Compliance with 47 CFR 2.1091 - For GSM WAN Radio

(c) Mobile devices that operate in the Cellular Radiotelephone Service, the Personal Communications Services, the Satellite Communications Services, the General Wireless Communications Service, the Wireless Communications Service, the Maritime Services and the Specialized Mobile Radio Service authorized under subpart H of part 22 of this chapter, parts 24, 25, 26 and 27 of this chapter, part 80 of this chapter (ship earth stations devices only) and part 90 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if they operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more, or if they operate at frequencies above 1.5 GHz and their ERP is 3 watts or more.

(d) The limits to be used for evaluation are specified in § 1.1310 of this chapter.

Compliance with 47 CFR 15.247(i) – For Bluetooth and 802.11b/g Radios

"*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 body worn accessories are provided with the unit. Three radio modules will be installed in the unit – one operating in the cellular and PCS bands, and two operating in the 2.4GHz band: a GSM WAN radio module, a 802.11(b)/(g) radio module, and a Bluetooth EDR radio module. The radios can transmit simultaneously. Each radio transmits through its own antenna.

The total transmit power is less than 1.5 W (ERP), 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. 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 tables on the following pages:

MPE Estimates for Self Co-located Device

FCC ID: S9E-NOMADBT

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
Chip	ANT-2.45-CHP-x	2400	2.5	0.5	0	0.001	1	0.001

Worst Case Ratio of Power Density to the Exposure Limit = 0.001

FCC ID: S9E-NOMADWF

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 (mW/cm^2)	General Population Exposure Limit from 1.1310 (mW/cm^2)	Ratio of Power Density to the Exposure Limit
Chip	ANT-2.45-CHP-x	2400	57.94	0.5	0	0.013	1	0.013

Worst Case Ratio of Power Density to the Exposure Limit = 0.013

FCC ID: S9E-NOMADWAN

GSM/GPRS/EDGE 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
Dual Band Chip	1513247-1	850	1050	0	0	0.209	0.567	0.369
		1900	541	1	0	0.135	1	0.135

Worst Case Ratio of Power Density to the Exposure Limit = 0.369

Worst Case Co-located Exposure Condition

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

Bluetooth Radio Worst Case Ratio of Power Density to the Exposure Limit	802.11b Radio Worst Case Ratio of Power Density to the Exposure Limit	GSM Radio 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	
0.00100	0.01300	0.36900		0.383	1.0	PASS

The results shown in the above table are equivalent to the Sum of the EIRP of the Three Co-located Transmitters (EIRP TX1 + EIRP TX2 + EIRP TX3) compared to the exposure limit. The benefit of this method, is that accounts for transmitters operating at different frequencies against different exposure limits.

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*
  o <u>*Separate antennas*</u> *– 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)*

  <u>*Note 24*</u> *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 ratios (power density to the exposure limit) does not exceed 1.0; therefore, the exposure condition is compliant with FCC rules.