RF EXPOSURE

1. Regulation
According to §15.247(i), 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.

Limits for Maximum Permissive Exposure: RF exposure is calculated.

Frequency Range	Electric Field Strength [V/m]	Magnetic Field Strength [A/m]	Power Density [mW/cm^2]	Averaging Time [minute]
Limits for General Population / Uncontrolled Exposure				
0.3 ~ 1.34	614	1.63	*(100)	30
1.34 ~ 30	824/f	2.19/f	*(180/f2)	30
30 ~ 300	27.5	0.073	0.2	30
300 ~ 1 500	/	/	f/1 500	30
1 500 ~ 15 000	/	/	1	30

f=frequency in MHz, *= plane-wave equivalent power density

MPE (Maximum Permissive Exposure) Prediction

Predication of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2 \quad \left(\Rightarrow R = \sqrt{PG/4\pi S}\right)$$

S = power density [mW/cm^2]
P = Power input to antenna [mW]
G = Power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna [cm]

2. RF Exposure Compliance Issue
The information should be included in the user's manual:
This appliance and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter. A minimum separation distance of 20 cm must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

SAR test exclusion considerations : WLAN 802.11b

- Frequency Range : 2 412 MHz ~ 2 462 MHz

- Measured RF Output Power (Avg.) : 9.78 dBm

- Target Power & Tolerance 9.50 dBm & ± 1.00 dB

(Maximum : 10.50 dBm & Minimum : 8.50 dBm)

- Maximum Peak Antenna Gain : 1.99 dBi

- Maximum Output Power for the Calculation : 10.50 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the
The MPE calculation for this exposure is shown below.

- EIRP = P + G = 10.50 dBm + 1.99 dBi = 12.49 dBm = 17.74 mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)

Power Density at the specific separation

- S = EIRP / (4 X $R^2\pi$) = 17.74 / (4 X 20^2 X π) = **0.003 53** mW/cm^2	- NOTE S : Maximum Power Density (mW/cm^2) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (20 cm)

SAR test exclusion considerations : WLAN 802.11g

- Frequency Range : 2 412 MHz ~ 2 462 MHz

- Measured RF Output Power (Avg.) : 10.01 dBm

- Target Power & Tolerance 10.00 dBm & ± 1.00 dB

(Maximum : 11.00 dBm & Minimum : 9.00 dBm)

- Maximum Peak Antenna Gain : 1.99 dBi

- Maximum Output Power for the Calculation : 11.00 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the
The MPE calculation for this exposure is shown below.

- EIRP = P + G = 11.00 dBm + 1.99 dBi = 12.99 dBm = 19.91 mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)

Power Density at the specific separation

- S = EIRP / (4 X R2π) = 19.91 / (4 X 20^2 X π) = **0.003 96** mW/cm^2	- NOTE S : Maximum Power Density (mW/cm^2) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (20 cm)

SAR test exclusion considerations : WLAN 802.11n_HT20

- Frequency Range : 2 412 MHz ~ 2 462 MHz

- Measured RF Output Power (Avg.) : 9.77 dBm

- Target Power & Tolerance 10.00 dBm & ± 1.00 dB

(Maximum : 11.00 dBm & Minimum : 9.00 dBm)

- Maximum Peak Antenna Gain : 1.99 dBi

- Maximum Output Power for the Calculation : 11.00 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the
The MPE calculation for this exposure is shown below.

- EIRP = P + G = 11.00 dBm + 1.99 dBi = 12.99 dBm = 19.91 mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)

Power Density at the specific separation

- S = EIRP / (4 X $R^2\pi$) = 19.91 / (4 X 20^2 X π) = **0.003 96** mW/cm^2	- NOTE S : Maximum Power Density (mW/cm^2) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (20 cm)

SAR test exclusion considerations : WLAN 802.11n_HT40

- Frequency Range : 2 412 MHz ~ 2 462 MHz

- Measured RF Output Power (Avg.) : 10.03 dBm

- Target Power & Tolerance 10.00 dBm & ± 1.00 dB

(Maximum : 11.00 dBm & Minimum : 9.00 dBm)

- Maximum Peak Antenna Gain : 1.99 dBi

- Maximum Output Power for the Calculation : 11.00 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the
The MPE calculation for this exposure is shown below.

- EIRP = P + G = 11.00 dBm + 1.99 dBi = 12.99 dBm = 19.91 mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)

Power Density at the specific separation

- S = EIRP / (4 X $R^2\pi$) = 19.91 / (4 X 20^2 X π) = **0.003 96** mW/cm^2	- NOTE S : Maximum Power Density (mW/cm^2) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (20 cm)

SAR test exclusion considerations : Bluetooth LE

- Frequency Range : 2 402 MHz ~ 2 480 MHz

- Measured RF Output Power (Avg.) : 2.48 dBm

- Target Power & Tolerance 2.00 dBm & ± 0.50 dB

(Maximum : 2.50 dBm & Minimum : 1.50 dBm)

- Maximum Peak Antenna Gain : 1.99 dBi

- Maximum Output Power for the Calculation : 2.50 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the
The MPE calculation for this exposure is shown below.

- EIRP = P + G = 2.50 dBm + 1.99 dBi = 4.49 dBm = 2.81 mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)

Power Density at the specific separation

- S = EIRP / (4 X $R^2\pi$) = 2.81 / (4 X 20^2 X π) = **0.000 559** mW/cm^2	- NOTE S : Maximum Power Density (mW/cm^2) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (20 cm)

SAR test exclusion considerations :
WLAN 802.11n_HT40 + Bluetooth LE

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the
The SAR test exclusion considerations for this exposure is shown below.

WLAN 802.11n_HT40 + Bluetooth LE

- EIRP = 19.91 mW + 2.81 mW = 22.72 mW	- NOTE WLAN 802.11n_HT40 + Bluetooth LE WLAN 802.11n_HT40 = 19.91 mW Bluetooth LE = 2.81 mW

Power Density at the specific separation

- S = EIRP / (4 X $R^2\pi$) = 22.72 / (4 X 20^2 X π) = **0.004 52** mW/cm^2	- NOTE S : Maximum Power Density (mW/cm^2) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (20 cm)