

RF EXPOSURE REPORT



Applicant: CASTLES TECHNOLOGY CO., LTD.
6F., NO. 207-5, SEC. 3, BEIXIN RD., XINDIAN DISTRICT,
NEW TAIPEI CITY 23143, TAIWAN (R.O.C)

Manufacturer: CASTLES TECHNOLOGY CO., LTD.
6F., NO. 207-5, SEC. 3, BEIXIN RD., XINDIAN DISTRICT,
NEW TAIPEI CITY 23143, TAIWAN (R.O.C)

Product Name: POS Terminal

Brand Name: 

Model No.: S2L

Model Difference: N/A

Report Number: TESA2307000436ES

FCC ID WIYS2L001

Date of EUT Received: July 24, 2023

Issue Date: December 07, 2023

Approved By

John Yeh

John Yeh

We hereby certify that:

The above equipment was evaluate by SGS Taiwan Ltd. The evaluation in this report is in compliance with FCC Rule Part §2.1091.

The results of this report relate only to the sample identified in this report.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.tw/Terms-and-Conditions> and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com.tw/Terms-and-Conditions>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.

No.134,Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan/新北市五股區新北產業園區五工路 134 號

台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

www.sgs.com.tw

Member of SGS Group

Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TESA2307000436ES	00	Original	Nov. 3, 2023	Candice Li	
TESA2307000436ES	01	Modify comments	Nov. 28, 2023	Candice Li	*
TESA2307000436ES	02	Modify comments	Dec. 7, 2023	Candice Li	*
TESA2307000436ES	03	Modify Section 2.3, 2.4	Dec. 7, 2023	Candice Li	*

Note:

- 1、The remark "*" indicates modification of the report upon requests from certification body.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.tw/Terms-and-Conditions> and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com.tw/Terms-and-Conditions>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.

No.134,Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan/新北市五股區新北產業園區五工路 134 號

台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

www.sgs.com.tw

Member of SGS Group

Contents

1	DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)	4
1.1	PRODUCT DESCRIPTION	4
1.2	EVALUATION SITE	4
1.3	ANTENNA INFORMATION:	5
1.4	RATED POWER	6
2	FCC MAXIMUM PERMISSIBLE EXPOSURE (MPE)	7
2.1	FCC STANDARD APPLICABLE	7
2.2	POWER DENSITY CALCULATION (WORST CASE) OF WLAN/BT	8
2.3	FCC NFC	8
2.4	SIMULTANEOUS TRANSMISSION CALCULATION	9

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.tw/Terms-and-Conditions> and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com.tw/Terms-and-Conditions>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.

No.134,Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan/新北市五股區新北產業園區五工路 134 號

台灣檢驗科技股份有限公司

t (886-2) 2299-3279



f (886-2) 2298-0488

www.sgs.com.tw

Member of SGS Group

1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

1.1 Product Description

Product Name:	POS Terminal
Brand Name:	
Model No.:	S2L
Model Difference:	N/A
Hardware Version:	V1A.00
Software Version:	N/A
EUT Series No.:	173232315138
Product Name of Module:	Smart module
Brand Name of Module:	
Model No. of Module:	SNM758
Module FCC ID:	WIYSNM758L
Power Supply:	12Vdc from Adapter

1.2 Evaluation site

Laboratory	Site Address		FCC Designation number	ISED Company Number	CAB Identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	<input type="checkbox"/>	No. 134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, 24803, Taiwan.	TW0027	4620A	TW3702
	<input checked="" type="checkbox"/>	No. 2, Keji 1st Rd., Guishan Township, Taoyuan County, 333 Taiwan.	TW0028	4620E	
	<input type="checkbox"/>	1F, No. 8, Alley 15, Lane 120, Sec. 1, Nei Hu Road, Nei Hu District, Taipei City, 222 Taiwan.	TW0029	23862	

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.tw/Terms-and-Conditions>, and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com.tw/Terms-and-Conditions>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.

No.134,Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan/新北市五股區新北產業園區五工路 134 號

台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

www.sgs.com.tw

Member of SGS Group

1.3 Antenna Information:

1.3.1 BT / WLAN 2.4GHz

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)
PIFA	AWAN	ALP6P-10000	2.4GHz	0.39

1.3.2 WLAN 5GHz

Antenna Type	Supplier	Antenna Part No.	Note
PIFA	AWAN	ALP6P-10000	Ant 1

Operating Frequency (MHz)	Ant 1 Peak Gain (dBi)
5150.0 ~ 5250.0	1.77
5725.0 ~ 5850.0	0.82

Note: Antenna information is provided by the applicant.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.tw/Terms-and-Conditions> and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com.tw/Terms-and-Conditions>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.

No.134,Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan/新北市五股區新北產業園區五工路 134 號

台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

www.sgs.com.tw

Member of SGS Group

1.4 Rated Power

1.4.1 Bluetooth / WLAN 2.4GHz

Mode	Freq. Range (MHz)	Channels	Modulation Technology	Max Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Worst Case
BR+EDR	2402-2480	79	GFSK + π /4DQPSK + 8DPSK	8.58	0.39	8.97	
WLAN2.4GHz	2412-2462	11	DSSS & OFDM	14.53	0.39	14.92	V

1.4.2 WLAN 5GHz:

802.11	Freq. Range (MHz)	Modulation Technology	Max. Output Power Include Tolerance (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Worst Case
a	5150~5250	OFDM	10.96	1.77	12.73	V
	5725~5850		8.34	0.82	9.16	
n HT20	5150~5250		10.86	1.77	12.63	
ac VHT20	5725~5850		8.59	0.82	9.41	
n HT40	5150~5250		9.65	1.77	11.42	
ac VHT40	5725~5850		8.31	0.82	9.13	
ac VHT80	5150~5250		3.54	1.77	5.31	
	5725~5850		6.81	0.82	7.63	

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.tw/Terms-and-Conditions> and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com.tw/Terms-and-Conditions>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

2 FCC MAXIMUM PERMISSIBLE EXPOSURE (MPE)

2.1 FCC Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device for WLAN/BT, the MPE is required.

According to §1.1310 and §2.1091 RF exposure is calculated.

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 (minute)
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
1500-100000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equipment power density

Prediction of MPE limit at a given distance

$$S=PG/4\pi R^2$$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.tw/Terms-and-Conditions> and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com.tw/Terms-and-Conditions>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.

No.134,Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan/新北市五股區新北產業園區五工路 134 號

台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

www.sgs.com.tw

Member of SGS Group

2.2 Power Density Calculation (Worst Case) of WLAN/BT

Operation Mode	Evaluation Frequency (MHz)	Operation Distance (cm)	Max. Output Power Include Tolerance (dBm)	Antenna Gain (dBi)	Max. EIRP (mW)	Power Density (PD) (mW/cm ²)	Limit (mW/cm ²)	Pass / Fail	Power Density / Limit
BT	2480.00	20	8.58	0.39	7.89	0.0016	1.000	Pass	0.002
WLAN 2.4G	2442.00	20	14.53	0.39	31.05	0.006	1.000	Pass	0.006
WLAN 5G	5180.00	20	10.96	1.77	18.75	0.004	1.000	Pass	0.004

Note: For conservativeness, the lowest uplink frequency of each band is used to determine the MPE limit of that band.

2.3 FCC NFC

Based on KDB447498D01v06 4.3.1 c), SAR test exclusion threshold for NFC(13.56MHz) shall be evaluated as below,

- For *test separation distances* ≤ 50 mm, the power threshold determined by the equation in 4.3.1 c) 1) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$
- The power threshold at 50mm/100 MHz in 4.3.1 b) is multiplied by $[1 + \log(100/f(\text{MHz}))]$ where f is 13.56MHz
- The power threshold in 4.3.1 b) is $[\text{Power allowed at numeric threshold for 50 mm in 4.3.1 a)} + [(\text{test separation distance} - 50 \text{ mm}) \cdot (f(\text{MHz})/150)] \text{ mW}$, for 100 MHz to 1500 MHz where test separation distance is 50mm, frequency is 100MHz.
- Power allowed at numeric threshold for 50 mm in 4.3.1 a) is $[3/\sqrt{f(\text{GHz})}] \cdot (\text{test separation distance})$

Hence, SAR test exclusion threshold is calculated in reverse sequence:

- $d) : [3/\sqrt{0.01}] \cdot 50 = 474.3416 \text{ mW}$
- $c) : 474.3416 + (50-50) \cdot (100/150) = 474.3416 \text{ mW}$
- $b) : 474.3416 \cdot [1 + \log(100/13.56)] = 885.9470 \text{ mW}$
- $a) : 885.9470 \cdot 0.5 = 442.974 \text{ mW}$

So the SAR test exclusion power threshold for NFC(13.56MHz) is 442.974mW(equal to 26.464dBm).

Also, the maximum power of NFC is -40.19dBm (converted from 34.97dBuV/m at 30m) and it is far below the exclusion threshold (26.464dBm), so SAR test for NFC can be excluded.

Step c:

Frequency (MHz)	E-FIELD dBuV/m	Test Distance (m)	EIRP (dBm)	EIRP (mW)	Threshold (mW)
13.56	34.97	30	-40.19	0.000096	442.974

Note:

$$\text{EIRP (dBm)} = (\text{E-FIELD(dBuV/m)} + 20\log(d(\text{m})) - 104.7$$

$$\text{EIRP(mW)} = (10^{(\text{EIRP(dBm)}/10)})$$

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.tw/Terms-and-Conditions>, and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com.tw/Terms-and-Conditions>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.

No.134,Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan/新北市五股區新北產業園區五工路 134 號

台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

www.sgs.com.tw

Member of SGS Group

Based on KDB447498D01v06 4.3.2 b), when an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:

1) $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}/x] \text{ W/kg}$, for test separation distances $\leq 50 \text{ mm}$, where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.

Using the most conservative test separation distance 5mm, so the estimated 1g-SAR for NFC would be 0.0000015 W/Kg.

$[0.000096/5] \cdot [\sqrt{0.01356/7.5}] = 0.0000015 \text{ W/Kg}$

2.4 Simultaneous Transmission Calculation

Operation Mode	SAR/Limit or Power Density/Limit	TER
NFC	0.00000094	0.012
BT	0.002	
WLAN 2.4G	0.006	
WLAN 5G	0.004	

Note:

1. The simultaneous transmission is compliant because the $[\Sigma \text{ of (the highest measured SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) } / 1.6 \text{ W/kg}] + [\Sigma \text{ of MPE ratios}] \leq 1.0$.

~ End of Report ~

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.tw/Terms-and-Conditions> and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com.tw/Terms-and-Conditions>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.