	**Power Density at R =20 cm (mW/cm2)**	**Limit**	**Result**
12.589	0	0.0025	**1**	PASS

Remark: The Max Conducted Peak Output Power data refer to report Report No.: HK2010293163-3E
Value : Pd = (Pout*G)/(4* Pi * R2)=(12.589 *1)/(4*3.1416*10*10)= 0.0025mW/cm2

Conclusion: Compliance with RF Exposure requirement