

# RF Exposure Report

**FCC-ID: 2AF2K-WM524**

## RF Exposure Measurement

The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The gain of the antennas used in the product is extracted from the Antenna data sheets provided and also the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis Transmission formula is far field assumption, the calculated result of that is an over-prediction for near field power density. It is taken as worst case to specify the safety range.

## RF Exposure Limit

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of the human exposure to radio-frequency (RF) radiation as specified in 1.1307 (b)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )
Limits for Occupational / controlled Exposures			
300 - 1500	--	--	F/300
1500 – 100000	--	--	5.0
Limits for General population / Uncontrolled Exposure			
300 - 1500	--	--	F/1500
1500 – 100000	--	--	1.0

Limits for Maximum Permissible Exposure (MPE)

F= Frequency in MHz

## Friss Formula

Friss Transmission Formula:  $P_d = (P_{out} * G) / (4 * \pi * r^2)$

Where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = output power to antenna in mW

$G$  = gain of antenna in linear scale

$\pi$  = 3.1416

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

If we know the maximum gain of the antenna and the total output power to the antenna, through calculation, we will know MPE value at distance 20cm.

## EUT Operation condition

EUT was enabled to transmit and receive at lowest, middle and highest channels.

## Classification

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance from the antenna should be included in the User manual. So, this device is classified as Mobile device.

### 2.4G WIFI

Mode	802.11b/g/n20: 2412-2462MHz 802.11n40: 2422-2452MHz
Detector	PEAK
802.11b	17±1dBm
802.11g	16±1dBm
802.11n20	18±1dBm
802.11n40	19±1dBm

### ANT Gain (G)

Antenna number: 2\*Dipole

Antenna A gain : 1dBi

Antenna B gain : 1dBi

MIMO technology Directional gain= 4.01dBi

(gain of antenna in linear scale=2.518)

Protocol	ANT Gain(gain of antenna in linear scale)	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )
802.11 b	2.518	2412	18	63.0957	0.03162	1
802.11 g	2.518	2412	17	50.1187	0.02512	1
802.11 n20	2.518	2462	19	79.4328	0.03981	1
802.11 n40	2.518	2452	20	#####	0.05012	1

#### 5G WIFI

##### ANT Gain (G)

Mode	IEEE 802.11a/ n/ac(HT20) 5.180GHz-5.240GHz IEEE 802.11n/ac(HT40) 5.190GHz-5.230GHz IEEE 802.11ac(HT80) 5.210GHz
Detector	PEAK
802.11 a/n/ac(HT20)	11±1dBm
802.11 n/ac(HT40)	10±1dBm
802.11 ac(HT80)	7±1dBm

**Antenna number: 2\*Dipole**

**Antenna A gain : 1dBi**

**Antenna B gain : 1dBi**

**MIMO technology Directional gain= 4.01dBi**

**(gain of antenna in linear scale=2.518)**

Protocol	ANT Gain(gain of antenna in linear scale)	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )
802.11 a/n/ac(HT20)	2.518	5180	12	15.8489	0.09999	1
802.11 n/ac(HT40)	2.518	5190	11	12.5893	0.00631	1
802.11 ac(HT80)	2.518	5210	8	6.3096	0.00316	1

**5G WIFI****ANT Gain (G)**

Mode	IEEE 802.11a/ n/ac(HT20)5.260GHz-5.320GHz IEEE 802.11a/ n/ac(HT40)5.270GHz-5.310GHz IEEE 802.11ac(HT80) 5.290GHz
Detector	PEAK
802.11 a/n/ac(HT20)	10.5±1dBm
802.11 n/ac(HT40)	9±1dBm
802.11 ac(HT80)	6±1dBm

**Antenna number: 2\*Dipole****Antenna A gain : 1dBi****Antenna B gain : 1dBi****MIMO technology Directional gain= 4.01dBi****(gain of antenna in linear scale=2.518)**

Protocol	ANT Gain(gain of antenna in linear scale)	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )
802.11 a/n/ac(HT20)	2.518	5260	11.5	14.1254	0.03162	1
802.11 n/ac(HT40)	2.518	5270	10	10.0000	0.00501	1
802.11	2.518	5290	7	5.0119	0.00251	1

**5G WIFI****ANT Gain (G)**

Mode	IEEE 802.11a/ n/ac(HT20)5.500GHz-5.700G Hz IEEE 802.11a/ n/ac(HT40)5.510GHz-5.670G Hz IEEE 802.11ac(HT80) 5.530-5.610GHz
Detector	PEAK
802.11 a/n/ac(HT20)	10.5±1dBm
802.11 n/ac(HT40)	10±1dBm
802.11 ac(HT80)	5±1dBm

**Antenna number: 2\*Dipole**

**Antenna A gain : 1dBi**

**Antenna B gain : 1dBi**

**MIMO technology Directional gain= 4.01dBi**

**(gain of antenna in linear scale=2.518)**

Protocol	ANT Gain(gain of antenna in linear scale)	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )
802.11 a/n/ac(HT20)	2.518	5500	11.5	14.1254	0.03162	1
802.11 n/ac(HT40)	2.518	5510	11	12.5893	0.00631	1
802.11	2.518	5530	6	3.9811	0.00200	1

#### **5G WIFI**

##### **ANT Gain (G)**

Mode	IEEE 802.11a/ n/ac(HT20)5.745GHz-5.825GHz IEEE 802.11a/ n/ac(HT40)5.755GHz-5.795GHz IEEE 802.11ac(HT80) 5.775GHz
Detector	PEAK
802.11 a/n/ac(HT20)	10±1dBm
802.11 n/ac(HT40)	9.5±1dBm
802.11 ac(HT80)	7±1dBm

**Antenna number: 2\*Dipole**

**Antenna A gain : 1dBi**

**Antenna B gain : 1dBi**

**MIMO technology Directional gain= 4.01dBi**

**(gain of antenna in linear scale=2.518)**

Protocol	ANT Gain(gain of antenna in linear	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )
802.11 a/n/ac(HT20)	2.518	5745	11	12.5893	0.03162	1
802.11 n/ac(HT40)	2.518	5755	10.5	11.2202	0.00562	1
802.11 ac(HT80)	2.518	5775	8	6.3096	0.00316	1