

RF EXPOSURE

Report Number: BATT20120201E-RF

Product Name: IP-CAM

Model: CM-I12316GY

Trade Name: Zmodo

According to subpart 15.247(i) and subpart §1.1307(b)(1), 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 of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

| (B) Limits for General Population/Uncontrolled Exposure | | | | |
|--|--------------------------------------|--------------------------------------|--|---------------------------------|
| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm²) | Averaging Time (minutes) |
| 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;

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

EUT Specification

| | |
|-----------------------------------|---|
| EUT | IP-CAM |
| Frequency band (Operating) | <input checked="" type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input type="checkbox"/> WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz <input type="checkbox"/> WLAN: 5.745GHz ~ 5825GHz <input type="checkbox"/> Others _____ |
| Device category | <input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others _____ |
| Exposure classification | <input type="checkbox"/> Occupational/Controlled exposure ($S = 5mW/cm^2$) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure ($S=1mW/cm^2$) |
| Antenna diversity | <input checked="" type="checkbox"/> Single antenna <input type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input type="checkbox"/> Tx/Rx diversity |
| Max. output power | 802.11b: 18.44 dBm (69.82 mW); 802.11g: 15.26dBm (33.57 mW) |
| Antenna gain (Max) | 2.5dBi (Numeric gain: 1.78) |
| Evaluation applied | <input checked="" type="checkbox"/> MPE Evaluation <input type="checkbox"/> SAR Evaluation |

Note:

1. The maximum output power is 802.11b 18.44 dBm (69.82 mW) at 2462MHz;
802.11g 15.26 dBm (33.57 mW) at 2412MHz (with 1.78 numeric antenna gain.)
2. For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20 cm, even if the calculations indicate that the MPE distance would be lesser.

TEST RESULTS

No non-compliance noted.

Calculation

Given $E = \sqrt{\frac{30 \times P \times G}{d}}$ & $S = \frac{E^2}{3770}$

Where $E = \text{Field Strength in Volts / meter}$

$P = \text{Power in Watts}$

$G = \text{Numeric antenna gain}$

$d = \text{Distance in meters}$

$S = \text{Power Density in milliwatts / square centimeter}$

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{\frac{30 \times P \times G}{3770 \times S}}$$

Changing to units of mW and cm, using:

$$P(\text{mW}) = P(\text{W}) / 1000 \text{ and}$$

$$d(\text{cm}) = 100 * d(\text{m})$$

Yields

$$d = 100 \times \sqrt{\frac{30 \times (P/1000) \times G}{3770 \times S}} = 0.282 \times \sqrt{\frac{P \times G}{S}}$$

Where $d = \text{distance in cm}$

$P = \text{Power in mW}$

$G = \text{Numeric antenna gain}$

$S = \text{Power Density in mW / cm}^2$

Substituting the logarithmic form of power and gain using:

$$P(\text{mW}) = 10^{(P(\text{dBm})/10)} \text{ and}$$

$$G(\text{numeric}) = 10^{(G(\text{dBi})/10)}$$

Yields

$$d = 0.282 \times \frac{10^{(P+G)/20}}{\sqrt{20}}$$

Equation 1

Where $d = \text{MPE safe distance in cm}$

$P = \text{Power in dBm}$

$G = \text{Antenna Gain in dBi}$

$S = \text{Power Density Limit in mW / cm}^2$

Maximum Permissible Exposure (2.4 GHz Band)

$$S = PG/4\pi R^2$$

S = Maximum power density (mW/cm²)

P = Power input to the antenna (mW).

G = Numeric power gain of the antenna

R = Distance to the center of the radiation of the antenna (20cm = limit for MPE) = 20cm

The maximum permissible exposure (MPE) for the general population is 1.00 mW/cm².

| Mode | Frequency (MHz) | Antenna Gain | | Conducted Power | | Evaluation Distance (cm) | Power Density (mW/cm ²) | MPE Limit (mW/cm ²) |
|---------|-----------------|--------------|-----------|-----------------|-------|--------------------------|-------------------------------------|---------------------------------|
| | | (dBi) | (numeric) | (dBm) | (mW) | | | |
| 802.11b | 2462 | 2.5 | 1.78 | 18.44 | 69.82 | 20 | 0.0247 | 1.0 |
| 802.11g | 2412 | 2.5 | 1.78 | 15.26 | 33.57 | 20 | 0.0119 | 1.0 |

The power density at 20cm does not exceed the 1 mW/cm² limit. Therefore, the exposure condition is compliant with FCC rules.