

RF Exposure Compliance Requirement

1 Standard requirement

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

(a) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S)(mW/cm ²)	Averaging Times $ E ^2, H ^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	F/300	6
1500-100000	--	--	5	6

(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 ²)	Averaging Times $ E ^2, H ^2$ 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
1500-100000	--	--	1.0	30

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

2 MPE Calculation Method

$$E \text{ (V/m)} = (30 \cdot P \cdot G)^{0.5} / d \quad \text{Power Density: } P_d \text{ (W/m}^2\text{)} = E^2 / 377$$

E=Electric Field (V/m)

P=Peak RF output Power (W)

G=EUT Antenna numeric gain (numeric)

d= Separation distance between radiator and human body (m)

The formula can be changed to

$$P_d = (30 \cdot P \cdot G) / (377 \cdot d^2)$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

3 Calculated Result and Limit (BT 4.1)

(1)

Frequency (MHz)	Antenna Gain (Numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
BT 4.1 classic	1.663	4	2.512	0.00083	1	Complies
BT 4.1 EDR	1.663	8	6.310	0.00209	1	Complies
BT 4.1 BLE	1.663	2	1.585	0.00052	1	Complies
WiFi 2.4GHz 802.11b	1.663	14	25.119	0.00831	1	Complies
WiFi 2.4GHz 802.11g	1.663	18	63.096	0.02088	1	Complies
WiFi 2.4GHz 802.11n	1.663	18	63.096	0.02088	1	Complies

Frequency (MHz)	Antenna Gain (Numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
WiFi 5.25-5.35GHz 802.11n20	2.844	15	31.623	0.01789	1	Complies
WiFi 5.25-5.35GHz 802.11n40	2.844	13	19.953	0.01129	1	Complies
WiFi 5.25-5.35GHz 802.11a	2.844	15	31.623	0.01789	1	Complies
WiFi 5.25-5.35GHz 802.11ac20	2.844	14	25.119	0.01421	1	Complies
WiFi 5.25-5.35GHz 802.11ac40	2.844	13	19.953	0.01129	1	Complies
WiFi 5.25-5.35GHz 802.11ac80	2.844	7	5.012	0.00284	1	Complies

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WiFi 5.47-5.725GHz z 802.11n20	2.844	15	31.623	0.01789	1	Complies
WiFi 5.47-5.725GHz z 802.11n40	2.844	12	15.849	0.00897	1	Complies
WiFi 5.47-5.725GHz z 802.11a	2.844	15	31.623	0.01789	1	Complies
WiFi 5.47-5.725GHz z 802.11ac20	2.844	15	31.623	0.01789	1	Complies
WiFi 5.47-5.725GHz z 802.11ac40	2.844	13	19.953	0.01129	1	Complies
WiFi 5.47-5.725GHz z 802.11ac80	2.844	7	5.012	0.00284	1	Complies

Frequency (MHz)	Antenna Gain (Numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
WiFi 5.15-5.25GHz 802.11n20	2.844	12	15.849	0.00897	1	Complies
WiFi 5.15-5.25GHz 802.11n40	2.844	12	15.849	0.00897	1	Complies
WiFi 5.15-5.25GHz 802.11a	2.844	13	19.953	0.01129	1	Complies
WiFi 5.15-5.25GHz 802.11ac20	2.844	12	15.849	0.00897	1	Complies
WiFi 5.15-5.25GHz 802.11ac40	2.844	12	15.849	0.00897	1	Complies
WiFi 5.15-5.25GHz 802.11ac80	2.844	8	6.310	0.00357	1	Complies

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WiFi 5.745-5.850GHz 802.11n20	2.844	12	15.849	0.00897	1	Complies
WiFi 5.745-5.850GHz 802.11n40	2.844	12	15.849	0.00897	1	Complies
WiFi 5.745-5.850GHz 802.11a	2.844	12	15.849	0.00897	1	Complies
WiFi 5.745-5.850GHz 802.11ac20	2.844	12	15.849	0.00897	1	Complies
WiFi 5.745-5.850GHz 802.11ac40	2.844	12	15.849	0.00897	1	Complies
WiFi 5.745-5.850GHz 802.11ac80	2.844	8	6.310	0.00357	1	Complies

Mode		Nominal Power (dBm)	Tolerance (dB)	Tune up max power (dBm)
BT: normal rate		3	+/- 1	4
BT: EDR		6	+/- 1	7
BT: BLE		1	+/- 1	2
WiFi 2.4G	b	13	+/- 1	14
	g	17	+/- 1	18
	n20	17	+/- 1	18
WiFi 5.25-5.35 GHz	n20	14	+/- 1	15
	n40	12	+/- 1	13
	a	14	+/- 1	15
	ac20	13	+/- 1	14
	ac40	12	+/- 1	13
	ac80	6	+/- 1	7
WiFi 5.47-5.72 5GHz	n20	14	+/- 1	15
	n40	11	+/- 1	12
	a	14	+/- 1	15
	ac20	14	+/- 1	15
	ac40	12	+/- 1	13
	ac80	6	+/- 1	7
WiFi 5.15 -5.25GHz	n20	11	+/- 1	12
	n40	11	+/- 1	12
	a	12	+/- 1	13
	ac20	11	+/- 1	12
	ac40	11	+/- 1	12
	ac80	7	+/- 1	8
WiFi 5.745 -5.85GHz	n20	11	+/- 1	12
	n40	11	+/- 1	12
	a	11	+/- 1	12
	ac20	11	+/- 1	12
	ac40	11	+/- 1	12
	ac80	7	+/- 1	8