MPE Calculations

Systems operating under the provision of 47 CFR 1.1307(b)(1) shall be operated in a manor that ensures that the public is not exposed to radio frequency energy levels in excess of the FCC guidelines.

The EUT will only be used with a separation 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 MPE calculation for this exposure is shown below.

Using the Antennas with highest output power:

The peak radiated output power (EIRP) is calculated as follows:

Antenna	*Frequency (GHz)*	*Power input to the antenna (P) (dBm)*	*Power gain of the antenna (G) (dBi)*	*EIRP (P+G) (dBm)*	*EIRP $Log^{-1(dBm/10)}$ (mW)*
Dell Travis Antenova	2.4	24.77	2.70	27.47	558.47
Dell Travis Antenova	5	19.72	2.50	22.22	166.72
Dell Travis Amphenol	2.4	24.77	-0.26	24.51	282.49
Dell Travis Amphenol	5	19.72	2.66	22.38	172.98
Dell ZRS Hitachi (Main)	2.4	24.77	1.50	26.27	423.64
Dell ZRS Hitachi (Main)	5	19.72	5.10	24.82	303.39
Dell ZRS Hitachi (Aux)	2.4	24.77	3.00	27.77	598.41
Dell ZRS Hitachi (Aux)	5	19.72	5.40	25.12	325.09

EIRP = P + G
Where
P = Power input to the antenna (mW).
G = Power gain of the antenna (dBi)

The numeric gain (G) of the antenna with a gain specified in dB is determined by:

Antenna	*Frequency (GHz)*	*Antenna Gain (G) (dBi)*	*Numeric Antenna Gain $Log^{-1(dBm/10)}$ (dB)*
Dell Travis Antenova	2.4	2.70	1.86
Dell Travis Antenova	5	2.50	1.78
Dell Travis Amphenol	2.4	-0.26	0.94
Dell Travis Amphenol	5	2.66	1.85
Dell ZRS Hitachi (Main)	2.4	1.50	1.41
Dell ZRS Hitachi (Main)	5	5.10	3.24
Dell ZRS Hitachi (Aux)	2.4	3.00	2.00
Dell ZRS Hitachi (Aux)	5	5.40	3.47

$G = Log^{-1}$ (dB antenna gain/10)

Power density at the specific separation:

Antenna	*Frequency (GHz)*	*Power input to the antenna (P) (mW)*	*Numeric Power Gain of the Antenna (G) (dB)*	*Maximum Power Spectral Density $S=PG/(4R^2\pi)$ (mW/cm^2)*	*Maximum Power Spectral Density Limit (mW/cm^2)*
Dell Travis Antenova	2.4	299.92	1.86	0.111	1.00
Dell Travis Antenova	5	93.76	1.78	0.033	1.00
Dell Travis Amphenol	2.4	299.92	0.94	0.056	1.00
Dell Travis Amphenol	5	93.76	1.85	0.034	1.00
Dell ZRS Hitachi (Main)	2.4	299.92	1.41	0.084	1.00
Dell ZRS Hitachi (Main)	5	93.76	3.24	0.060	1.00
Dell ZRS Hitachi (Aux)	2.4	299.92	2.00	0.119	1.00
Dell ZRS Hitachi (Aux)	5	93.76	3.47	0.065	1.00

$S = PG/(4R^2\pi)$
Where
S = Maximum power density (mW/cm^2)
P = Power input to the antenna (mW).
G = Numeric power gain of the antenna
R = Distance to the center of the radiation of the antenna (20cm = limit for MPE)

The maximum permissible exposure (MPE) for the general population is $1mW/cm^2$.

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