



1 Cover Page

RF MPE REPORT

Application No.:	SHEM1811000750CR
FCC ID:	SVC-C658
IC:	152C-C658
Applicant:	Lenbrook Industries Limited.
Address of Applicant:	633 Granite Count, Pickering Ontario, L1W 3K1, Canada
Manufacturer:	Lenbrook Industries Limited.
Address of Manufacturer:	633 Granite Count, Pickering Ontario, L1W 3K1, Canada
Factory:	Hansong (Nanjing) Technology Ltd
Address of Factory:	8th Kangping Road, Jiangning Economy and Techonology Development Zone, Nanjing, 211106, China.
Equipment Under Test (EUT):	
Product Name:	BluOS STREAMING DAC
Model No.(EUT):	C 658
Trade mark:	NAD
Standards:	FCC Rules 47 CFR §2.1091 KDB447498 D01 General RF Exposure Guidance v06 RSS-102 Issue 5 (March 2015)
Date of Receipt:	2018-11-19
Date of Test:	2018-11-19 to 2018-11-26
Date of Issue:	2018-11-30
Test Result:	Pass*

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

Parlan Zhan

Parlan 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.



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Attention: To check the authenticity of testing /inspection report & certificate, please contact us at telephone: (86-755) 8307 1443, or email: CN.Doccheck@sgs.com

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.
Testing Center Electronic Services

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Revision Record			
Version	Description	Date	Remark
00	Original	2018-11-30	/

Authorized for issue by:				
		Bill Wu		
		Bill Wu / Project Engineer		
		Parlam Zhan		
		Parlam Zhan /Reviewer		



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3 General Information

3.1 General Description of E.U.T.

Power supply:	AC 100-240V~50/60Hz
Test voltage:	AC 120V/60Hz
Cable:	AC Cable 1.8m

3.2 Technical Specifications

BT

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

BLE

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



2.4G WiFi

Antenna Gain	2dBi
Antenna Type	Dipole 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

5G WiFi

Antenna Gain	2dBi
Antenna Type	Dipole Antenna
DFS Function	Slave without Radar detection
TPC Function	Not Support



3.3 Test Location

All tests were performed at:

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

For 5G band, the limit of worse case is 4.53W

5 Measurement and Calculation

5.1 Maximum transmit power

The Power Data is based on the RF Test Report SHEM181100075001, SHEM181100075002
SHEM181100075003, SHEM181100075004

For BT

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Reading Power (mW)
DH5	2402	6.26	4.23
	2441	7.80	6.03
	2480	7.92	6.19
2DH5	2402	4.90	3.09
	2441	6.91	4.91
	2480	6.67	4.65
3DH5	2402	4.90	3.09
	2441	6.85	4.84
	2480	6.68	4.66

For BLE

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Reading Power (mW)
BLE	2402	1.5	1.41
	2440	4.34	2.72
	2480	3.99	2.51

For 2.4G WiFi:

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Reading Power (mW)
802.11b	2412	15.66	36.81
	2437	15.39	34.59
	2462	15.62	36.48
802.11g	2412	15.02	31.77
	2437	14.73	29.72
	2462	14.96	31.33
802.11 n20	2412	13.74	23.66
	2437	13.53	22.54
	2462	13.69	23.39
802.11 n40	2422	13.74	23.66
	2437	13.50	22.39
	2452	13.75	23.71



For 5G WiFi:

Test Mode	Test Channel	Power (dBm)	Reading Power (mW)	EIPR (dBm)	EIRP (mW)
802.11a	5180	9.99	9.98	11.99	15.81
	5220	8.72	7.45	10.72	11.80
	5240	8.51	7.10	10.51	11.25
	5745	6.15	4.12	8.15	6.53
	5785	3.47	2.22	5.47	3.52
	5825	3.65	2.32	5.65	3.67
802.11n20	5180	9.63	9.18	11.63	14.55
	5220	8.44	6.98	10.44	11.07
	5240	8.29	6.75	10.29	10.69
	5745	5.91	3.90	7.91	6.18
	5785	3.60	2.29	5.6	3.63
	5825	3.48	2.23	5.48	3.53
802.11n40	5190	7.91	6.18	9.91	9.79
	5230	6.62	4.59	8.62	7.28
	5755	4.79	3.01	6.79	4.78
	5795	3.24	2.11	5.24	3.34
802.11ac20	5180	9.57	9.06	11.57	14.35
	5220	8.52	7.11	10.52	11.27
	5240	8.29	6.75	10.29	10.69
	5745	5.96	3.94	7.96	6.25
	5785	3.50	2.24	5.5	3.55
	5825	3.51	2.24	5.51	3.56
802.11ac40	5190	7.79	6.01	9.79	9.53
	5230	6.33	4.30	8.33	6.81
	5755	4.72	2.96	6.72	4.70
	5795	3.31	2.14	5.31	3.40
802.11ac80	5210	6.71	4.69	8.71	7.43
	5775	4.25	2.66	6.25	4.22

5.2 MPE Calculation

For FCC:

For 2.4G WiFi

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

The Max Conducted Output Power is 36.81mW;

For 5GHz WiFi

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

The Max Conducted Output Power is 9.98mW;

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:

$$2.4GHz\ WiFi: S = \frac{PG}{4R^2\pi} = \frac{36.81 \times 1.58}{4 \times 400 \times 3.14} = 0.012\ mW/cm^2$$

$$5GHz\ WiFi: S = \frac{PG}{4R^2\pi} = \frac{9.98 \times 1.58}{4 \times 400 \times 3.14} = 0.003\ mW/cm^2$$

For BT & BLE:

The Max Conducted Peak Output Power is 6.19mW

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

$$So, S = \frac{PG}{4R^2\pi} = \frac{6.19 \times 1.58}{4 \times 400 \times 3.14} = 0.002\ mW/cm^2$$

The BT and the WiFi modules can simultaneous transmitting at frequency 2.4GHz band. But the maximum rate of MPE is $\frac{0.002}{1.0} + \frac{0.012}{1.0} = 0.014 \leq 1.0$. 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 $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz
For BT:

$$\text{E.I.R.P.} = P \cdot G = 0.00619 \times 1.58 = 0.01\text{W} < 2.68\text{W}$$

For WiFi:

$$2.4\text{GHz WiFi: E.I.R.P.} = 0.03681 \times 1.58 = 0.058\text{W} < 2.68\text{W}$$

$$5\text{GHz WiFi: E.I.R.P.} = 0.0098 \times 1.58 = 0.015\text{W} < 4.53\text{W}$$

The WiFi module can't simultaneous transmitting at 2.4G and 5G band, and the BT and the WiFi module can simultaneous transmitting. But the maximum MPE is $0.01\text{W} + 0.058\text{W} = 0.068\text{W} < 2.68\text{W}$.
So the device is exclusion from SAR test.

--End of the Report--