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Maximum Permissible Exposure Evaluation

FCC ID: 2BN5S-2602B

IC: 33667-2602B

EUT Specification

Product Name:	WIFI module
Trade Mark:	/
Model/Type reference:	ATBM6162-44PE-02
Listed Model(s):	/
Operating Frequency band:	BLE: 2402~2480MHz WLAN: 2412~2462MHz RLAN: 5180~5240MHz 5260~5320MHz 5500~5700MHz 5745~5828MHz
Device category:	☐ Portable (<5mm separation) ☐ Mobile (>20cm separation) ☒ Fixed (>20cm separation) ☐ Others ____
Exposure classification:	☐ Occupational/Controlled exposure (S=5mW/cm ²) ☒ General Population/Uncontrolled exposure (S=1mW/cm ²)
Antenna diversity:	☒ Single antenna ☐ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☐ Tx/Rx diversity
Antenna gain:	BLE: 4.87dBi Max WLAN: 4.87dBi Max U-NII-1: 6.91dBi Max U-NII-2A: 6.91dBi Max U-NII-2C: 6.91Bi Max U-NII-3: 6.91dBi Max
Evaluation applied:	☒ MPE Evaluation ☐ SAR Evaluation

According to FCC 1.1310: 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 §1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density(mW/cm ²)	Average Time
(A) Limits for Occupational/Control Exposures				
300-1500	--	--	F/300	6



1500-100000	--	--	5	6
(B) Limits for General Population/Uncontrol Exposures				
300-1500	--	--	F/1500	30
1500-100000	--	--	1	30

F = frequency in MHz

Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where

P_d = Power density in mW/cm^2

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

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

P_d the limit of MPE $1mW/cm^2$. If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, We will know the distance where the MPE limit is reached.

RF exposure evaluation Limits for IC

RSS-102 Issue 6 Section 6.6

Field reference level (FRL) exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm (i.e. mobile devices), except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 1 W (adjusted for tune-up tolerance)
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance)
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz
- at or above 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 5 W (adjusted for tune-up tolerance)

FCC Measurement Result

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Tune up tolerance (dBm)	Max. Tune up Power (dBm)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)	Verdict
BLE	2402	4.87	1.53	2±1	3	0.001222	1.000	PASS
802.11b	2437	4.87	18.42	18±1	19	0.048526	1.000	PASS
802.11a	5180	6.91	14.25	14±1	15	0.030896	1.000	PASS
802.11n(HT20)	5260	6.91	12.57	12±1	13	0.019493	1.000	PASS
802.11n(HT20)	5500	6.91	15.40	15±1	16	0.038898	1.000	PASS
802.11n(HT20)	5825	6.91	14.41	14±1	15	0.030896	1.000	PASS

The WLAN and BLE can transmit simultaneously (Worst-case: BLE+2.4GHz Wi-Fi)

WLAN Output power/ Threshold power	BLE Output power/ Threshold power	Total of the ratios	Limit	Verdict
$0.001222/1=0.001222$	$0.048526/1=0.048526$	0.079718	1	PASS

Total E-field strength = $((E\text{-field strength}) / (\text{Limit}) + (E\text{-field strength}) / (\text{Limit}) \dots) \leq 1$



IC Measurement Result

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	EIRP (dBm)	Tune up tolerance (dBm)	Max. Tune up Power (dBm)	Field reference level (W)	Limit (W)	Verdict
BLE	2402	4.87	1.53	6.4	4±1	5	0.0032	2.68	PASS
802.11b	2437	4.87	18.42	23.29	23±1	24	0.2512	2.70	PASS
802.11ac(VHT20)	5180	6.91	14.25	21.16	21±1	22	0.1585	4.53	PASS
802.11ac(VHT20)	5260	6.91	12.57	19.48	19±1	20	0.1000	4.57	PASS
802.11ac(VHT20)	5500	6.91	15.40	22.31	22±1	23	0.1995	4.71	PASS
802.11n(HT20)	5825	6.91	14.41	21.32	21±1	22	0.1585	4.90	PASS

The WLAN and BLE can transmit simultaneously (Worst-case: BLE+2.4GHz Wi-Fi)

WLAN Output power/ Threshold power	BLE Output power/ Threshold power	Total of the ratios	Limit	Verdict
0.2512/2.70=0.0930	0.0032/2.68=0.0012	0.0942	1	PASS

Note:

For a more detailed features description, Please refer to the RF Test Report.

*****THE END*****