# RF Exposure Evaluation
# MPE Calculations
## in co-locating with a Bluetooth transmitter

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 applying modular device (FCC ID: PD9LEN3945ABG) has a capability to co-locate with the following Bluetooth transmitter.

## 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) |
|---|---|---|---|---|---|
| Hitachi HFT38/39 (3945ABG WLAN) | 2.4 | 24.83 | 1.80 | 26.63 | 460.26 |
| Hitachi HFT38/39 (3945ABG WLAN) | 5 | 19.78 | 1.69 | 21.47 | 140.28 |
| **Co-located transmitter** | | | | | |
| HON HAI Precision Ind. Co., Ltd. BT | 2.4 | 4.90 | 2.00 | 6.90 | 4.90 |

*Power input and gain of the Bluetooth antenna is based on approved BT module (FCC ID: MCLJ07H081) previous filing with the FCC.

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) |
|---|---|---|---|
| Hitachi HFT38/39 (3945ABG WLAN) | 2.4 | 1.80 | 1.51 |
| Hitachi HFT38/39 (3945ABG WLAN) | 5 | 1.69 | 1.48 |
| **Co-located transmitter** | | | |
| HON HAI Precision Ind. Co., Ltd. BT | 2.4 | 2.00 | 1.58 |

$G = Log^{-1}$ (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$^2$) |
|---|---|---|---|---|---|
| Hitachi HFT38/39 (3945ABG WLAN) | 2.4 | 304.09 | 1.51 | 0.092 | 1.00 |
| Hitachi HFT38/39 (3945ABG WLAN) | 5 | 95.06 | 1.48 | 0.028 | 1.00 |
| **Co-located transmitter** | | | | | |
| HON HAI Precision Ind. Co., Ltd. BT | 2.4 | 3.09 | 1.58 | 0.001 | 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.