



## MPE Report

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

Refer Standard: KDB 447498 D01 General RF Exposure Guidance v06

FCC Part 2 §2.1091

### 1. Evaluation method

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is  $\leq 1.0$ . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

### 2. Limits for General Population/Uncontrolled Exposure

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; \*Plane-wave equivalent power density

### 3. Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S=power density



P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

From the EUT RF output power, the minimum mobile separation distance,  $d=0.2\text{m}$ , as well as the maximum gain of the used antenna is 2dBi for 5GWLAN and 3.0dBi for 2.4GWLAN, the RF power density can be obtained.

#### 4. Estimation Result

##### 4.1 Manufacturing tolerance

###### 2.4G WiFi

IEEE 802.11 b (AVG)			
Frequency (MHz)	Antenna 1		
	2412	2437	2462
Target (dBm)	17.0	17.0	17.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

IEEE 802.11 g (AVG)						
Frequency (MHz)	Antenna 0			Antenna 1		
	2412	2437	2462	2412	2437	2462
Target (dBm)	16.0	16.0	15.0	17.0	17.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0	1.0	1.0	1.0

IEEE 802.11 n HT20 (AVG)			
Frequency (MHz)	Antenna 0+Antenna 1		
	2412	2437	2462
Target (dBm)	17.0	17.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

IEEE 802.11 n HT40 (AVG)			
Frequency (MHz)	Antenna 0+Antenna 1		
	2422	2437	2452
Target (dBm)	15.0	17.0	15.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

**5G WiFi**

<b>IEEE 802.11 a (AVG)</b>			
Frequency (MHz)	Antenna 1		
	5180	5200	5240
Target (dBm)	18.0	18.0	18.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
Frequency (MHz)	Antenna 1		
	5745	5785	5825
Target (dBm)	19.0	19.0	19.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

<b>IEEE 802.11 n HT20 (AVG)</b>			
Frequency (MHz)	Antenna 0+Antenna 1+ Antenna 2		
	5180	5200	5240
Target (dBm)	19.0	19.0	19.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
Frequency (MHz)	Antenna 0+Antenna 1+ Antenna 2		
	5745	5785	5825
Target (dBm)	23.0	23.0	23.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

<b>IEEE 802.11 n HT40 (AVG)</b>			
Frequency (MHz)	Antenna 0+Antenna 1+ Antenna 2		
	5190	---	5230
Target (dBm)	20.0	---	20.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
Frequency (MHz)	Antenna 0+Antenna 1+ Antenna 2		
	5755	---	5795
Target (dBm)	24.0	---	24.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

<b>IEEE 802.11 ac VHT80 (AVG)</b>			
Frequency (MHz)	Antenna 0+Antenna 1+ Antenna 2		
	5210	---	5775
Target (dBm)	19.0	---	24.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

**4.2 Maximum RF average output power among production units**

Mode		Average Power(dBm)
2.4GHz	802.11 b	18.0
	802.11 g	18.0
	802.11 n HT20	18.0
	802.11 n HT40	18.0
5GHz	802.11 a	20.0
	802.11 n HT20	24.0
	802.11 n HT40	25.0
	802.11 ac VHT80	25.0

**4.3 Radio Frequency Radiation Exposure Evaluation**

Band	Directional Gain (dBi)	Maximum Power	Maximum EIRP		Power Density at 20cm(mW/cm^2)	Limit mW/cm^2)
			(dBm)	(mW)		
2.4GHz WLAN	5.0	18.0	23.0	199.53	0.0397	1
5GHz WLAN	2.8	25.0	27.8	602.56	0.1199	1

Note: For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.

**Conclusion:**

Both of the 2.4GHz WLAN function and 5GHz WLAN function can transmit simultaneously, the formula of calculated the MPE is:

$$\text{CPD1/LPD1} + \text{CPD2/LPD2} + \dots \text{etc.} < 1$$

**CPD**=Calculation power density

**LPD**=Limit of power density

Therefore, the worst-case situation is  $0.0397/1 + 0.1199/1 = 0.1596$ , which is less than "1", This confirmed that the device comply with the FCC limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.