RF EXPOSURE 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)

FCC ID: 2AYHW-TN7231N1

EUT Specification

EUT	TN7231N1 3 Key control box
Frequency band (Operating)	☒ WLAN: 2.412GHz ~ 2.462GHz ☐ WLAN: 5.18GHz ~ 5.24GHz ☐ WLAN: 5.745GHz ~ 5.825GHz ☒ Others: 2.402GHz~2.480GHz
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others ___
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm2) ☒ General Population/Uncontrolled exposure (S=1mW/cm2)
Antenna diversity	☒ Single antenna ☐ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☐ Tx/Rx diversity
Max. output power	BLE: 0.17 dBm (0.0010W) WiFi 2.4G: 15.47 dBm (0.0352W)
Antenna gain (Max)	1.9 dBi
Evaluation applied	☒ MPE Evaluation ☐ SAR Evaluation

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**	**6**
1500-100000	**--**	**--**	**1**	**30**

Friis transmission formula: Pd=(Pout*G)\(4*pi*R2)

Where
Pd= Power density in mW/cm^2
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 the limit of MPE, 1mW/cm2. 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.

Max Measurement Result

Operating Mode	Channel Frequency	Measured Power	Tune up tolerance	Max. Tune up Power	Antenna Gain	Power density at 20cm	Power density Limits (mW/cm2)
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(mW/ cm2)	
802.11b	2412	14.09	14.09 ±1	15.09	1.9	0.0100	1
	2437	12.65	12.65 ±1	13.65	1.9	0.0071	1
	2462	12.57	12.57 ±1	13.57	1.9	0.0070	1
802.11g	2412	13.87	13.87 ±1	14.87	1.9	0.0095	1
	2437	14.66	14.66 ±1	15.66	1.9	0.0113	1
	2462	14.76	14.76 ±1	15.76	1.9	0.0116	1
802.11n (HT20)	2412	13.99	13.99 ±1	14.99	1.9	0.0097	1
	2437	14.76	14.76 ±1	15.76	1.9	0.0116	1
	2462	15.47	15.47 ±1	16.47	1.9	0.0137	1
802.11n (HT40)	2422	13.38	13.38 ±1	14.38	1.9	0.0084	1
	2437	12.90	12.90 ±1	13.90	1.9	0.0076	1
	2452	12.95	12.95 ±1	13.95	1.9	0.0077	1
BLE	2402	-0.27	-0.27 ±1	0.73	1.9	0.0004	1
	2440	-1.40	-1.40 ±1	-0.40	1.9	0.0003	1
	2480	0.17	0.17 ±1	1.17	1.9	0.0004	1

The WLAN 2.4G and BLE can transmit simultaneously:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$=S_{WIFI2.4}/S_{limit-2.4}+ S_{BLE}/S_{limit-2.4}$
$=0.0137/1+0.0004/1$
$=0.0141$
< 1.0