

MPE Calculation / RF Exposure

Product: Guardian

Applicant: Umain Inc.

Model: UM80GA1

Address: 504, Fifth Floor, 59, Oncheon-ro, Yuseong-gu, Daejeon, Republic of Korea

FCC ID: 2AN8QUM80GA1

This document is prepared to show compliance with the RF Exposure requirements as required in §1.1310 of the FCC Rules and Regulations.

The limit for Maximum Permissible Exposure (MPE), specified in FCC §1.1310 is listed in below table. According to FCC §1.1310: the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b).

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
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
1500-100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

Result

Calculated Formulary:

Predication of MPE limit at a given distance

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

S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

MPE Prediction Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

Classification The antenna of this product is at least 20 cm away from the body of the user. So this product is classified as mobile device.

- UWB

Frequency (GHz)	Tune up EIRP		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBm)	(mW)			
8.019	-2.19	0.604	20	0.000 12	1

Conclusion This confirms compliance to the required radio frequency radiation exposure limit of 1.0 mW/cm² at 20 cm operation.

- Wi-Fi

Max. tune-up power(dBm)

802.11b	802.11g	802.11n(HT20)	802.11n(HT40)
26.0	25.5	25.5	26.0

$$S = \text{ERP}/4 \pi R^2$$

In other words, $R = \sqrt{\text{ERP}/4\pi \times S(Pd)}$

Where S = Power density

ERP = Effective Radiated Power

R = distance to the centre of radiation of the antenna

Values $S = 1.0 \text{ mW/cm}^2$ for General population uncontrolled exposure (FCC Part 1.1310 Radiofrequency radiation exposure limits)

S = 1.0 mW/cm²

PT = 26.00 dBm (398.11 mW) : measured maximum output power

G = Antenna gain = 3.40 dBi (2.188 in linear terms)

EIRP = PT x G

$R = 20 \text{ cm}$

Calculation $EIRP = 398.11 \times 2.188 = 870.96 \text{ mW}$

$S = 870.96/12.56 \times (20)^2 = 870.96/5024$

S = 0.173 mW/cm²

Conclusion This confirms compliance to the required radio frequency radiation exposure limit of 1.0 mW/cm² at 20 cm operation.

- **BLE**

Max. tune-up power(dBm)

BLE
8.0

$$S = \text{ERP}/4 \pi R^2$$

In other words, $R = \sqrt{\text{ERP}/4\pi \times S(Pd)}$

Where S = Power density

ERP = Effective Radiated Power

R = distance to the centre of radiation of the antenna

Values $S = 1.0 \text{ mW/cm}^2$ for General population uncontrolled exposure (FCC Part 1.1310 Radiofrequency radiation exposure limits)

S = 1.0 mW/cm²

PT = 8.00 dBm (6.31 mW) : measured maximum output power

G = Antenna gain = 3.40 dBi (2.188 in linear terms)

EIRP = PT x G

R = 20 cm

Calculation EIRP = $6.31 \times 2.188 = 13.80 \text{ mW}$

$S = 13.80/12.56 \times (20)^2 = 13.80/5024$

S = 0.002 75 mW/cm²

Conclusion This confirms compliance to the required radio frequency radiation exposure limit of 1.0 mW/cm² at 20 cm operation.

Simultaneously MPE

Simultaneously MPE = PSD1/Limit1 + PSD2/Limit2 + PSD3/Limit3

UWB+BLE+Wi-Fi

Simultaneously MPE = $(0.000\ 12 \text{ mW/cm}^2 / 1) + (0.173 \text{ mW/cm}^2 / 1) + (0.002\ 75 \text{ mW/cm}^2 / 1)$
 $= 0.175\ 87 \text{ mW/cm}^2$

Results: Compliant

This confirms compliance to the required radio frequency radiation exposure limit of 1.0 mW/cm² at 20 cm operation.