

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). No radiating structure will be within 2.5cm of the user's hands or wrists. The EUT will only be used in the applicant's Model 700C Hand-held Terminal. There are no provisions for body worn configurations. The 700C can be configured with the EUT and a 802.11b radio (FCC ID: HN2011B).

The maximum peak power was measured to be 73.2 mW (ERP) for FCC ID: HN2011B, and 0.61 mW (ERP) for FCC ID: HN2ABTM3-2. 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 (mW/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: HN2011B

802.11 (b) 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^2)	General Population Exposure Limit from 1.1310 (mW/cm^2)	Ratio of Power Density to the Exposure Limit
External tuned dipole	805-606	2400	89	1.3	0	0.024	1	0.024
Internal folded monopole	805-608	2400	89	-2	0	0.011	1	0.011

Worst Case Ratio of Power Density to the Exposure Limit = 0.024 (External Tuned Dipole Antenna)

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FCC ID: HN2ABTM3-2

Bluetooth 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 ²)	General Population Exposure Limit from 1.1310 (mW/cm ²)	Ratio of Power Density to the Exposure Limit
Internal Integral Antenna	ABTM3	2400	3.78	-5.77	0	0.00020	1	0.00020

Worst Case Ratio of Power Density to the Exposure Limit = 0.00020 (Internal Integral Antenna)

Exposure Scenarios for 700C

Per **Note 24** shown below (taken from FCC slides), the Sum of Worst Case Power Ratios cannot exceed 1.0

802.11b Radio Worst Case Ratio of Power Density to the Exposure Limit (FCC ID: HN2011B)	Bluetooth Radio Worst Case Ratio of Power Density to the Exposure Limit (FCC ID: HN2ABTM3-2)	Sum of Worst Case Ratios (Power Density to the Exposure Limit)	FCC Limit for Sum of Worst Case Ratios	
0.02400	0.00020	0.02420	1.0	PASS
no radio	0.00020	0.00020	1.0	PASS
0.02400	no radio	0.02400	1.0	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 it 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

802.11b Radio (FCC ID: HN2011B) Worst Case ERP (mW)	Bluetooth Radio (FCC ID: HN2ABTM3-2) Worst Case ERP (mW)	Sum of Worst Case ERPs (mW)	Power Density @ 20 cm (mW/cm ²)	General Population Exposure Limit from 1.1310 (mW/cm ²)	
73.21	0.61	73.82	0.01469	1.0	PASS
no radio	0.61	0.61	0.00012	1.0	PASS
73.21	no radio	73.21	0.01456	1.0	PASS

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.”

The sum of the worst-case power ratios in any scenario does not exceed 1.0 (see Note 24 above); therefore, the exposure condition is compliant with FCC rules.