

## Compliance with 47 CFR 15.247(b)(5)

*“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 § 1.1307(b)(1) of this chapter.”*

The EUT will only be used with a separation distance of 20 centimeters or greater between the antenna and the body of the user or nearby persons and can therefore be considered a mobile transmitter per 47 CFR 2.1091 (b). The EUT has two antenna ports. One antenna port is for both transmit and receive, the other antenna port is for receive only. The EUT will only be used in the applicant's WA21 or WA22 access points. The access point can accommodate up to two radios for a total of two transmit/receive ports and two receive only ports. The access point can be configured with either two 802.11(b)/(g) radios (FCC ID: HN2WAMIG2), or two 802.11(a) radios (FCC ID: HN2WN-5MP01), or one of each type of radio.

The maximum peak power was measured to be 675 mW (ERP) for FCC ID: HN2WAMIG2 and 144 mW (ERP) for FCC ID: HN2WN-5MP01. The transmit frequency is greater than 1.5 GHz, therefore the EUT is categorically excluded from routine environmental evaluation per 47 CFR 2.1091(c).

The MPE estimates are as follows:

Table 1 in 47 CFR 1.1310 defines the maximum permissible exposure (MPE) for the general population as  $1\text{mW}/\text{cm}^2$ . The exposure level at a 20 cm distance from the EUT's transmitting antenna is calculated using the general equation:

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

Where: S = power density ( $\text{mW}/\text{cm}^2$ )

P = power input to the antenna (mW)

G = numeric power gain relative to an isotropic radiator

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

PG = EIRP

Solving for S, the maximum power densities 20 cm from the transmitting antennas are summarized in the following tables:

### MPE Estimates for Self Co-located Device

#### FCC ID: HN2WAMIG2

##### 802.11(b)/(g) Radio

Antenna Type	Antenna Part No.	Transmit Frequency (MHz)	Max Peak Conducted Output Power (mW)	Antenna Gain (dBi)	Minimum Antenna Cable Loss (dB)	Power Density @ 20 cm ( $\text{mW}/\text{cm}^2$ )	General Population Exposure Limit from 1.1310 ( $\text{mW}/\text{cm}^2$ )	Ratio of Power Density to the Exposure Limit
Omni	063363	2400	35	5	0	0.022	1	0.022
Yagi	063365	2400	35	15	0	0.220	1	0.220
Omni	065349	2400	35	9	0	0.055	1	0.055
Omni	066147	2400	35	1	0	0.009	1	0.009
Mini Omni	067261	2400	35	3	0	0.014	1	0.014
Flat Panel	067262	2400	35	5	0	0.022	1	0.022
Flat Panel	067263	2400	35	9	0	0.055	1	0.055
Corner Reflector	071122	2400	35	9	0	0.055	1	0.055

**Worst Case Ratio of Power Density to the Exposure Limit = 0.220 (Yagi Antenna)**

**FCC ID: HN2WN-5MP01**

**802.11 (a) Radio**

Antenna Type	Antenna Part No.	Transmit Frequency (MHz)	Max Peak Conducted Output Power (mW)	Antenna Gain (dBi)	Minimum Antenna Cable Loss (dB)	Power Density @ 20 cm (mW/cm <sup>2</sup> )	General Population Exposure Limit from 1.1310 (mW/cm <sup>2</sup> )	Ratio of Power Density to the Exposure Limit
Omni	072759	5.25	14.9	6	0	0.012	1	0.012
Omni	072760	5.25	14.9	9	2	0.015	1	0.015
Omni	072761	5.25	14.9	3	0	0.006	1	0.006
Corner Reflector	072762	5.25	14.9	14	2	0.047	1	0.047
Omni	072664	5.15	15.5	5	0	0.010	1	0.010
Omni	072730	5.25	14.9	5	0	0.009	1	0.009

**Worst Case Ratio of Power Density to the Exposure Limit = 0.047 (Corner Reflector)**

**Excerpts from TCB Training, April 3, 2002, “Mobile Transmitters”, Slide 6:**

*“Devices operating in multiple frequency bands*

- *When RF exposure evaluation is required for TCB approval*
  - *Separate antennas – estimated minimum separation distances may be considered for the frequency bands that do not require evaluation or TCB approval, however, the estimated distance should take into account the effect of co-located transmitters. (Note 24)*

*Note 24 According to multiple frequency exposure criteria, the ratio of field strength or power density to the applicable exposure limit at the exposure location should be determined for each transmitter and the sum of these ratios must not exceed 1.0 for the location to be compliant.”*

**Exposure Scenarios for Access Point**

Per Note 24 shown above, the Sum of Worst Case Power Ratios cannot exceed 1.0

Slot 1	Slot 2	Slot 1 Worst Case Ratio of Power Density to the Exposure Limit	Slot 2 Worst Case Ratio of Power Density to the Exposure Limit	Sum of Worst Case Ratios (Power Density to the Exposure Limit)	FCC Limit for Sum of Worst Case Ratios
802.11(a)	802.11(a)	0.04700	0.04700	0.09400	1.0
802.11(a)	802.11(b)/(g)	0.04700	0.22019	0.26719	1.0
802.11(a)	no radio	0.04700	no radio	0.04700	1.0
802.11(b)/(g)	802.11(b)/(g)	0.22019	0.22019	0.44038	1.0
802.11(b)/(g)	no radio	0.22019	no radio	0.22019	1.0

PASS  
PASS  
PASS  
PASS  
PASS

The results shown in the above table are equivalent to the Sum of the EIRP of the Two Co-located Transmitters (EIRP TX1 + EIRP TX2) compared to the exposure limit. The benefit of this method, is that accounts for transmitters operating at different frequencies against different exposure limits.

Please note that EIRP = ERP x 1.64, so EIRP is worst case. However, because some parties would prefer to see the calculation as the Sum of the ERP of the Two Co-located Transmitters, the table below shows compliance with ERP TX1 + ERP TX2

Slot 1	Slot 2	Slot 1 Worst Case ERP (mW)	Slot 2 Worst Case ERP (mW)	Sum of Worst Case ERPs (mW)	Power Density @ 20 cm (mW/cm <sup>2</sup> )	General Population Exposure Limit from 1.1310 (mW/cm <sup>2</sup> )
802.11(a)	802.11(a)	143.99	143.99	287.98	0.05729	1.0
802.11(a)	802.11(b)/(g)	143.99	674.88	818.87	0.16291	1.0
802.11(a)	no radio	143.99	no radio	143.99	0.02865	1.0
802.11(b)/(g)	802.11(b)/(g)	674.88	674.88	1349.75	0.26852	1.0
802.11(b)/(g)	no radio	674.88	no radio	674.88	0.13426	1.0

PASS  
 PASS  
 PASS  
 PASS  
 PASS

The sum of the worst-case ERPs (in any scenario) does not exceed 1.0 mW/cm<sup>2</sup> at 20 cm; therefore, the exposure condition is compliant with FCC rules.