RF EXPOSURE EVALUATION REPORT

Application No.:	SZCR2305001443AT
Applicant:	Shenzhen Digitech Co., Ltd.
Address of Applicant:	Room 305, Building A9, Tianliao Industrial Zone, Nanshan, Shenzhen, China
Manufacturer:	Shenzhen Digitech Co., Ltd.
Address of Manufacturer:	Room 305, Building A9, Tianliao Industrial Zone, Nanshan, Shenzhen, China
Equipment Under Test (EUT):	
EUT Name:	Smart Helmet
Model No.:	EH20
FCC ID:	2BBG8-EH20
Standard(s) :	FCC Rules 47 CFR §2.1093
	KDB 447498 D04 interim General RF Exposure Guidance v01
Date of Receipt:	2023-05-15
Date of Test:	2023-05-26 to 2023-06-06
Date of Issue:	2023-06-19
Evaluation Result:	**Pass***

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

Keny Xu
EMC Laboratory Manager

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Revision Record				
Version	***Chapter***	***Date***	***Modifier***	***Remark***
01		*2023-06-19*		*Original*

Authorized for issue by:				
		Darren Yuan		
		Darren Yuan/Project Engineer		
		Eric Fu		
		Eric Fu/Reviewer		

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3 General Information

3.1 General Description of E.U.T.

Power supply:	Powered by rechargeable Li-ion battery Battery information Model: 822048 Nominal Voltage: 3.8V DC Rated Capacity: 3.8Wh
For BT:	
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.3 Dual mode
Modulation Type:	GFSK, pi/4DQPSK, 8DPSK
Number of Channels:	79
Channel Spacing:	1MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Antenna Type:	Chip Antenna
Antenna Gain:	3dBi
For BLE:	
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.3 Dual mode
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	Chip Antenna
Antenna Gain:	3dBi

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3.2 Separation Distance

Minimum test separation distance:	5mm
Remark: This minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander.	

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3.3 Test Location

All tests were performed at:

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

No tests were sub-contracted.

All tests were performed at:

3.4 Test Facility

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

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI (Member No. 1937)

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen EMC laboratory have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1336

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1336. Test Firm Registration Number: 787754.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

3.5 Deviation from Standards

None

3.6 Abnormalities from Standard Conditions

None

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4 FCC Radiofrequency radiation exposure limits

Test exemptions apply for devices used in general population/uncontrolled exposure environments, according to the SAR-based, or MPE-based exemption thresholds.

4.1 Blanket 1 mW Blanket Exemption

The 1 mW Blanket Exemption of §1.1307(b)(3)(i)(A) applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power of no more than 1 mW, regardless of separation distance.

The 1-mW blanket exemption applies at separation distances less than 0.5 cm, including where there is no separation. This exemption shall not be used in conjunction with other exemption criteria other than those for multiple RF sources in paragraph §1.1307(b)(3)(ii)(A).

The 1-mW exemption is independent of service type and covers the full range of 100 kHz to 100 GHz, but it shall not be used in conjunction with other exemption criteria or in devices with higher-power transmitters operating in the same time-averaging period. Exposure from such higher-power transmitters would invalidate the underlying assumption that exposure from the lower-power transmitter is the only contributor to SAR in the relevant volume of tissue.

4.2 MPE-based Exemption

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of §1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

Table B.1—Thresholds For Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	λ_L / 2π		λ_H / 2π	W
0.3	–	1.34	159 m	–	35.6 m	1,920 R^2
1.34	–	30	35.6 m	–	1.6 m	3,450 R^2/f^2
30	–	300	1.6 m	–	159 mm	3.83 R^2
300	–	1,500	159 mm	–	31.8 mm	0.0128 R^2f
1,500	–	100,000	31.8 mm	–	0.5 mm	19.2R^2
Subscripts L and H are low and high; λ is wavelength. From §1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.						

The table applies to any RF source (i.e. single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least λ/2π. The thresholds are

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based on the general population MPE limits with a single perfect reflection, outside of the reactive near-field, and in the main beam of the radiator.

For mobile devices that are not exempt per Table B.1 [Table 1 of §1.1307(b)(1)(i)(C)] at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in §1.1310 is necessary if the ERP of the device is greater than ERP_{20cm} in Formula (B.1) [repeated from §2.1091(c)(1); also in §1.1307(b)(1)(i)(B)].

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

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 λ/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.

Limit calculation			
Frequency range	Frequency(MHz)	R(λ/2π)(m)	Threshold ERP(W)
300~1500MHz	**915**	0.0522	0.032
1500~100000MHz	**2480**	0.0193	0.007

4.3 SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of λ/4.

As for devices with antennas of length greater than λ/4 where the gain is not well defined, but always less than that of a half-wave dipole (length λ/2), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

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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).

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

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_{20cm} is per Formula (B.1).

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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

Limit calculation				
Frequency range(GHz)	Frequency(GHz)	X	Distance(cm)	Pth (mW)
0.3~1.5	**0.915**	1.474	**0.5**	**8.133**
1.5~6	**2.48**	1.905	**0.5**	**2.717**

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5 Measurement and Calculation

5.1 Maximum transmit power

For BT:

The Power Data is based on the RF Test Report SZCR230500144302

Antenna Gain: 3dBi

Output Power Into Antenna & RF Exposure Evaluation Distance:

Frequency	Maximum EIRP [dBm]	Maximum EIRP (mW)
2480	-5.71	0.27

For BLE:

The Power Data is based on the RF Test Report SZCR230500144303

Antenna Gain: 3dBi

Output Power Into Antenna & RF Exposure Evaluation Distance:

Frequency	Maximum EIRP [dBm]	Maximum EIRP (mW)
2480	-6.87	0.21

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5.2 RF Exposure Calculation

Remark: we used the maximum power between the conducted power and ERP/EIRP to perform RF exposure exemption evaluation.

For BT transmitter:

The Max Power is 0.27mW. The best case gain of the antenna is 3dBi.

	Evaluation method	Exempt Limit(mW)	Verdict
☒	Blanket 1 mW Blanket Exemption	1mW	Yes
☐	MPE-based Exemption(ERP)	7mW(ERP)	N/A
☐	SAR-based Exemption(P_{th})	3060	N/A

So, the device is to qualify for SAR test exemption, the exemption report is in lieu of the SAR report.

For BLE transmitter:

The Max Power is 0.21mW. The best case gain of the antenna is 3dBi.

	Evaluation method	Exempt Limit(mW)	Verdict
☒	Blanket 1 mW Blanket Exemption	1mW	Yes
☐	MPE-based Exemption(ERP)	7mW(ERP)	N/A
☐	SAR-based Exemption(P_{th})	3060	N/A

So, the device is to qualify for SAR test exemption, the exemption report is in lieu of the SAR report.

--End of the Report--

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