SGS-CSTC Standards Technical Services Co., Ltd. Shanghai Branch

588 West Jindu Road, Xinqiao, Songjiang, 201612 Shanghai, China
Telephone: +86 (0) 21 6191 5666
Fax: +86 (0) 21 6191 5678
ee.shanghai@sgs.com

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RF MPE REPORT

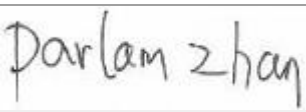
Application No.:	SHEM1805004264CR
Applicant:	Lenbrook Industries Limited
FCC ID:	SVC-PN2I
IC:	152C-PN2I
Equipment Under Test (EUT): **NOTE:** The following sample(s) was/were submitted and identified by the client as	
Product Name:	Wireless Music Streaming Amplifier
Model No.(EUT):	Powernode 2i
Trade mark:	Bluesound
Standards:	FCC Rules 47 CFR §2.1091 KDB447498 D01 General RF Exposure Guidance v06 RSS-102 Issue 5 (March 2015)
Date of Receipt:	2018-05-31
Date of Test:	2018-08-25 to 2018-08-31
Date of Issue:	2018-11-13
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Parlam Zhan
E&E Section 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.

Revision Record			
Version	**Description**	**Date**	**Remark**
00	Original	2018-11-13	/

Authorized for issue by:				
				
		Vincent Zhu / Project Engineer		
				
		Parlam Zhan /Reviewer		

2 Contents

3 General Information

3.1 Client Information

Applicant:	Lenbrook Industries Limited
Address of Applicant:	633 Granite Court, Pickering Ontario, Canada, L1W 3K1
Manufacturer:	Lenbrook Industries Limited
Address of Manufacturer:	633 Granite Court, Pickering Ontario, Canada, L1W 3K1
Factory:	HANSONG(NANJING) TECHNOLOGY LTD.
Address of Factory:	8th Kangping Road, Jiangning Economy and Technology Development Zone, Nanjing, 211106, China.

3.1 General Description of E.U.T.

Power supply:	AC 100-240V 50/60Hz
Test voltage:	AC 120V/60Hz
Cable:	AC Cable 180cm

3.2 Technical Specifications

BT

Antenna Gain	2dBi
Antenna Type	PIFA Antenna
Channel Spacing	1MHz
Modulation Type	GFSK, π/4DQPSK, 8DPSK
Number of Channels	79
Operation Frequency	2402MHz to 2480MHz
Spectrum Spread Technology	Frequency Hopping Spread Spectrum(FHSS)

BLE

Antenna Gain	2dBi
Antenna Type	PIFA Antenna
Channel Spacing	2MHz
Modulation Type	GFSK
Number of Channels	40
Operation Frequency	2402MHz to 2480MHz

2.4G WiFi

Antenna Gain	0dBi
Antenna Type	PIFA Antenna
Channel Spacing	5MHz
Modulation Type	802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Number of Channels	802.11b/g/n(HT20):11 802.11n(HT40):7
Operation Frequency	802.11b/g/n(HT20): 2412MHz to 2462MHz 802.11n(HT40): 2422MHz to 2452MHz
Power Class	>=10mW

5G WiFi

Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels
	Band 1	802.11a/n(HT20)/ac(HT20)	5180-5240	4
		802.11n(HT40)/ac(HT40)	5190-5230	2
		802.11ac(HT80)	5210	1
Modulation Type:	802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)			
Channel Spacing:	802.11a/n(HT20)/ac(HT20): 20MHz 802.11n(HT40)/ac(HT40): 40MHz 802.11ac(HT80): 80MHz			
Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels
	Band 3	802.11a/n(HT20)/ac(HT20)	5745-5825	5
		802.11n(HT40)/ac(HT40)	5755-5795	2
		802.11ac(HT80)	5775	1
Modulation Type:	802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)			
Channel Spacing:	802.11a/n(HT20)/ac(HT20): 20MHz 802.11n(HT40)/ac(HT40): 40MHz 802.11ac(HT80): 80MHz			
Antenna Gain	2.90dBi			
Antenna Type	PIFA Antenna			
DFS Function	Slave without Radar detection			

3.3 Test Location

All tests were performed at:
SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. E&E Lab
588 West Jindu Road, Xinqiao, Songjiang, 201612 Shanghai, China
Tel: +86 21 6191 5666 Fax: +86 21 6191 5678

No tests were sub-contracted.

3.4 Test Facility

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

- **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. 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.

- **NVLAP (Certificate No. 201034-0)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. is accredited by the National Voluntary Laboratory Accreditation Program(NVLAP). Certificate No. 201034-0.

- **FCC –Designation Number: CN5033**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been recognized as an accredited testing laboratory.
Designation Number: CN5033. Test Firm Registration Number: 479755.

- **Industry Canada (IC) – IC Assigned Code: 8617A**

The 3m Semi-anechoic chamber of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 8617A-1.

- **VCCI (Member No.: 3061)**

The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-13868, C-14336, T-12221, G-10830 respectively.

4 Test Standards and Limits

4.1 FCC Radiofrequency radiation exposure limits:

According to§1.1310, the limit for general population/uncontrolled exposures

Frequency	Power density(mW/cm^2)	Averaging time(minutes)
300MHz~1.5GHz	f/1500	30
1.5GHz~100GHz	1.0	30

4.2 IC Radiofrequency radiation exposure limits:

According to RSS-102 section 2.5.2, 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:

below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);

• at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;

• at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);

• 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 $1.31 \times 10^{-2}\ f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

• at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

For 2.4G device, the limit of worse case is 2.68 W

5 Measurement and Calculation

5.1 Maximum transmit power

The Power Data is based on the RF Test Report SHEM180500426401 & SHEM180500426402 & SHEM180500426403 & SHEM180500426404.

For BT

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Reading Power (mW)
GFSK	2402	6.93	4.93
	2441	7.85	6.10
	2480	7.89	6.15
π/4DQPSK	2402	6.53	4.50
	2441	7.54	5.68
	2480	7.51	5.64
8DPSK	2402	6.80	4.79
	2441	7.74	5.94
	2480	7.80	6.03

For BLE

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Reading Power (mW)
BLE	2402	6.91	4.91
	2440	7.89	6.15
	2480	7.94	**6.22**

For 2.4G WiFi:

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Reading Power (mW)
802.11b	2412	12.67	18.49
	2437	13.38	**21.78**
	2462	13.11	20.46
802.11g	2412	11.15	13.03
	2437	11.93	15.60
	2462	12.22	16.67
802.11 n20	2412	10.97	12.50
	2437	11.49	14.09
	2462	11.58	14.39
802.11 n40	2422	9.58	9.08
	2437	9.90	9.77
	2452	9.82	9.59

For 5G WiFi:

Test Mode	Test Channel	Power (dBm)	EIRP (dBm)	EIRP (mW)
802.11a	5180	13.36	16.26	42.27
	5220	13.93	16.83	48.19
	5240	**14.44**	**17.34**	**54.20**
	5745	13.54	16.44	44.06
	5785	14.02	16.92	49.20
	5825	14.02	16.92	49.20
802.11n20	5180	12.02	14.92	31.05
	5220	12.8	15.7	37.15
	5240	13.46	16.36	43.25
	5745	13.17	16.07	40.46
	5785	13.41	16.31	42.76
	5825	13.22	16.12	40.93
802.11n40	5190	10.89	13.79	23.93
	5230	11.89	14.79	30.13
	5755	12.07	14.97	31.41
	5795	12.31	15.21	33.19
802.11ac20	5180	11.37	14.27	26.73
	5220	11.81	14.71	29.58
	5240	12.5	15.4	34.67
	5745	12.18	15.08	32.21
	5785	12.56	15.46	35.16
	5825	12.12	15.02	31.77
802.11ac40	5190	9.29	12.19	16.56
	5230	10.33	13.23	21.04
	5755	11.13	14.03	25.29
	5795	11.37	14.27	26.73
802.11ac80	5210	12.63	15.53	35.73
	5775	12.25	15.15	32.73

5.2 MPE Calculation

For FCC:

For 2.4G WiFi

The best case gain of the antenna is 0dBi, 0dB logarithmic terms convert to numeric result is nearly 1

The Max Conducted Output Power is 21.78mW(0.022W);

For 5GHz WiFi

The best case gain of the antenna is 2.9dBi, 2.9dB logarithmic terms convert to numeric result is nearly 1.95

The Max Conducted Output Power is 27.80mW(0.029W);

According to the formula S= $\frac{PG}{4R^2\pi}$, we can calculate S which is MPE.

Note:

1) P (Watts) =Power Input to antenna = $10^{\frac{dBm}{10}}$ / 1000
2) G (Antenna gain in numeric) = 10^ (Antenna gain in dBi /10)
3) R = distance to the center of radiation of antenna (in meter) = 20cm
4) MPE limit = 1mW/cm²

For WiFi:

2.4GHz WiFi: S= $\frac{PG}{4R^2\pi} = \frac{21.78\times1}{4\times400\times3.14}$ =0.004 mW/cm²

5GHz WiFi: S= $\frac{PG}{4R^2\pi} = \frac{27.80\times1.95}{4\times400\times3.14}$ =0.011 mW/cm²

For BT & BLE:

The Max Conducted Peak Output Power is 6.22mW

The best case gain of the antenna is 2dBi. 2dB logarithmic terms convert to numeric result is nearly 1.58

So, S= $\frac{PG}{4R^2\pi} = \frac{6.22\times1.58}{4\times400\times3.14}$ =0.002 mW/cm²

The BT and the 2.4G WiFi modules can simultaneous transmitting.But the maximum rate of MPE is $\frac{0.002}{1.0}+\frac{0.004}{1.0}$ =0.006<=1.0.

The BT and the 5G WiFi modules can simultaneous transmitting.But the maximum rate of MPE is $\frac{0.002}{1.0}+\frac{0.011}{1.0}$ =0.013<=1.0.

according to the KDB447498 section 7.2 determine the device is exclusion from SAR test.

For IC:

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 x 10^{-2} f0.6834 W (adjusted for tune-up tolerance), where f is in MHz

For WiFi:

2.4GHz WiFi: E.I.R.P.=P*G=0.02178 x 1.00=0.02178W＜2.68W

5GHz WiFi: E.I.R.P.=P*G=0.05420W＜2.68W

For BT & BLE: E.I.R.P.=P*G=0.00622 x 1.58=0.00983W＜2.68W

The BT and the 2.4G WiFi modules can simultaneous transmitting.But the maximum rate of MPE is

0.02178+0.00983=0.03161W＜2.68W

The BT and the 5G WiFi modules can simultaneous transmitting.But the maximum rate of MPE is

0.05420+0.00983=0.06403W＜2.68W

So the device is exclusion from SAR test.

--End of the Report--