

TEST REPORT

Applicant: Shanghai Xiangcheng Communication Technology Co., Ltd
Address: 6th Floor, Building 10, No.3000, Longdong Avenue, Pudong New District, Shanghai
Equipment Type: Smart Electronic Cash Register
Model Name: D8
Brand Name: KOZEN
FCC ID: 2A2UU-D8
Test Standard: 47 CFR Part 2.1091
KDB 447498 D04 v01
Test Date: Sep. 19, 2024 - Oct. 18, 2024
Date of Issue: Nov. 22, 2024

ISSUED BY:

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Revision History

<u>Version</u>	<u>Issue Date</u>	<u>Revisions Content</u>
<u>Rev. 01</u>	<u>Nov. 22, 2024</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	☐ Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	☒ 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	Shanghai Xiangcheng Communication Technology Co., Ltd
Address	6th Floor, Building 10, No.3000, Longdong Avenue, Pudong New District, Shanghai

2.2 Manufacturer Information

Manufacturer	Shanghai Xiangcheng Communication Technology Co., Ltd
Address	6th Floor, Building 10, No.3000, Longdong Avenue, Pudong New District, Shanghai

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	Smart Electronic Cash Register
Model Name Under Test	D8
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	D0861_A0_MB_V1.0
Software Version	d0861_kozen_combo_
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Technical Information

Network and Wireless connectivity	2G Network GSM/GPRS/EDGE 850/1900 MHz 3G Network WCDMA/HSDPA/HSUPA Band 2/4/5 4G Network LTE FDD Band 2/4/5/7 LTE TDD Band 38/41 Bluetooth 5.0(BR+EDR+BLE) 2.4G WIFI 802.11b, 802.11g and 802.11n(HT20/40) 5G WIFI 802.11a, 802.11n(HT20/HT40), 802.11ac(VHT20/HT40) GPS, GLONASS, BDS, NFC
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The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	Bluetooth, WIFI, WWAN		
Frequency Range	Bluetooth	2400 ~ 2483.5 MHz	
	2.4G WIFI	2400 ~ 2483.5 MHz	
	5G WIFI	U-NII-1: 5150 ~ 5250MHz U-NII-2A: 5250 ~ 5350MHz U-NII-2C: 5470 ~ 5725MHz U-NII-3: 5725 ~ 5850MHz	
	GSM850	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	GSM1900	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	WCDMA B2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	WCDMA B4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	WCDMA B5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE B2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	LTE B4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	LTE B5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE B7	TX: 2500 ~ 2570 MHz	RX: 2620 ~ 2690 MHz
	LTE B38	TX: 2570 ~ 2620 MHz	RX: 2570 ~ 2620 MHz
	LTE B41	TX: 2530 ~ 2650 MHz	RX: 2530 ~ 2650 MHz
Antenna Type	Bluetooth	PIFA Antenna	
	WIFI	PIFA Antenna	
	WWAN	PIFA Antenna	
Exposure Category	General Population/Uncontrolled Exposure		
Product 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 Devices:

CFR Title 47 §2.1091(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_{20cm} 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

According with FCC KDB 447498 D04, Appendix A, Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance.

This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.

When maximum available power each individual transmitting antenna within the same time averaging period is ≤ 1 mW, and the nearest parts of the antenna structures of the simultaneously operating transmitters are separated by at least 2 cm.

When the aggregate maximum available power of all transmitting antennas is ≤ 1 mW in the same time-averaging period.

5 ASSESSMENT RESULT

5.1 Output Power

Bluetooth				
Mode	GFSK	$\pi/4$ -DQPSK	8-DPSK	BLE
Conducted Power (dBm)	13.7	13.82	13.79	-1.24
Antenna Gain (dBi)	2.05	2.05	2.05	2.05
EIRP (dBm)	15.75	15.87	15.84	0.81
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-SH2490661-601 and BL-SH2490661-602 for more details.				

WLAN					
Mode	2.4GWIFI	5GWIFI(U-NII-1: 5150-5250MHz)	5GWIFI(U-NII-2A: 5250 MHz to 5350 MHz)	5GWIFI(U-NII-2C: 5470 MHz to 5725 MHz)	5GWIFI(U-NII-3: 5725 MHz to 5850 MHz)
Conducted Power (dBm)	24.64	14.56	14.53	13.99	14.23
Antenna Gain (dBi)	2.05	2.20	2.20	2.20	2.20
EIRP (dBm)	26.69	16.76	16.73	16.19	16.43
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-SH2490661-603 and BL-SH2490661-604 for more details.					

GSM					
Mode	Burst Average Power(dBm)		Division Factors	Frame-Averaged power (dBm)	
	GSM 900	GSM 1800		GSM 900	GSM 1800
GSM	32.61	29.86	9.19	N/A	N/A
GPRS (GMSK, 1-Slot)	32.58	29.86	9.19	23.39	20.67
GPRS (GMSK, 2-Slots)	21.83	29.13	6.13	15.70	23.00
GPRS (GMSK, 3-Slots)	30.1	27.34	4.42	25.68	22.92
GPRS (GMSK, 4-Slots)	28.99	26.34	3.18	25.81	23.16
Antenna Gain (dBi)	0.65	1.17	N/A	0.65	1.17
MAX ERP/EIRP (dBm)	31.11	31.03	N/A	24.31	24.33
Note: This report listed the worst Transmitter output power value, please refer to BL-SH2490661-501 report for more details.					

WCDMA			
Mode	Band 2	Band 4	Band 5
Conducted Power (dBm)	23.96	23.94	21.40
Antenna Gain (dBi)	1.17	1.17	0.65
ERP/EIRP (dBm)	25.13	25.11	19.90
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-SH2490661-501 for more details.			

LTE						
Mode	Band 2	Band 4	Band 5	Band 7	Band 38	Band 41
Conducted Power (dBm)	24.43	24.31	21.62	23.75	24.2	24.27
Antenna Gain (dBi)	1.17	1.17	0.65	1.12	1.12	1.12
ERP/EIRP (dBm)	25.6	25.48	20.12	24.87	25.32	25.39
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-SH2490661-501 for more details.						

5.2 Tune-up power

Mode		Conducted Power Range (dBm)	EIRP Range (dBm)	ERP Range (dBm)
GSM	GSM 850	【24.50,26.50】	/	【23.00,25.00】
	GSM 1900	【22.00,24.00】	【23.17,25.17】	【21.02,23.02】
WCDMA	Band 2	【23.00,25.00】	【24.17,26.17】	【22.02,24.02】
	Band 4	【23.00,25.00】	【24.17,26.17】	【22.02,24.02】
	Band 5	【20.50,22.50】	/	【19.00,21.00】
LTE	Band 2	【23.50,25.50】	【24.67,26.67】	【22.52,24.52】
	Band 4	【23.50,25.50】	【24.67,26.67】	【22.52,24.52】
	Band 5	【20.50,22.50】	/	【19.00,21.00】
	Band 7	【22.50,24.50】	【23.52,25.62】	【21.37,23.47】
	Band 38	【23.00,25.00】	【24.12,26.12】	【21.97,23.97】
	Band 41	【23.00,25.00】	【24.12,26.12】	【21.97,23.97】
Bluetooth		【13.00,15.00】	【15.05,17.05】	【12.90,14.90】
2.4GWIFI		【20.50,22.50】	【22.55,24.55】	【20.40,22.40】
5GWIFI(U-NII-1: 5150-5250MHz)		【13.50,15.50】	【15.70,17.70】	【13.55,15.55】
5GWIFI(U-NII-2A: 5250-5350MHz)		【13.50,15.50】	【15.70,17.70】	【13.55,15.55】

5GWIFI(U-NII-2C: 5470 MHz to 5725 MHz)	【13.50,15.50】	【15.70,17.70】	【13.55,15.55】
5GWIFI(U-NII-3: 5725-5850MHz)	【13.50,15.50】	【15.70,17.70】	【13.55,15.55】
Note1: ERP= EIRP -2.15dB.			
Note2: 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

Evolution mode	f(MHz)	Distance (cm)	Maximum power (dBm)	Maximum power (mw)	Threshold Power (mW)	P/Plimit	Verdict
GSM 850	824	20	26.50	446.68	1680.96	0.2657	Pass
GSM 1900	1850	20	25.17	328.85	3060.00	0.1075	Pass
WCDMA Band 2	1850	20	26.17	414.00	3060.00	0.1353	Pass
WCDMA Band 4	1710	20	26.17	414.00	3060.00	0.1353	Pass
WCDMA Band 5	824	20	22.50	177.83	1680.96	0.1058	Pass
Band 2	1850	20	26.67	464.52	3060.00	0.1518	Pass
Band 4	1710	20	26.67	464.52	3060.00	0.1518	Pass
Band 5	824	20	22.50	177.83	1680.96	0.1058	Pass
Band 7	2500	20	25.62	364.75	3060.00	0.1192	Pass
Band 38	2570	20	26.12	409.26	3060.00	0.1337	Pass
Band 41	2496	20	26.12	409.26	3060.00	0.1337	Pass
Bluetooth	2400	20	17.05	50.70	3060.00	0.0166	Pass
2.4GWIFI	2400	20	24.55	285.10	3060.00	0.0932	Pass
5GWIFI (U-NII-1: 5150-5250MHz)	5150	20	17.70	58.88	3060.00	0.0192	Pass
5GWIFI (U-NII-2A: 5250-5350MHz)	5250	20	17.70	58.88	3060.00	0.0192	Pass
5GWIFI (U-NII-2C: 5470 MHz to 5725 MHz)	5470	20	17.70	58.88	3060.00	0.0192	Pass
5GWIFI (U-NII-3: 5725-5850MHz)	5725	20	17.70	58.88	3060.00	0.0192	Pass

5.4 Collocated Power Calculation

Evolution mode	Frequency (MHz)	Power /Limit	$\Sigma(\text{Power} / \text{Limit})$ of GSM850 + WLAN + Bluetooth	Verdict
GSM850	824MHz ~ 849MHz	0.2657	0.3947	Pass
5G WIFI	5725 MHz ~ 5850 MHz	0.0192		
Bluetooth	2400MMHz ~ 2483.5MHz	0.0166		
2.4G WIFI	2400MMHz ~ 2483.5MHz	0.0932		

Note:

- $\Sigma(\text{Power} / \text{Limit})$: This is a summation of [(power for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding Power limit)], for Bluetooth+ WLAN 2.4GHz+WLAN 5GHz+WWAN.
- Both of the 850MHz/2.4GHz/2.5GHz/5GHz/ 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 5.2GHz WIFI and 5.8GHz WIFI can't transmit simultaneously at same time.
- The worst-case situation is 0.3947, 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 824 MHz ~ 849 MHz, 1850 MHz ~ 1915 MHz, 1710 MHz ~ 1780 MHz, 2500 MHz ~ 2570 MHz, 830 ~845 MHz, 2570 MHz ~ 2620 MHz, 2535 MHz ~ 2655 MHz, 2400MHz ~ 2483.5 MHz, 5150MHz ~ 5250 MHz, 5250MHz ~ 5350 MHz, 5470MHz ~ 5725 MHz, 5725MHz ~ 5850 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 test report No. BL-SH2490661-601/602/603/604/501.

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

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
2. The report without China inspection body and laboratory Mandatory Approval (CMA) mark has no effect of proving to the society.
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--END OF REPORT--