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	Oceana 800, Terra 800
Frequency band (Operating)	☐WLAN: 2.412GHz ~ 2.462GHz ☐WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~5.70GHz ☑Others :1626.5 – 1660.5 MHz
Device category	☐Portable (<20cm separation) ☑Mobile (>20cm separation) ☐Others
Exposure classification	☐Occupational/Controlled exposure (S = 5mW/cm2) ☑General Population/Uncontrolled exposure (S=1mW/cm2)
Max. conducted output power (for active antenna)	37.5 dBm (5623.4mW) (core module output: 29.04dBm + gain of amplifier: 11dB > Max. RF output power of antenna: 37.5dBm)
Max. conducted output power (for passive antenna)	29.04 dBm (801.68mW)
Antenna gain (Max) (for active antenna)	6 dBi (Numeric gain: 4)
Antenna gain (Max) (for passive antenna)	11 dBi (Numeric gain: 12.6)
Evaluation applied	☑MPE Evaluation ☐SAR Evaluation
Note: 1. The maximum conducted output power is 37.5 dBm (5623.4mW) (with 4 numeric antenna gain.) for active antenna. And the maximum conducted output power is 29.04 dBm (801.68mW) (with 12.6 numeric antenna gain.) for passive antenna. 2. Manufacturer’instruction for separation distance between antenna and persons required: 55cm. 3. Antenna installation and device operating instructions shall be provided to installers to maintain and ensure compliance with RF exposure requirements.	

TEST RESULTS

No non-compliance noted

Calculation

Given $E = \sqrt{\frac{30 * P * G}{d}}$ & 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:

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

Changing to units of mW and cm, using:
P (mW) = P (W) / 1000 and
*d (cm) =100 * d (m)*

Yields

$$d = 100 \text{ X } \sqrt{\frac{30 * (P/1000) * G}{3770 \,\&\, S}} = 0.282 \text{ X } \sqrt{\frac{P * G}{S}}$$

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

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

For active antenna:
EUT output power = 37.5dBm = 5623.4mW
Antenna Gain = 6dBi = 4 Numeric
S = 1.0 mW / cm^2 from 1.1310 Table 1
R = 55 cm
Substituting these parameters into the above Equation 1:

$$\rightarrow \text{MPE} = \frac{P*G}{4\prod R^2} = \frac{22387.21}{4*3.14*55^2} = 0.589 \text{ mW/cm}^2$$

For passive antenna:
EUT output power = 29.04dBm = 801.68mW
Antenna Gain = 11dBi = 12.6 Numeric
S = 1.0 mW / cm^2 from 1.1310 Table 1
R = 55 cm
Substituting these parameters into the above Equation 1:

$$\rightarrow \text{MPE} = \frac{P*G}{4\prod R^2} = \frac{10101.17}{4*3.14*55^2} = 0.266 \text{ mW/cm}^2$$