

Maximum Permissible Exposure (MPE)

Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

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This is a Mobile device, the MPE is required.

FCC: According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

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2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz⁶ and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $22.48/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

Tune-Up Power and Tolerance:

WLAN: 1TX, 1RX

Wi-Fi	Frequency Range (MHz)	Channels	Average Tune-Up Power	Modulation Technology
802.11b	2412 – 2462(DTS)	11	Channel 1-11 17.5 dBm	DSSS
802.11g	2412 – 2462(DTS)	11	Channel 1-11 16.15 dBm	DSSS, OFDM
802.11n	HT20 2412 – 2462(DTS)	11	Channel 1-11 16.15 dBm	OFDM
	HT40 2422 – 2452(DTS)	7	Channel 3-9 16.15 dBm	
Power Tolerance:		+/- 1 dBm		
Antenna Gain:		2.4dBi		

FCC: 2.4GHz mode: 802.11 b mode

Maximum Permissible Exposure (MPE) Evaluation: The worst case of Average power

Power measurement: refer to Part15.247 and RSS 247 report for details.

Prediction 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

	CH 1-11	
Tune-Up power at antenna input terminal:	17.50	(dBm)
Tune-Up power at antenna input terminal:	56.23	(mW)
Tune-Up power Tolerance:	1.00	dB
Duty cycle:	100.00	(%)
Maximum Pav :	70.79	(mW)
Antenna gain (typical):	2.40	(dBi)
Maximum antenna gain:	1.74	(numeric)
Prediction distance:	20.00	(cm)
MPE limit for uncontrolled exposure at prediction frequency:	1.00	(mW/cm ²)
Power density at predication frequency at 20 (cm) distance	0.0245	(mW/cm ²)

Result:

The worst power density is 0.0245 mW/cm² which is less than 1 mW/cm².

FCC: GSM/WCDMA/LTE mode:

Maximum Permissible Exposure (MPE) Evaluation: The worst case of Average power

Power measurement: refer to GSM/WCDMA/LTE modular grant for details.

Prediction of MPE limit at a given distance

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

$$S = \frac{P}{4\pi R^2}$$

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

Prediction frequency(MHz):	848.80	848.80	486.60	1909.80
Peak Output Power (W)	1.96	0.50	0.23	0.96
Maximum Peak output power at antenna terminal(dBm):	32.92	26.96	23.66	29.80
Maximum Peak output power at antenna terminal(mW):	1958.00	496.60	232.30	955.00
Emission Designator	246KGXW	250KG7W	4M14F9W	248KGXW
Duty cycle:	0.125	0.500	1.000	0.125
Antenna gain (typical)(dBi):	2.00	2.00	2.00	2.00
Maximum antenna gain(numeric):	1.58	1.58	1.58	1.58
Prediction distance(cm):	20.00	20.00	20.00	20.00
MPE limit for uncontrolled exposure at prediction frequency (mW/ cm ²):	0.57	0.57	0.32	1.00
Power density at predication frequency at 20 (cm) distance (mW/ cm ²):	0.0772	0.0783	0.0733	0.0377
EIRP Power(Average)(W):	0.3879	0.3935	0.3682	0.1892

1909.80	1907.60	1752.60	848.30	484.30	847.50	847.50
0.42	0.26	0.24	0.19	0.17	0.21	0.18
26.20	24.16	23.75	22.89	22.39	23.22	22.46
416.90	260.60	237.10	194.50	173.40	209.90	176.20
254KG7W	4M10F9W	5M08F9W	1M14G7D	1M8D7W	2M73G7D	2M74D7W
0.500	1.000	1.000	1.000	1.000	1.000	1.000
2.00	2.00	2.00	2.00	2.00	2.00	2.00
1.58	1.58	1.58	1.58	1.58	1.58	1.58
20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.00	1.00	1.00	0.57	0.32	0.57	0.57
0.0658	0.0822	0.0748	0.0614	0.0547	0.0662	0.0556
0.3304	0.4130	0.3758	0.3083	0.2748	0.3327	0.2793

846.50	846.50	844.00	844.00	1909.30	1909.30	1908.50
0.21	0.17	0.21	0.18	0.16	0.14	0.17
23.21	22.41	23.25	22.54	22.07	21.34	22.42
209.40	174.20	211.30	179.50	161.10	136.10	174.60
4M54G7D	4M50D7W	9M13G7D	9M07D7W	1M12G7D	1M14D7W	2M73G7D
1.000	1.000	1.000	1.000	1.000	1.000	1.000
2.00	2.00	2.00	2.00	2.00	2.00	2.00
1.58	1.58	1.58	1.58	1.58	1.58	1.58
20.00	20.00	20.00	20.00	20.00	20.00	20.00
0.56	0.56	0.56	0.56	1.00	1.00	1.00
0.0661	0.0550	0.0667	0.0566	0.0508	0.0429	0.0551
0.3319	0.2761	0.3349	0.2845	0.2553	0.2157	0.2767

1908.50	1907.50	1907.50	1905.00	1905.00	1902.50	1902.50
0.14	0.19	0.15	0.21	0.18	0.15	0.13
21.41	22.70	21.74	23.15	22.45	21.68	21.05
138.40	186.20	149.30	206.50	175.80	147.20	127.40
2M74D7W	4M52G7D	4M52D7W	9M13G7D	9M10D7W	13M6G7D	13M6D7W
1.000	1.000	1.000	1.000	1.000	1.000	1.000
2.00	2.00	2.00	2.00	2.00	2.00	2.00
1.58	1.58	1.58	1.58	1.58	1.58	1.58
20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.27	1.00	1.00	1.00	1.00	1.00	1.00
0.0437	0.0587	0.0471	0.0651	0.0555	0.0464	0.0402
0.2193	0.2951	0.2366	0.3273	0.2786	0.2333	0.2019

1900.00	1900.00	1754.30	1754.30	1753.50	1753.50	1752.50
0.18	0.16	0.18	0.16	0.19	0.16	0.18
22.55	21.92	22.51	21.98	22.69	21.99	22.55
179.90	155.60	178.20	157.80	185.80	158.10	179.90
18M8G7D	18M8D7W	1M17G7D	1M13D7W	2M75G7D	2M75D7W	4M56G7D
1.000	1.000	1.000	1.000	1.000	1.000	1.000
2.00	2.00	2.00	2.00	2.00	2.00	2.00
1.58	1.58	1.58	1.58	1.58	1.58	1.58
20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.0568	0.0491	0.0562	0.0498	0.0586	0.0499	0.0568
0.2851	0.2466	0.2824	0.2501	0.2945	0.2506	0.2851

1752.50	1750.00	1750.00	1747.50	1747.50	1745.00	1745.00
0.16	0.18	0.16	0.18	0.17	0.19	0.16
22.00	22.59	22.07	22.64	22.23	22.83	22.01
158.50	181.60	161.10	183.70	167.10	191.90	158.90
4M54D7W	9M20G7D	9M16D7W	13M6G7D	13M6D7W	18M8G7D	18M9D7W
1.000	1.000	1.000	1.000	1.000	1.000	1.000
2.00	2.00	2.00	2.00	2.00	2.00	2.00
1.58	1.58	1.58	1.58	1.58	1.58	1.58
20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.0500	0.0573	0.0508	0.0580	0.0527	0.0605	0.0501
0.2512	0.2878	0.2553	0.2911	0.2648	0.3041	0.2518

2567.50	2567.50	2565.00	2565.00	2562.50	2562.50	2527.00
0.21	0.17	0.18	0.15	0.20	0.16	0.21
23.30	22.24	22.65	21.82	23.02	22.13	23.14
213.80	167.50	184.10	152.10	200.40	163.30	206.10
4M55G7D	4M52D7W	9M23G7D	9M13D7W	13M6G7D	13M6D7W	18M1G7D
1.000	1.000	1.000	1.000	1.000	1.000	1.000
2.00	2.00	2.00	2.00	2.00	2.00	2.00
1.58	1.58	1.58	1.58	1.58	1.58	1.58
20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.0674	0.0528	0.0581	0.0480	0.0632	0.0515	0.0650
0.3389	0.2655	0.2918	0.2411	0.3176	0.2588	0.3266

2527.00	784.50	784.50	782.00	782.00	713.50	713.50
0.17	0.20	0.18	0.21	0.19	0.21	0.19
22.30	22.99	22.55	23.12	22.73	23.30	22.69
169.80	199.10	179.90	205.10	187.50	213.80	185.80
18M1D7W	4M54G7D	4M52D7W	9M20G7D	9M13D7W	4M54G7D	4M50D7W
1.000	1.000	1.000	1.000	1.000	1.000	1.000
2.00	2.00	2.00	2.00	2.00	2.00	2.00
1.58	1.58	1.58	1.58	1.58	1.58	1.58
20.00	20.00	20.00	20.00	20.00	20.00	20.00
1.00	0.52	0.52	0.52	0.52	0.48	0.48
0.0536	0.0628	0.0568	0.0647	0.0591	0.0674	0.0586
0.2691	0.3156	0.2851	0.3251	0.2972	0.3389	0.2945

711.00	711.00	MHz
0.21	0.19	
23.32	22.78	(dBm)
214.80	189.70	(mW)
9M17G7D	9M10D7W	
1.000	1.000	(%)
2.00	2.00	(dBi)
1.58	1.58	(numeric)
20.00	20.00	(cm)
0.47	0.47	(mW/cm ²)
0.0678	0.0598	(mW/cm ²)
0.3404	0.3007	

Result(the worst case):

The max. power density is 0.0822 mW/ cm² at 1907.6MHz WCDMA mode which is less than 1 mW/cm².

Simultaneous transmission mode:

2.4GHz wifi mode + WCDMA 1900MHz Mode(Worst Case):

Prediction frequency:	2.4	(GHz)
Power density at predication	0.0245000	(mW/cm ²)

Prediction frequency:	1907.6	(GHz)
Power density at predication	0.0822000	(mW/cm ²)
2.4GHz Wifi + WCDMA 1900MHz Power density at	0.1067000	(mW/cm ²)
MPE limit for uncontrolled	1	(mW/cm ²)

The predicted power density level at 20 cm is 0.1067mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm².

IC EIRP/Conducted Power level: 802.11 b mode

	CH 1-11	
	2412	MHz
Tune-UP power at antenna input terminal:	17.5	(dBm)
Tune-Up power Tolerance:	1	dB
Duty cycle:	100	(%)
Antenna gain (typical):	2.4	(dBi)
Conducted Power:	70.795	mW
Conducted Power:	0.07079	W
EIRP:	123.027	mW
EIRP:	0.12303	W
EIRP Limit	2.286	W

Measurement Result:

The EIRP Power level is 0.12303 W which less than RSS102 section 2.5.2 Exemption Limits (2.286W) above 300 MHz and below 6 GHz condition .

IC EIRP/Conducted Power level: GSM/WCDMA/LTE mode:

See page 4~8, The max. EIRP(Average) at WCDMA 1907.6MHz is 0.4130W.

Measurement Result:

The EIRP Power level (Average) is 0.4130 W which less than RSS102 section 2.5.2 Exemption Limits (2.286W) above 300 MHz and below 6 GHz condition .

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