RADIO FREQUENCY EXPOSURE

LIMIT

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 levels in excess of the Commission's guidelines. See §15.247(b)(4) and §1.1307(b)(1) of this chapter.

EUT Specification

EUT	WLAN ROUTER
Frequency band (Operating)	☒ WLAN: 2.412GHz ~ 2.462GHz ☐ WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz ☐ WLAN: 5.745GHz ~ 5825GHz ☐ Others _____
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others _____
Exposure classification	☐ Occupational/Controlled exposure *(S = 5mW/cm^2)* ☒ General Population/Uncontrolled exposure *(S=1mW/cm^2)*
Antenna diversity	☐ Single antenna ☒ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☒ Tx/Rx diversity
Max. output power	15.59 dBm (36.22mW)
Antenna gain (Max)	2 dBi (Numeric gain: 1.58)
Evaluation applied	☒ MPE Evaluation ☐ SAR Evaluation

Note:

1. *The maximum output power is 15.59 dBm (36.22mW) at 2412MHz (with 1.58 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 RESULT

No non-compliance noted.

Calculation

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

Where *E = Field Strength in Volts / meter*
P = Power in Watts
G=Numeric antenna gain
d=Distance in meters
S=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 (mW) = P (W) / 1000 and

*d (cm) =100 * d (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 = distance in cm*
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW / cm^2

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and

G (numeric) = 10 ^ (G (dBi) / 10)

Yields

$$d = 0.282 \times \frac{10^{(P+G)/20}}{\sqrt{20}}$$ ***Equation 1***

Where *d = MPE safe distance in cm*

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW / cm^2

Maximum Permissible Exposure (2.4 GHz Band)

S = Maximum power density (mW/cm^2)

P = Power input to the antenna (mW). = 36.22mW

G = Numeric power gain of the antenna = 1.58

R = Distance to the center of the radiation of the antenna (20cm = limit for MPE) = 0.02^2

The maximum permissible exposure (MPE) for the general population is 1.00 mW/cm^2.

$(36.22 * 1.58) / (4\pi * 0.02^2) = 0.011$ mW/cm^2

The power density at 20cm does not exceed the 1 mW/cm^2 limit. Therefore, the exposure condition is compliant with FCC rules.