

Safety Human Exposure

1.1 Radio Frequency Exposure Compliance

1.1.1 Electromagnetic Fields

RESULT:

Pass

Test item : BRANDHAKE
Identification / Type No. : E2588
FCC ID : FHO-E2588
IC : 10912A-E2588
Test standard : CFR47 FCC Part 2: Section 2.1091
CFR47 FCC Part 1: Section 1.1310
FCC KDB Publication 447498 D01 V06
RSS-102 Issue 6 December 2023

➤ 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 least 20 centimeters is normally maintained between the RF source's radiating structure(s) and the body of the user or nearby persons.

Max 2.76 dBi for Wi-Fi, 1.17dBi for BLE, 1.72dBi for Zigbee and Thread

➤ FCC Radio Frequency Exposure Limit

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

➤ 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

➤ **IC Field reference level exposure exemption limits**

Field reference level (FRL) exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm (i.e. mobile devices), except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 1 W (adjusted for tune-up tolerance)
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $4.49/f^{0.5}W$ (adjusted for tune-up tolerance), where f is in MHz
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance)
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $1.31 \times 10^{-2}f^{0.6834}W$ (adjusted for tune-up tolerance), where f is in MHz
- at or above 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 5 W (adjusted for tune-up tolerance)

a) EUT RF Exposure Evaluation standalone operations

FCC

Mode	Frequency (MHz)	*Measured RF Output Power (dBm)	EIRP (dBm)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
2.4GHz Wi-Fi	2412	16.692	19.452	20	0.018	1
BLE	2478	9.600	10.770	20	0.002	1
Zigbee	2445	6.700	8.420	20	0.001	1
Thread	2445	6.800	8.520	20	0.001	1

IC

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b) EUT RF Exposure Evaluation simultaneous operations

FCC

Mode	MPE ratios	Limit
2.4GHz Wi-Fi + Thread	$0.018/1+0.001/1=0.019$	≤ 1
BLE + Thread	$0.002/1+0.001/1=0.003$	≤ 1

IC

Mode	MPE ratios	Limit
2.4GHz Wi-Fi + Thread	$0.088/2.684+0.007/2.709=0.035$	≤ 1
BLE + Thread	$0.012/2.734+0.007/2.709=0.007$	≤ 1

Note:

1. 2.4GHz Wi-Fi RF Output Power: Refer CN26N4V8 001
2. BLE RF Output Power: Refer CN26Q3QS 001
3. Zigbee RF Output Power: Refer CN26WNBW 001
4. Thread RF Output Power: Refer CN262X19 001
5. Zigbee and Thread share one RF chip and antenna, so no need to evaluation simultaneous transmission.
6. Wi-Fi and BLE share one RF chip, and using time division multiplexing for transmission, so no need to evaluation simultaneous transmission for Wi-Fi and BLE.

➤ **Conclusion**

The distance between antenna and human is larger than 20 cm in normal use.

Therefore, the maximum calculations result of above are meet the requirement of Radio Frequency Exposure limit.