

Safety Human Exposure

1.1 Radio Frequency Exposure Compliance

1.1.1 Electromagnetic Fields

RESULT:

Pass

Test Specification

Test standard : CFR47 FCC Part 2: Section 2.1091
CFR47 FCC Part 1: Section 1.1310
FCC KDB Publication 447498 v06, section 7

➤ FCC requirements (FCC ID: 2AC7Z-ESPWROOM32UE)

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = 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, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

EUT RF Exposure Evaluation operations

Test Mode	Frequency Range(MHz)	Antenna gain		Max. conducted output Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		dBi	numeric	dBm	mW			
802.11b	2412-2462	4	2.512	15.92	39.08	20	0.0195	1.0
802.11g		4	2.512	12.31	17.02	20	0.0085	1.0
802.11n-HT20		4	2.512	12.23	16.71	20	0.0084	1.0
802.11n-HT40	2422-2452	4	2.512	8.95	7.85	20	0.0039	1.0
BLE	2402-2480	4	2.512	4.81	3.03	20	0.0015	1.0
BT3.0	2402-2480	4	2.512	7.59	5.74	20	0.0029	1.0

Note: WIFI and BT/BLE can't transmit simultaneously.

1.1.2 RF Exposure Compliance Requirement for IC (IC: 21098-ESPWROOMUE)

The EUT shall comply with the requirement of RSS-102 section 2.5.2.

Exemption from Routine Evaluation Limits – RF Exposure Evaluation

RF 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, except when the device operates as follows:
at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834} \text{ W}$ (adjusted for tune-up tolerance), where f is in MHz;

The nominal maximum conducted output power specified:

The Max. e.i.r.p. for BT: 11.59 dBm = 0.014 W

The Max. e.i.r.p. for BLE: 8.91 dBm = 0.008 W

The Max. e.i.r.p. for WIFI: 19.92 dBm = 0.098 W

Note: WIFI and BT/BLE can't transmit simultaneously.

Antenna Gain: 4.0 dBi for 2.4GHz BT/BLE/WIFI

RF exposure evaluation exempted power for 2.4GHz: 2.67 W

The Max. e.i.r.p. for BT/BLE/WIFI are less than the RF exposure evaluation exempted power. So RF exposure evaluation is not required

“RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons.”