SGS-CSTC Standards Technical Services Co., Ltd.

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RF Exposure Evaluation Report

Application No.:	SZEM1408004753RF
Applicant:	Seeed Technology Limited
Manufacturer:	Seeed Technology Limited
Factory	Seeed Technology Limited
Product Name:	LinkIt ONE
Model No.(EUT):	LinkIt ONE v1.0
Trade Mark:	LinkIt ONE
FCC ID:	Z4T-LINKITONEV10
Standards:	47 CFR Part 1.1307(2013)
	47 CFR Part 1.1310(2013)
Date of Receipt:	2014-09-09
Date of Test:	2014-10-17 to 2014-10-28
Date of Issue:	2014-12-12
Test Result :	**PASS***

* In the configuration tested, the EUT complied with the standards specified above. This report supersedes our previous report SZEM140800475305, issued on 2014-11-24, which is hereby deemed null and void.

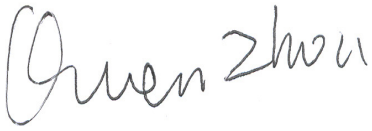
Authorized Signature:

Jack Zhang
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.
If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

2 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
00		2014-11-24		Original
01		2014-12-12		New

Authorized for issue by:				
Tested By		 **(Jim Huang) /Project Engineer**		2014-10-28 **Date**
Prepared By		 **(Bella Ou) /Clerk**		2014-12-12 **Date**
Checked By		 **(Owen Zhou) /Reviewer**		2014-11-27 **Date**

3 Contents

4 General Information

4.1 Client Information

Applicant:	Seeed Technology Limited
Address of Applicant:	5th Floor, 8th Building, shilling industrial Park, XiLi Town, NanShan dist. Shenzhen, Guangdong, China
Manufacturer:	Seeed Technology Limited
Address of Manufacturer:	5th Floor, 8th Building, shilling industrial Park, XiLi Town, NanShan dist. Shenzhen, Guangdong, China
Factory:	Seeed Technology Limited
Address of Factory:	5th Floor, 8th Building, shilling industrial Park, XiLi Town, NanShan dist. Shenzhen, Guangdong, China

4.2 General Description of EUT

Product Name:	LinkIt ONE	
Model No.:	LinkIt ONE v1.0	
Trade Mark:	LinkIt ONE	
Bluetooth Version:	V4.0	
	This test report is for dual mode	
Antenna Type and Gain:	Type :Integral Gain :2dBi	
Power Supply:	Adapter:	N/A
	Battery:	3.7V 1000mAh Li-polymer Battery Pack
Test Voltage:	DC 3.7V battery fully charged	
USB cable:	80cm (shielded)	
Earphone:	100cm (unshielded)	
For BLE Bluetooth:		
Operation Frequency:	2402MHz~2480MHz	
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)	
Modulation Type:	GFSK	
Number of Channel:	40	
Hopping Channel Type:	Adaptive Frequency Hopping systems	
Sample Type:	mobile production	
Test Power Grade:	7 (manufacturer declare)	
Test Software of EUT:	MediaTek BT Tool (manufacturer declare)	
For classical Bluetooth:		
Operation Frequency:	2402MHz~2480MHz	
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)	

Modulation Type:	GFSK, π/4DQPSK, 8DPSK	
Number of Channel:	79	
Hopping Channel Type:	Adaptive Frequency Hopping systems	
Sample Type:	mobile production	
Test Power Grade:	7 (manufacturer declare)	
Test Software of EUT:	MediaTek BT Tool (manufacturer declare)	
For WIFI:		
Operation Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11n(HT40): 2422MHz to 2452MHz	
Channel Numbers:	IEEE 802.11b/g, IEEE 802.11n HT20: 11 Channels IEEE 802.11n HT40: 7 Channels	
Channel Separation:	5MHz	
Type of Modulation:	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)	
Sample Type:	Mobile production	
Highest Frequency:	260MHz	
Test Power Grade:	IEEE for 802.11b: 22; IEEE for 802.11g: 20 ;IEEE for 802.11n (HT20 and HT40): 18	
Test Software of EUT:	Mediatek WIFI tool	
For 2G:		
Radio System Type	☒ GSM	
Supported Frequency Range	GSM850	Transmission (TX): 824 to 849 MHz
		Receiving (RX): 869 to 894 MHz
	GSM1900	Transmission (TX): 1850 to 1910 MHz
		Receiving (RX): 1930 to 1990 MHz
Supported Channel Bandwidth	GSM system:	☒200 kHz
Hardware Version:	V1.0	
Software Version:	V1.0.38	

4.3 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch E&E Lab

No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China 518057

Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594

No tests were sub-contracted.

4.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L2929)**

  CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **VCCI**

  The 10m Semi-anechoic chamber and Shielded Room (7.5m x 4.0m x 3.0m) of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

- **FCC – Registration No.: 556682**

  SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 556682.

- **Industry Canada (IC)**

  Two 3m Semi-anechoic chambers of SGS-CSTC Standards Technical Services Co., Ltd. have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1 & 4620C-2.

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

5.1.1 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 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)
(A) Limits for Occupational/Controlled Exposures				
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
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) 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
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

F= Frequency in MHz

Friis Formula

Friis transmission formula: $Pd = (Pout*G)/(4* Pi * R^2)$

Where

Pd = power density in mW/cm2

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in cm

Pd id the limit of MPE, 1 mW/cm2 . If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

5.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

4.1.3 EUT RF Exposure Evaluation

Antenna Gain: 2dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.5849 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

For BLE Bluetooth:

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit	Result
Highest	2480	1.27	1.3397	0.0004	1.0	PASS

For classical Bluetooth:

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit	Result
Highest	2480	1.29	1.3459	0.0004	1.0	PASS

For WIFI:

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit	Result
Lowest	2412	19.06	80.5378	0.0254	1.0	PASS

For 2G:

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit	Result
128	836.6	33.21	2094.1125	0.6603	1.0	PASS
512	1850.2	29.81	957.1941	0.3018	1.0	PASS

Note: Refer to report No. SZEM140800457309 for EUT test Max Conducted Peak Output Power value.

The distance r (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.