

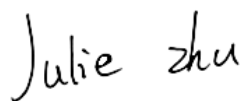
# TEST REPORT

**Applicant:** Seeed Technology Co., Ltd.  
**Address:** 9F, G3 Building, TCL International E City,  
Zhongshanyuan Road, Nanshan District, Shenzhen  
518055, China  
**Equipment Type:** SenseCAP Indicator  
**Model Name:** D1Pro (refer section 2.4)  
**Brand Name:** Seeed Studio  
**FCC ID:** Z4T-D1-A  
**Test Standard:** 47 CFR Part 2.1091  
KDB 447498 D04 v01  
**Sample Arrival Date:** Apr. 06, 2023  
**Test Date:** Apr. 12, 2023 - Apr. 19, 2023  
**Date of Issue:** May 08, 2023

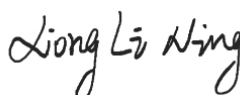
**ISSUED BY:**

Shenzhen BALUN Technology Co., Ltd.

**Tested by:** Julie Zhu



**Checked by:** Xiong Lining



**Approved by:** Tolan Tu

(Testing Director)



<b>Revision History</b>		
Version	Issue Date	Revisions Content
<u>Rev. 01</u>	<u>May 08, 2023</u>	<u>Initial Issue</u>

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# 1 GENERAL INFORMATION

## 1.1 Test Laboratory

Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

## 1.2 Test Location

Name	Shenzhen BALUN Technology Co., Ltd.
Location	<input checked="" type="checkbox"/> Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	<input type="checkbox"/> 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.

## 2 PRODUCT INFORMATION

### 2.1 Applicant Information

Applicant	Seeed Technology Co., Ltd.
Address	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen 518055, China

### 2.2 Manufacturer Information

Manufacturer	Seeed Technology Co., Ltd.
Address	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen 518055, China

### 2.3 Factory Information

Factory	Shenzhen Xinxian Technology Co., Limited
Address	F5, Building B17, Hengfeng Industrial City, No. 739 Zhoushi Rd, Baoan District, Shenzhen, Guangdong, P.R.C.

### 2.4 General Description for Equipment under Test (EUT)

EUT Name	SenseCAP Indicator				
Model Name Under Test	D1Pro				
Series Model Name	D1L				
Description of Model name differentiation	All models are same with electrical parameters and internal circuit structure, but only differ as below (this information provided by the customer):				
	Model	BT/WIFI	LoRa	CO2, tVOC sensor	Accessory
	D1Pro	Support	Support	Support	Type C cable, Grove ATH20 TH Sensor
	D1L	Support	Support	Not support	Type C cable
Hardware Version	v1.3				
Software Version	v1.0				
Dimensions (Approx.)	N/A				
Weight (Approx.)	N/A				

### 2.5 Ancillary Equipment

Note: Not applicable.

## 2.6 Technical Information

Network and Wireless connectivity	Bluetooth (BLE), LoRa 2.4G WIFI 802.11b, 802.11g, 802.11n(HT20/HT40)
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The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	Bluetooth; LoRa; 2.4G WLAN	
Frequency Range	Bluetooth	2402 MHz ~ 2480 MHz
	LoRa	902 MHz ~ 928 MHz
	802.11b/g/n(HT20/HT40)	2412 MHz ~ 2462 MHz
Antenna Type	Bluetooth	PIFA Antenna
	LoRa	PIFA Antenna
	WLAN	PIFA Antenna
Exposure Category	General Population/Uncontrolled Exposure	
EUT Type	Mobile Device	

### 3 SUMMARY OF TEST RESULT

#### 3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2.1091	Radiofrequency radiation exposure evaluation: mobile devices
2	KDB 447498 D04 v01	447498 D04 Interim General RF Exposure Guidance v01

## 4 DEVICE CATEGORY AND LEVELS LIMITS

### Mobile Device:

CFR Title 47 §2.1091(b)

(b) For purposes of this section, a mobile device is 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 transmitter's radiating structure(s) and the body of the user or nearby persons.

### FCC KDB 447498 D04 General RF Exposure Guidance v01 Limit

Evaluation of compliance with the exposure limits in § 1.1310 is necessary if the ERP of the device is greater than ERP<sub>20cm</sub> in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (\text{B.1})$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i. e., without consideration of ERP only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of  $\lambda/4$  or if the antenna gain is less than that of a half-wave dipole.

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold  $P_{th}$  (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive).  $P_{th}$  is given by Formula (B.2).

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases} \quad \text{(B.2)}$$

where

$$x = -\log_{10} \left( \frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right)$$

and  $f$  is in GHz,  $d$  is the separation distance (cm), and  $ERP_{20 \text{ cm}}$  is per Formula (B.1). The example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)									
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169



## 5 ASSESSMENT RESULT

### 5.1 Output Power

Bluetooth		
Mode	GFSK (BLE 1Mbps)	GFSK (BLE 2Mbps)
Conducted Power (dBm)	8.93	9.19
Antenna Gain (dBi)	1.89	
EIRP (dBm)	10.82	11.08

Note: This report listed the worst case power value, please refer to BL-SZ2340268-601 report for more details.

LoRa-DTS	
Conducted Power (dBm)	21.42
Antenna Gain (dBi)	0.59
EIRP (dBm)	22.01

Note: This report listed the worst case power value, please refer to BL-SZ2340268-602 report for more details.

LoRa-FHSS	
Conducted Power (dBm)	21.22
Antenna Gain (dBi)	0.59
EIRP (dBm)	21.81

Note: This report listed the worst case power value, please refer to BL-SZ2340268-603 report for more details.

WLAN 2.4G	
Mode	802.11b/g/n(HT20/HT40)
Conducted Power (dBm)	17.20
Antenna Gain (dBi)	1.89
EIRP (dBm)	19.09

Note: This report listed the worst case power value, please refer to BL-SZ2340268-604 report for more details.

### 5.2 Tune-up power

Mode	Conducted Power Range (dBm)	EIRP Range (dBm)	ERP Range (dBm)
Bluetooth	[8.00, 10.00]	[10.00, 12.00]	[7.85, 9.85]
Max. LoRa	[20.00, 22.00]	[21.00, 23.00]	[18.85, 20.85]
Max. WLAN 2.4G	[16.00, 18.00]	[18.00, 20.00]	[15.85, 17.85]

Note 1: ERP= EIRP -2.15dB  
 Note 2: According KDB 447498 D04, used the greater of maximum conducted power and ERP to compare with the threshold value Pth.

### 5.3 RF Exposure Evaluation Result

Mode	Distance (mm)	Calculation Frequency (MHz)	Tune-up limit power (dBm)	Tune-up limit power (mW)	Threshold Power (mW)	Power / Limit	Verdict
Bluetooth	200	2402	10.00	10.00	3060.00	0.003	Pass
Max. LoRa	200	902	22.00	158.49	1840.08	0.086	Pass
Max. WLAN 2.4G	200	2412	18.00	63.10	3060.00	0.021	Pass

### 5.4 Collocated Power Calculation

Evolution mode	Frequency(MHz)	Power /Limit	$\Sigma$ (Power / Limit) of Bluetooth + LoRa	Verdict
Bluetooth	2402	0.003	<b>0.089</b>	Pass
Max. LoRa	902	0.086		
Evolution mode	Frequency(MHz)	Power /Limit	$\Sigma$ (Power / Limit) of LoRa + WLAN 2.4G	Verdict
Max. LoRa	902	0.086	<b>0.107</b>	Pass
Max. WLAN 2.4G	2412	0.021		

Note:

- $\Sigma$ (Power / Limit): This is a summation of [(power for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding Power limit)], for Bluetooth + LoRa and LoRa + WLAN 2.4G.
- Both of the Bluetooth + LoRa and LoRa + WLAN 2.4G can transmit simultaneously, the formula of calculated the Power is  

$$CP1 / LP1 + CP2 / LP2 + \dots \text{etc.} < 1$$
 CP = Calculation power  
 LP = Limit of power
- Both of the Bluetooth and WLAN 2.4G can't transmit simultaneously at same time.
- The worst-case situation is 0.107, which is less than "1". This confirmed that the device comply with FCC KDB 447498 D04 Power limit.
- The DUT work frequency range used is 2402 MHz ~ 2480 MHz, 902 MHz ~ 928 MHz and 2412 MHz ~ 2462 MHz the result close to the limit by the above formula, so we select worst case power to calculate the exclusion power threshold.
- More power list please refer to RF test report.

### 5.5 Conclusion

This EUT is deemed to comply with the reference level limits, therefore the basic restrictions are compliant with human exposure limits.

## Statement

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--END OF REPORT--