RF Exposure Evaluation for the DBWIFIBLE01 module

FCC ID: QVHDBWIFIBLE01

The Dyson DBWIFIBLE01 module is a standalone PCBA. It will support dual-band 1 × 1 IEEE802.11a/b/g/n WLAN and BLE operation.

Simultaneous transmission of the dual band Wi-Fi and Bluetooth technology is not supported. Only one technology will transmit at any time.

The following FCC Rule Parts and procedures are applicable:

Part 1.1310 – Radiofrequency radiation exposure limits

Part 2.1091 – Radiofrequency radiation exposure evaluation: mobile devices

KDB447498 D01 v06

Mobile and Portable Devices RF Exposure Procedures and Equipment Authorisation Policies

MAXIMUM TRANSMITTER POWER

WLAN 2.4GHz:

Power conducted = 14.0dBm max (SISO)

Antenna Gain: +3.2dBi

$EIRP_{SISO}$ = 17.2dBm = 52.48 mW

WLAN 5GHz:

Power conducted = 13.0dBm max (SISO)

Antenna Gain: +4.1dBi

$EIRP_{SISO}$ = 17.1dBm = 51.28 mW

Bluetooth Low Energy 2.4GHz

Power conducted = 4.0dBm

Antenna Gain: +1.7dBi

EIRP = 5.7dBm = 3.72 mW

MPE CALCULATIONS (>20cm Usage)

The MPE calculation used to calculate the safe operating distance for the user is.

$$S = EIRP/4 \pi R^2$$

Where S = Power density

EIRP = Effective Isotropic Radiated Power (EIRP = P x G)

P = Conducted Transmitter Power

G = Antenna Gain (relative to an isotropic radiator)

R = distance to the centre of radiation of the antenna (20cm requirement).

For WLAN 2.4GHz

Values:

Transmitter frequency range = 2402 MHz to 2482MHz

$EIRP_{SISO}$ = 52.48 mW

R = 20cm

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for 2.4GHz

S_{req} = 1.0 mW/cm^2

Calculation for 20cm separation:

$S = EIRP_{SISO} /4 \pi R^2$

$S = 52.48/(12.56 \times 20^2)$

$S = 52.48/ (5024)$

S_{SISO} = 0.01mW/ cm^2 (<1.0 mW/cm^2)

This equates to minimum safe operating distance of 2.04 cm at the RF exposure limit of 1.0 mW/cm^2

For WLAN 5GHz

Values:

Transmitter frequency range = 5170 MHz to 5835MHz

$EIRP_{SISO}$ = 51.28 mW

R = 20cm

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for 5GHz

S_{req} = 1.0 mW/cm^2

Calculation for 20cm separation:

$S = EIRP_{SISO} / 4 \pi R^2$

$S = 51.28/(12.56 \times 20^2)$

$S = 51.28/(5024)$

S_{SISO} = 0.01mW/ cm^2 (<1.0 mW/cm^2)

This equates to minimum safe operating distance of 2.02 cm at the RF exposure limit of 1.0 mW/cm^2

For Bluetooth 2.4 GHz

Values:

Transmitter frequency range = 2402 MHz to 2480MHz

EIRP = 3.72 mW

R = 20cm

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for 5GHz

$\mathbf{S_{req}}$ = 1.0 mW/cm^2

Calculation for 20cm distance:

S = EIRP/4 π R^2

S = 3.72/(12.56 x 20^2)

S = 3.72/(5024)

S = 0.0007mW/ cm^2 (<1.0 mW/cm^2)

This equates to a safe operating distance of 0.54cm at the RF exposure limit of 1.0 mW/cm^2

CALCULATIONS (<20cm Usage)

For portable usage the following is used to calculate SAR test exemption (KDB 449498i V06, Section 4.3.1 (a)):

[(*max. conducted power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR

(Power and distance are rounded to the nearest mW and mm before calculation)

Considering 10gm extremity SAR test exemption only:

WLAN 2.4GHz:

Max conducted power P_{max} = 14.0dBm (25mW)

(P_{max}/ Dist) x [$\sqrt{f_{(GHz)}}$] ≤ 7.5

P_{max} x [$\sqrt{f_{(GHz)}}$] / 7.5 = $Dist_{min}$

i.e.: 25 x [$\sqrt{2.4}$] / 7.5 = $Dist_{min}$

5.2mm = $Dist_{min}$

WLAN 5GHz:

Max conducted power P_{max} = 13.0dBm (20mW)

(P_{max}/ Dist) x [$\sqrt{f_{(GHz)}}$] ≤ 7.5

P_{max} x [$\sqrt{f_{(GHz)}}$] / 7.5 = $Dist_{min}$

i.e.: 20x [$\sqrt{5.8}$] / 7.5 = $Dist_{min}$

6.4mm = $Dist_{min}$

Conclusion

The required 20cm RF exposure limits for General Population/ Uncontrolled Exposure will not be exceeded for the DBWIFIBLE01 module using antennas having a maximum gain of +3.2dBi for 2.4 WLAN, +4.1dBi for 5 GHz WLAN and +1.7dBi for, Bluetooth operation.

For portable applications at less than 20cm usage (extremity SAR only), the DBWIFIBLE01 module is exempt from SAR testing at minimum distances of 5.2mm at 2.4GHz and 6.4mm at 5GHz operation.