

Maximum Permissible Exposure (MPE) & Exposure evaluation

Report identification number: 1-3116/16-01-37

Certification numbers and labeling requirements	
FCC ID	MCQ-CQIMX6UL
IC number	1846A-CCIMX6UL
HVIN (Hardware Version Identification Number)	ConnectCore 6UL
PMN (Product Marketing Name)	CC IMX6UL
FVIN (Firmware Version Identification Number)	82004060
HMN (Host Marketing Name)	-/-

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EUT technologies:

Technologies:	Max. power conducted: (AVG)	Max. antenna gain:	Min. pathloss:
Bluetooth 2.4 GHz	Declared 6 dBm	Declared : 4.6 dBi)*	-- (if applicable)
Bluetooth LE 2.4 GHz	Declared 0 dBm	Declared : 4.6 dBi)**	-- (if applicable)
WLAN 2.4 GHz	Declared 18 dBm	Declared : 4.6 dBi)***	-- (if applicable)
WLAN 5 GHz	Declared 11 dBm	Declared : 5.1 dBi)****	-- (if applicable)

-)* worst case of 5 PCB or dipole antenna types, see CTC advanced test report 1-3116/16-01-18 section 11.1
-)** worst case of 5 PCB or dipole antenna types, see CTC advanced test report 1-3116/16-01-19 section 11.1
-)*** worst case of 5 PCB or dipole antenna types, see CTC advanced test report 1-3116/16-01-17 section 11.1
-)**** worst case of 3 PCB or dipole antenna types, see CTC advanced test report 1-3116/16-01-20 section 12.2

See also hardware reference manual section ‘FCC-approved antennas’

Prediction of MPE limit at given distance - FCC

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 the antenna
- G = Antenna gain
- R = Distance to the center of radiation of the antenna

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled “Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure”

Frequency Range (MHz)	Power Density (mW/cm ²)	Averaging Time (minutes)
300 -1500	f/1500	30
1500 - 100000	1.0	30

where f = Frequency (MHz)

Prediction: worst case

	Technology	BT/BTLE 2.4 GHz	WLAN 2.4 GHz	WLAN 5 GHz
P	Maximum output power	6 dBm	18 dBm	11 dBm
R	Distance	20 cm	20 cm	20 cm
G	Antenna gain	4.6 dBi	4.6 dBi	5.1 dBi
	Antenna	Yageo ANTX100P001B24553	Yageo ANTX100P001B24553	Yageo ANTX100P001B24553
S	MPE limit for uncontrolled exposure	1.0 mW/cm ²	1.0 mW/cm ²	1.0 mW/cm ²
	Calculated Power density:	mW/cm²	mW/cm²	mW/cm²
	Percentage of limit: (BT + WLAN 2.4 GHz)	0.23%	3.62%	0.81%
	Collocation scenario 1: (BT + WLAN 2.4 GHz)	3.85%		
	Collocation scenario 2: (BT + WLAN 5 GHz)	1.04%		

This prediction demonstrates the following:

The power density levels for FCC at a distance of 20 cm are below the maximum levels allowed by regulations.

Prediction of MPE limit at given distance - IC

RSS-102, Issue 5, 2.5.2

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 MHz 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 $4.49/f^{0.5}W$ (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).

Prediction: worst case

	Technology	BT/BTLE 2450	WLAN 2450	WLAN 5 GHz
P	Maximum output power	6 dBm	18 dBm	11 dBm
G	Antenna gain	4.6 dBi	4.6 dBi	5.1 dBi
	Antenna	Yageo ANTX100P001B24553	Yageo ANTX100P001B24553	Yageo ANTX100P001B24553
S	MPE limit for uncontrolled exposure	2675 mW)*	2675 mW)*	4478 mW)**
	Calculated output power:	11.5 mW	182 mW	40.7 mW
	Collocation scenario 1: (BT + WLAN 2.4 GHz)	193.5 mW		
	Collocation scenario 2: (BT + WLAN 5 GHz)	52.2 mW		
	Antenna	Yageo ANTX100P001B24553	Yageo ANTX100P001B24553	Yageo ANTX100P001B24553

)* lowest limit at 2400 MHz

)** lowest limit at 5100 MHz

Conclusion: RF exposure evaluation is not required.

For applications where minimum distance to radiating element is 20cm Annex C of RSS-102 should be filled out.