RF Exposure Evaluation Report

Product	:	BeagleConnect Freedom
Trade mark	:	seeed studio
Model/Type reference	:	BeagleConnect Freedom
Serial Number	:	N/A
Report Number	:	EED32P80062403
FCC ID	:	Z4T-BCF-00001
Date of Issue	:	Feb. 13, 2023
Test Standards	:	47 CFR Part 1.1307 47 CFR Part 2.1091 KDB447498D01 General RF Exposure Guidance v06
Test result	:	PASS

Prepared for:

Seeed Technology Co., Ltd
9F, G3 Building, TCL International E City, Zhongshanyuan Road,Nanshan District Shenzhen China

Prepared by:

Centre Testing International Group Co., Ltd.
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Check No.: 5257130123

2 Version

Version No.	Date	Description
00	Feb. 13, 2023	Original

3 Contents

4 General Information

4.1 Client Information

Applicant:	Seeed Technology Co., Ltd
Address of Applicant:	9F, G3 Building, TCL International E City, Zhongshanyuan Road,Nanshan District Shenzhen China
Manufacturer:	Seeed Technology Co., Ltd
Address of Manufacturer:	9F, G3 Building, TCL International E City, Zhongshanyuan Road,Nanshan District 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:	BeagleConnect Freedom
Model No.:	BeagleConnect Freedom
Trade mark:	seeed studio

4.3 Product Specification subjective to this standard

Frequency Range:	Bluetooth: 2402MHz to 2480MHz LoRa DTS: 902MHz~928MHz
Modulation Type:	Bluetooth: GFSK LoRa DTS: Chirp Spread Spectrum
Test Power Grade:	Default
Antenna Type	External Antenna
Antenna Gain	Bluetooth: 2dBi LoRa DTS: 2.5dBi
Power Supply:	DC 5V
Max Conducted Peak Output Power:	BLE: 1.55dBm, LoRa: 13.90dBm
	The Max Conducted Peak Output Power data refer to the report EED32P80062401, EED32P80062402.
Sample Received Date:	Jan. 16, 2023
Sample tested Date:	Jan. 16, 2023 to Feb. 09, 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 (mW) = P (W) / 1000 and

d (cm) = d(m) / 100

Yields

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

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm^2

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 / cm^2

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 2M:

GFSK mode(Worst)				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	1.55	1±1	2	1.585
Middle(2440MHz)	1.3	1±1	2	1.585
Highest(2480MHz)	1.31	1±1	2	1.585

2) For LoRa

LoRa:

LoRa mode(Worst)				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(903MHz)	13.84	13±1	14	25.119
Middle(907.8MHz)	13.79	13±1	14	25.119
Highest(914.2MHz)	13.74	13±1	14	25.119

BLE:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm^2	Limit (mW/cm^2)
0	2402	1.585	1.585	20	0.00050	1

LoRa DTS:

Ch.	Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm^2	Limit (mW/cm^2)
1	906	25.119	1.778	20	0.0089	0.6

Note: 1.Refer to report No. EED32P80062401, EED32P80062402.

2. BLE and LoRa that simultaneous transmission is not possible.

*** End of Report ***