

## 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: Z4TSEEED8720DN

### EUT Specification

<b>EUT</b>	<b>RTL8720DN</b>
<b>Frequency band (Operating)</b>	<input checked="" type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input checked="" type="checkbox"/> WLAN: 5.18GHz ~ 5.24GHz <input checked="" type="checkbox"/> WLAN: 5.745GHz ~ 5.825GHz <input checked="" type="checkbox"/> Others: 2.402GHz~2.480GHz (BLE)
<b>Device category</b>	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others ____
<b>Exposure classification</b>	<input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm <sup>2</sup> ) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm <sup>2</sup> )
<b>Antenna diversity</b>	<input type="checkbox"/> Single antenna <input checked="" type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input type="checkbox"/> Tx/Rx diversity
<b>Max. output power</b>	2.4GHz WiFi: 13.90dBm (0.0245W) 5.1G WiFi: 14.69dBm (0.0294W) 5.8G WiFi: 13.24dBm (0.0211W) BLE: -0.190dBm (0.0010W)
<b>Antenna gain (Max)</b>	WiFi 2.4G & BLE(ANT A): 4.1 dBi WiFi 5.1G(ANT A): 3.6 dBi WiFi 5.8G(ANT A): 2.1 dBi WiFi 2.4G & BLE(ANT B): 1 dBi WiFi 5.1G & WiFi 5.8G(ANT B): 4 dBi
<b>Evaluation applied</b>	<input checked="" type="checkbox"/> MPE Evaluation <input type="checkbox"/> 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 <sup>2</sup> )	Average Time
<b>(A) Limits for Occupational/Control Exposures</b>				
<b>300-1500</b>	--	--	<b>F/300</b>	<b>6</b>
<b>1500-100000</b>	--	--	<b>5</b>	<b>6</b>
<b>(B) Limits for General Population/Uncontrol Exposures</b>				
<b>300-1500</b>	--	--	<b>F/1500</b>	<b>6</b>
<b>1500-100000</b>	--	--	<b>1</b>	<b>30</b>

## Friis transmission formula: $P_d = \frac{P_{out} * G}{4 * \pi * R^2}$

Where

$P_d$  = Power density in  $mW/cm^2$

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

G = gain of antenna in linear scale

$\pi = 3.1416$

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.

## Measurement Result

### 2.4GHz WiFi & BT (ANT A):

Operating Mode	Channel Frequency	Measured Power	Tune up tolerance	Max. Tune up Power	Antenna Gain	Power density at 20cm	Power density Limits ( $mW/cm^2$ )
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	( $mW/cm^2$ )	
802.11b	2412	13.20	13.20±1	14.20	4.1	0.0135	1
	2437	13.72	13.72±1	14.72	4.1	0.0152	1
	2462	13.90	13.90±1	14.9	4.1	0.0158	1
802.11g	2412	12.80	12.80±1	13.80	4.1	0.0123	1
	2437	12.99	12.99±1	13.99	4.1	0.0128	1
	2462	13.16	13.16±1	14.16	4.1	0.0133	1
802.11n (HT20)	2412	12.63	12.63±1	13.63	4.1	0.0118	1
	2437	13.02	13.02±1	14.02	4.1	0.0129	1
	2462	12.83	12.83±1	13.83	4.1	0.0124	1
802.11n (HT40)	2422	13.75	13.75±1	14.75	4.1	0.0153	1
	2437	13.47	13.47±1	14.47	4.1	0.0143	1
	2452	13.37	13.37±1	14.37	4.1	0.0140	1
BLE	2402	-1.483	-1.483±1	-0.483	4.1	0.0005	1
	2440	-0.405	-0.405±1	0.595	4.1	0.0006	1
	2480	-0.245	-0.245±1	0.755	4.1	0.0006	1

**2.4GHz WiFi & BT (ANT B):**

Operating Mode	Channel Frequency	Measured Power	Tune up tolerance	Max. Tune up Power	Antenna Gain	Power density at 20cm	Power density Limits (mW/cm <sup>2</sup> )
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(mW/ cm <sup>2</sup> )	
802.11b	2412	13.14	13.14±1	14.14	1	0.0065	1
	2437	13.66	13.66±1	14.66	1	0.0073	1
	2462	13.71	13.71±1	14.71	1	0.0074	1
802.11g	2412	12.76	12.76±1	13.76	1	0.0060	1
	2437	13.16	13.16±1	14.16	1	0.0065	1
	2462	12.98	12.98±1	13.98	1	0.0063	1
802.11n (HT20)	2412	12.62	12.62±1	13.62	1	0.0058	1
	2437	12.71	12.71±1	13.71	1	0.0059	1
	2462	12.69	12.69±1	13.69	1	0.0059	1
802.11n (HT40)	2422	13.21	13.21±1	14.21	1	0.0066	1
	2437	13.39	13.39±1	14.39	1	0.0069	1
	2452	13.14	13.14±1	14.14	1	0.0065	1
BLE	2402	-1.014	-1.014±1	-0.014	1	0.0002	1
	2440	-0.878	-0.878±1	0.122	1	0.0003	1
	2480	-0.190	-0.190±1	0.810	1	0.0003	1

**5.1GHz WiFi (ANT A):**

Operating Mode	Channel Frequency	Measured Power	Tune up tolerance	Max. Tune up Power	Antenna Gain	Power density at 20cm	Power density Limits (mW/cm <sup>2</sup> )
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(mW/ cm <sup>2</sup> )	
802.11a	5180	14.09	14.09±1	15.09	3.6	0.0147	1
	5200	14.08	14.08±1	15.08	3.6	0.0147	1
	5240	14.69	14.69±1	15.69	3.6	0.0169	1

**5.1GHz WiFi (ANT B):**

Operating Mode	Channel Frequency	Measured Power	Tune up tolerance	Max. Tune up Power	Antenna Gain	Power density at 20cm	Power density Limits (mW/cm <sup>2</sup> )
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(mW/ cm <sup>2</sup> )	
802.11a	5180	13.24	13.24±1	14.24	4	0.0133	1
	5200	14.03	14.03±1	15.03	4	0.0159	1
	5240	14.56	14.56±1	15.56	4	0.0180	1

**5.8GHz WiFi (ANT A):**

Operating Mode	Channel Frequency	Measured Power	Tune up tolerance	Max. Tune up Power	Antenna Gain	Power density at 20cm	Power density Limits (mW/cm <sup>2</sup> )
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(mW/ cm <sup>2</sup> )	
802.11a	5745	12.85	12.85±1	13.85	2.1	0.0078	1
	5785	13.27	13.27±1	14.27	2.1	0.0086	1
	5825	13.24	13.24±1	14.24	2.1	0.0086	1

**5.8GHz WiFi (ANT B):**

Operating Mode	Channel Frequency	Measured Power	Tune up tolerance	Max. Tune up Power	Antenna Gain	Power density at 20cm	Power density Limits (mW/cm <sup>2</sup> )
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(mW/ cm <sup>2</sup> )	
802.11a	5745	12.49	12.49±1	13.49	4	0.0112	1
	5785	12.52	12.52±1	13.52	4	0.0112	1
	5825	13.18	13.18±1	14.18	4	0.0131	1

**Note: Two antennas do not support MIMO.**