

MAXIMUM PERMISSIBLE EXPOSURE

This Maximum Permissible Exposure (MPE) report demonstrates compliance for WL13A Module with FCC CFR 47 §1.1310 and 2.1091 and IC Safety Code 6, Section 2.2.1 (a) for standalone and collocated simultaneous transmission in mobile exposure conditions. The MPE analysis is valid for transmitters operating within the parameters defined in Table A2 and A3 used for analysis.

Any collocated transmitter must have a valid FCC ID documenting equivalent or degraded RF Output Power with the collocated parameters calculated in this MPE analysis.

The mobile classification applies when 20 cm or more separation distance is maintained between the end user and WWAN, WLAN and Bluetooth transmission antennas.

Portable user conditions or additional collocated modules not allowed based on this RF exposure analysis require a Class II permissive change and updated MPE or SAR report.

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—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 (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) 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

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m ²)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	280/ <i>f</i>	2.19/ <i>f</i>		6
10–30	28	2.19/ <i>f</i>		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> ^{0.5}	0.0042 <i>f</i> ^{0.5}	<i>f</i> /150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 / <i>f</i> ^{1.2}
150 000–300 000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616 000 / <i>f</i> ^{1.2}

* Power density limit is applicable at frequencies greater than 100 MHz.

- Notes:**
1. Frequency, *f*, is in MHz.
 2. A power density of 10 W/m² is equivalent to 1 mW/cm².
 3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

EQUATIONS

Power density is given by:

$$S = \text{EIRP} / (4 * \text{Pi} * D^2)$$

where

S = Power density in W/m²

EIRP = Equivalent Isotropic Radiated Power in W

D = Separation distance in m

Power density in units of W/m² is converted to units of mW/cm² by dividing by 10.

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

From FCC §1.1310 Table 1 (B),

the maximum value of

S = 0.469 mW/cm² @ 704MHz

S = 0.521 mW/cm² @ 779.5MHz

S = 0.549 mW/cm² @ 824.2MHz

S = 1.0 mW/cm² @ 1710MHz, 1900MHz, 2.4GHz, 5GHz

From IC Safety Code 6, Section 2.2 Table 5 Column 4,

S = 4.69 W/m² @ 704MHz

S = 5.21 W/m² @ 779.5MHz

S = 5.49 W/m² @ 824.2MHz

S = 10 W/m² @ 1710MHz, 1900MHz, 2.4GHz, 5GHz

1. Stand Alone Transmitter Calculation

RESULTS

Table A1: WL13A (External Antenna)

Technology	Distance (m)	Power (dBm) (Note1)	Gain (dBi)	(W)	Density (W/m ²)	Density (mW/cm ²)
2412 - 2462	0.20	15.00	5.00	0.100	0.20	0.020

Note 1: This is the upper limit of the tune-up tolerance.

Table A2: Bluetooth (WLAN Aux Antenna)

Technology	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m ²)	FCC Power Density (mW/cm ²)
2402 - 2480	0.20	7.00	2.71	0.02	0.002

Table A3: WWAN

Technology	Frequency (MHz)	Separation		Antenna Gain (dBi)	ERP			Average EIRP (W)	FCC Power Density (mW/cm ²)	FCC MPE Limit (mW/cm ²)
		Distance (m)	Output Power (dBm)		(W)	Duty Cycle (%)	Average EIRP (dBm)			
GPRS/EDGE 850 (2 UL Slots)	824 - 849	0.20	33.50	6.50	6.10	25	34.00	2.51	0.498	0.549
GPRS/EDGE 1900 (2 UL Slots)	1850 - 1910	0.20	30.50	2.50	1.22	25	27.00	0.50	0.099	1.000
WCDMA Band4/ LTE Band 4	1710 - 1755	0.20	24.00	6.00	0.61	100	30.00	1.00	0.199	1.000
LTE Band 17	704 - 716	0.20	24.00	9.00	1.22	100	33.00	2.00	0.397	0.469
LTE Band 13	779.5 - 784.5	0.20	24.00	9.00	1.22	100	33.00	2.00	0.397	0.521
WCDMA Band 5/LTE Band5 (850MHz)	824-849	0.20	24.00	6.50	0.68	100	30.50	1.12	0.223	0.549
CDMA 850MHz	824-849	0.20	25.00	6.50	0.86	100	31.50	1.41	0.281	0.549
WCDMA Band 2/LTE Band 2/LTE Band 25 (1900MHz)	1850 - 1910	0.20	24.00	3.00	0.31	100	27.00	0.50	0.100	1.000
CDMA 1900MHz	1850 - 1910	0.20	25.00	3.00	0.38	100	28.00	0.63	0.126	1.000

2. Collocated MPE Calculations

Table B: WWAN/MPE Limit value

Technology	Frequency (MHz)	FCC Power Density (mW/cm ²)	FCC MPE Limit (mW/cm ²)	WWAN/MPE Limit
GPRS 850 (2 UL Slots)	824 - 849	0.498	0.549	0.907
GPRS 1900 (2 UL Slots)	1850 - 1910	0.099	1.000	0.099
WCDMA Band 4/LTE Band 4	1710 - 1755	0.199	1.000	0.199
LTE Band 17	704 - 716	0.397	0.469	0.846
LTE Band 13	779.5 - 784.5	0.397	0.521	0.762
WCDMA B5/LTE B5 850MHz	824 - 849	0.223	0.549	0.406
CDMA 850MHz	824 - 849	0.281	0.549	0.512
WCDMA B2/ LTE B2/LTE B25 1900MHz	1850 - 1910	0.100	1.000	0.100
CDMA 1900MHz	1850 - 1910	0.126	1.000	0.126

Table C: WL12B + Bluetooth + WWAN

Technology	WWAN/MPE Limit	WLAN/MPE Limit	BT/MPE Limit	Sum	Limit
GPRS 850 (2 UL Slots)	0.907	0.020	0.002	0.929	1
GPRS 1900 (2 UL Slots)	0.099	0.020	0.002	0.121	1
WCDMA Band 4/LTE Band 4	0.199	0.020	0.002	0.221	1
LTE Band 17	0.846	0.020	0.002	0.868	1
LTE Band 13	0.762	0.020	0.002	0.784	1
WCDMA Band 5/LTE Band 5 850MHz	0.406	0.020	0.002	0.428	1
CDMA 850MHz	0.512	0.020	0.002	0.534	1
WCDMA Band 2/LTE Band 2/LTE Band 25 1900MHz	0.100	0.020	0.002	0.122	1
CDMA 1900MHz	0.126	0.020	0.002	0.148	1

As shown in the calculations above, when all devices are operational, the worst case combination is within the limit at a distance of 20cm from the device.