

Safety Human Exposure

1.1 Radio Frequency Exposure Compliance

1.1.1 Electromagnetic Fields

RESULT:

Pass

Test Specification

Test item	: BT & WLAN Module
Identification / Type No.	: BTWDB01
FCC ID	: OL3BTWDB01
IC:	1737D-BTWDB01
HVIN	: BTWDB01
Test standard	: CFR47 FCC Part 2: Section 2.1091 CFR47 FCC Part 1: Section 1.1310 FCC KDB Publication 447498 v06 FCC KDB Publication 865664 D01 v01r04 FCC KDB Publication 865664 D02 v01r02 RSS-102 Issue 5 February 2021

➤ Product Classification

This device defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at 20 cm is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

Max 3.16 dBi for Bluetooth & 2.4GHz Wi-Fi, Max 3.00 dBi for 5GHz Wi-Fi

➤ Radio Frequency Exposure Limit

For FCC:

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)
300-1,500	--	--	f/1500
1,500-100,000	--	--	1.0

For IC:

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ⁻²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ f ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ f ^{0.25}	0.1540/ f ^{0.25}	8.944/ f ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619 f ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ f ^{1.2}
150000-300000	0.158 f ^{0.5}	4.21 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616000/ f ^{1.2}

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

➤ **Radio Frequency Exposure Calculation Formula**

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density (in appropriate units, e.g. mW/cm²)
 P = power input to the antenna (in appropriate units, e.g., 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 (appropriate units, e.g., cm)

or:

$$S = \frac{EIRP}{4\pi R^2}$$

where: EIRP = equivalent (or effective) isotropically radiated power

a) EUT RF Exposure Evaluation standalone operations

Mode	*Measured RF Output Power (dBm)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	FCC Limit (mW/cm ²)	IC Limit (mW/cm ²)
Bluetooth	2.90	3.16	20	0.0008	1.0	5.41
2.4G Wi-Fi	21.50	3.16	20	0.0582	1.0	5.40
5G Wi-Fi	17.57	3.00	20	0.0227	1.0	9.44

Note:

1. *Bluetooth RF Output Power: Refer to CN2118OG 001
2. *2.4GHz Band RF Output Power: Refer CN2118OG 002
3. *5GHz Bands RF Output Power: Refer CN2118OG 003 Appendix B

b) Simultaneous transmission MPE:

Per KDB 447498 D01 v06, simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density, is ≤ 1.0 .

Simultaneous transmission Scenarios

No.	Simultaneous transmission Scenarios
1	Bluetooth + 2.4GHz Wi-Fi
2	Bluetooth + 5GHz Wi-Fi

1) For Bluetooth + 2.4GHz Wi-Fi:

The MPE ratio for Bluetooth can be calculated as follow:

=The power density at 20cm distance/MPE limit

= $0.0008 \text{ mW/cm}^2 / 1 \text{ mW/cm}^2$

=0.0008

The MPE ratio for 2.4GHz WiFi can be calculated as follow:

=The power density at 20cm distance/MPE limit

= $0.0582 \text{ mW/cm}^2 / 1 \text{ mW/cm}^2$

=0.0582

The sum of the MPE ratios for all simultaneous transmitting antennas:

= $0.0008 + 0.0582$

= $0.059 < 1.0$

As the sum of MPE ratios for all simultaneous transmitting antennas is ≤ 1.0 , simultaneous transmission MPE test exclusion will be applied.

2) For Bluetooth + 5GHz Wi-Fi:

The MPE ratio for Bluetooth can be calculated as follow:

=The power density at 20cm distance/MPE limit

= $0.0008 \text{ mW/cm}^2 / 1 \text{ mW/cm}^2$

=0.0008

The MPE ratio for 5GHz WiFi can be calculated as follow:

=The power density at 20cm distance/MPE limit

= $0.0227 \text{ mW/cm}^2 / 1 \text{ mW/cm}^2$

=0.0227

The sum of the MPE ratios for all simultaneous transmitting antennas:

= $0.0008 + 0.0227$

= $0.0235 < 1.0$

As the sum of MPE ratios for all simultaneous transmitting antennas is ≤ 1.0 , simultaneous transmission MPE test exclusion will be applied.

➤ Conclusion

Therefore the maximum calculations result of above are meet the requirement of Radio Frequency Exposure (MPE) limit.