

RF Exposure Evaluation Report

Product : BeaglePlay
Trade mark : Beagleboard.org
Model/Type reference : BeaglePlay
Serial Number : N/A
Report Number : EED32P80002503
FCC ID : Z4T-BBP23010V1
Date of Issue : Feb. 21, 2023
: 47 CFR Part 1.1307
: 47 CFR Part 2.1091
Test Standards : KDB447498D01 General
: RF Exposure Guidance v06
Test result : PASS

Prepared for:

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2 Version

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4 General Information

4.1 Client Information

Applicant:	Seeed Technology Co., Ltd
Address of Applicant:	9F, Building G3, TCL International E city, Zhongshanyuan Road, Nanshan, Shenzhen, China.
Manufacturer:	Seeed Technology Co., Ltd
Address of Manufacturer:	9F, Building G3, TCL International E city, Zhongshanyuan Road, Nanshan, Shenzhen, China.
Factory:	Shenzhen Xinxian Technology Co., Limited
Address of Factory:	F5, Building B17, Hengfeng Industrial City, No. 739 Zhoushi Rd, Baoan District, Shenzhen, Guangdong, P.R.C.

4.2 General Description of EUT

Product Name:	BeaglePlay
Model No.:	BeaglePlay
Trade mark:	Beagleboard.org

4.3 Product Specification subjective to this standard

Frequency Range:	Bluetooth: 2402MHz to 2480MHz LoRa DTS: 902MHz~928MHz WLAN: 11a/b/g/n HT20/HT40
Modulation Type:	Bluetooth: GFSK LoRa DTS: Chirp Spread Spectrum IEEE for 802.11b:DSSS(CCK,DQPSK,DBPSK) IEEE for 802.11g:OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11n(HT20 and HT40): OFDM (64QAM, 16QAM,QPSK,BPSK) IEEE 802.11a: OFDM (BPSK, QPSK, 16QAM, 64QAM)
Test Power Grade:	Default
Antenna Type	PCB Antenna
Antenna Gain	Bluetooth: 1.54dBi LoRa DTS: 1.81dBi WIFI 1: 2.4GWIFI:1.54 dBi 5GWIFI:3.40 dBi WIFI 2: 2.4GWIFI:1.54 dBi 5GWIFI:3.40 dBi
Power Supply:	DC 5V
Max Conducted Peak Output Power:	BLE: 2.97dBm, LoRa: 20.62dBm The Max Conducted Peak Output Power data refer to the report EED32P80002501, EED32P80002502.
Sample Received Date:	Jan. 03, 2023
Sample tested Date:	Jan. 03, 2023 to Feb. 16, 2023
Company Name and Address shown on Report, the sample(s) and sample Information was/ were provided by the applicant who should be responsible for the authenticity which CTI hasn't verified.	

4.4 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd

Building C, Hongwei Industrial Park Block 70, Bao'an District, Shenzhen, China

Telephone: +86 (0) 755 33683668 Fax: +86 (0) 755 33683385

No tests were sub-contracted.

FCC Designation No.: CN1164

4.5 Deviation from Standards

None.

4.6 Abnormalities from Standard Conditions

None.

4.7 Other Information Requested by the Customer

None.

5 RF Exposure Evaluation

5.1 RF Exposure Compliance Requirement

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{377}$

Where E = Field strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{377 d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P/1000) \times G}{377 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \text{Equation 1}$$

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

5.2 Maximum Permissible Exposure

Substituting the MPE safe distance using $d = 20$ cm into Equation 1:

$$S = 0.000199 \times P \times G$$

Where P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

TABLE 1 TO §1.1310(E)(1)—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f ²)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
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
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

1) For BLE

Measurement Data:

BLE 1M:

GFSK mode(Worst)				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	2.97	2±1	3	1.995
Middle(2440MHz)	2.87	2±1	3	1.995
Highest(2480MHz)	2.91	2±1	3	1.995

2) For LoRa

LoRa:

LoRa mode(Worst)				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(906MHz)	20.54	20±1	21	125.893
Middle(914MHz)	20.54	20±1	21	125.893
Highest(924MHz)	20.51	20±1	21	125.893

BLE:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
0	2402	1.995	1.426	20	0.00057	1

Note: 1.Refer to report No. EED32P80002501.

LoRa DTS:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
1	906	125.893	1.517	20	0.0380	0.6

Note: 2.Refer to report No. EED32P80002502.

2.4GHz WLAN:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
1	2412	56.234	1.426	20	0.0160	1

Note: 3.Refer to report No. FA741330,FCC ID:Z64-WL18DBMOD.

the module(FCC ID:Z64-WL18DBMOD) antenna gain changed from 3.2dBi to 1.54dBi and does not support bluetooth function.

5GHz WLAN:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
36	5180	89.125	2.188	20	0.039	1

Note: 4.Refer to report No. FA741330,FCC ID:Z64-WL18DBMOD.

the module(FCC ID:Z64-WL18DBMOD) antenna gain changed from 4.5dBi to 3.40dBi and does not support bluetooth function.

5.2.1 EUT RF Exposure Evaluation simultaneous transmission operations

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits :

Simultaneous transmission mode		The sum of the ratios	Result
BLE + 2.4G Wi-Fi	Support	$0.00057/1 + 0.0160/1$	$=0.01657 < 1$
BLE + 5G Wi-Fi	Support	$0.00057/1 + 0.039/1$	$=0.03957 < 1$
LoRa + 2.4G Wi-Fi	Support	$0.038/0.6 + 0.0160/1$	$=0.0793 < 1$
LoRa + 5G Wi-Fi	Support	$0.038/0.6 + 0.039/1$	$=0.1023 < 1$
2.4G Wi-Fi + 5G Wi-Fi	Not support	\	\
BLE + LoRa	Not support	\	\

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*** End of Report ***