

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: Z4TSEED8720DN

EUT Specification

EUT	RTL8720DN
Frequency band (Operating)	☒ WLAN: 2.412GHz ~ 2.462GHz ☒ WLAN: 5.18GHz ~ 5.24GHz ☒ WLAN: 5.745GHz ~ 5.825GHz ☒ Others: 2.402GHz~2.480GHz (BLE)
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others ____
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm ²) ☒ General Population/Uncontrolled exposure (S=1mW/cm ²)
Antenna diversity	☐ Single antenna ☒ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☐ Tx/Rx diversity
Max. output power	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)
Antenna gain (Max)	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
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: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

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 ²)
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(mW/ cm ²)	
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 ²)
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(mW/ cm ²)	
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 ²)
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(mW/ cm ²)	
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 ²)
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(mW/ cm ²)	
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 ²)
	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(mW/ cm ²)	
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.