RF Exposure Evaluation Report

1 RF EXPOSURE

Product Name: HGU

Model No.:   HL-4BX3V-F, HLE-4BX3V-F

FCC ID: 2AWIZHL4BX3VF

2. RF Exposure Evaluation

FCC KDB447498 D01 General RF Exposure Guidance v06: Mobile and Portable Device, RF Exposure, Equipment Authorization Procedures.

FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radiofrequency radiation exposure evaluation: mobile devices.

2.1 LIMITS

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 to § 1.1310(e)(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)
(i) Limits for Occupational/Controlled Exposure				
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
300−1,500			f/300	<6
1,500−100,000			5	<6
(ii) 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
300−1,500			f/1500	<30
1,500−100,000			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.

Test Result of RF Exposure Evaluation

2.4GWIFI ANT1: 3.53dBi ; ANT2: 3.9dBi; MIMO: 3.72dBi

5GWIFI ANT1: 5.2G:4.34dBi ; 5.3G:4.52dBi ; 5.6G:5.19dBi ; 5.8G:3.62dBi

      ANT2: 5.2G:3.37dBi ; 5.3G:3.78dBi ; 5.6G:3.67dBi ; 5.8G:4.11dBi

      ANT3: 5.2G:4.20dBi ; 5.3G:3.21dBi ; 5.6G:3.97dBi ; 5.8G:4.45dBi

      MIMO: 5.2G:3.99dBi ; 5.3G:3.87dBi; 5.6G:4.33dBi ; 5.8G:4.07dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.0 in linear scale.

The Max Conducted Peak Output Power data refer to report Report No.: POCE240305009RL001 & POCE240305009RL002

2.4GWIFI worst mode and channel:

Test channel (MHz)	Conducted Power (dBm)		Maximum tune-up Power (dbm)		Maximum tune-up Power (mW)			Calculated value (mW/cm^2)	Limit (mW/cm^2)
	ANT1	ANT2	ANT1	ANT2	ANT1	ANT2	SUM		
802.11b-2412	16.65	17.53	17±1	17±1	63.10	63.10	/	0.03081	1.0
802.11n-2412	13.71	14.10	14±1	14±1	31.62	31.62	63.24	0.02963	1.0
Results: the max calculated value is 0.03081 mW/cm^2 < limit(1.0 mW/cm^2)									

Remark:

802.11b-2412: Pd=(Pout*G)/(4* Pi * R^2)=(63.10*2.4547)/(4*3.1415*20*20)= 0.03081, ANT1Gain=3.9dBi, $G=10^{gain/10}$ =$10^{3.9/10}$ =2.4547

802.11n-2412: Pd = (Pout*G)/(4* Pi * R^2)=(63.24*2.3550)/(4*3.1415*20*20)= 0.02963, MIMOGain=3.72dBi $G=10^{gain/10}$ =$10^{3.72/10}$ =2.3550

5GWIFI- worst mode and channel:

Test channel (MHz)	Conducted Power (dBm)			Maximum tune-up Power (dbm)			Maximum tune-up Power (mW)				Calculated value (mW/cm2)	Limit (mW/cm2)
	ANT1	ANT2	ANT3	ANT1	ANT2	ANT3	ANT1	ANT2	ANT3	SUM		
802.11n-5240	16.28	19.42	19.50	17±1	20±1	20±1	63.10	125.89	125.89	314.88	0.1570	1.0
802.11ax-5310	10.81	14.33	14.52	11±1	15±1	15±1	15.85	39.81	39.81	95.47	0.0463	1.0
802.11ax-5510	13.82	16.54	17.38	14±1	17±1	17±1	31.62	63.10	63.10	157.81	0.0851	1.0
802.11n-5785	15.86	19.21	18.95	16±1	19±1	19±1	50.12	100	100	250.12	0.1270	1.0
Results: the max calculated value is 0.0157 mW/cm^2 < limit(1.0 mW/cm^2)												

802.11n-5240: Pd=(Pout*G)/(4* Pi * R^2)=(314.88*2.5061)/(4*3.1415*20*20)=0.157, MIMOGain=3.99dBi, $G=10^{gain/10}$ =$10^{3.99/10}$ =2.5061

802.11ax-5310 : Pd = (Pout*G)/(4* Pi * R^2)=(95.47*2.388)/(4*3.1415*20*20)= 0.0468, MIMOGain=3.87dBi, $G=10^{gain/10}$ $=10^{3.87/10}$ =2.438

802.11ax-5510: Pd = (Pout*G)/(4* Pi * R^2)=(157.81*2.710)/(4*3.1415*20*20)= 0.0851, MIMOGain=4.33dBi, $G=10^{gain/10}$ $=10^{4.33/10}$ =2.710

802.11n-5785: Pd = (Pout*G)/(4* Pi * R^2)=(250.12*2.5527)/(4*3.1415*20*20)= 0.1270, MIMOGain=4.07dBi, $G=10^{gain/10}$ $=10^{4.07/10}$ =2.5527

EUT RF Exposure Evaluation simultaneous transmission operations

According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits :

Simultaneous transmission mode	The sum of the ratios	SUM	Limit
2.4G WIFI + 5G WIFI	0.03081+0.1570	≈0.188	1.0
Conclusion: 0.188 < 1.0, So there is no sar requirement			

NOTE:1. EUT wifi-5G module & wifi-2.4G module is more than 20cm away from the human body.