

RF Exposure Evaluation Report

APPLICANT : CASTLES TECHNOLOGY CO., LTD.

EQUIPMENT : Smart Module

BRAND NAME :  CASTLES
TECHNOLOGY

MODEL NAME : CWM100

FCC ID : WIYCWM100001

STANDARD : 47 CFR Part 2.1091
FCC KDB 447498 D01 v06

The product evaluation date was started from Dec. 20, 2024 and completed on Dec. 20, 2024. We, Sporton International Inc. (Kunshan), would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091 and FCC KDB 447498 D01 v06, and pass the limit. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.



Approved by: Si Zhang

Sporton International Inc. (Kunshan)

No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China



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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA4N0518	Rev. 01	Initial issue of report.	Jan. 06, 2025



1. Administration Data

1.1. Testing Laboratory

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Testing Laboratory			
Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR01-KS	CN1257	314309

Applicant	
Company Name	CASTLES TECHNOLOGY CO., LTD.
Address	6F, NO. 207-5, SEC. 3, BEIXIN RD., XINDIAN DISTRICT, NEW TAIPEI CITY 231030, TAIWAN (R.O.C.)

Manufacturer	
Company Name	CASTLES TECHNOLOGY CO., LTD.
Address	6F, NO. 207-5, SEC. 3, BEIXIN RD., XINDIAN DISTRICT, NEW TAIPEI CITY 231030, TAIWAN (R.O.C.)

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	Smart Module
Brand Name	 CASTLES TECHNOLOGY
Model Name	CWM100
FCC ID	WIYCWM100001
Wireless Technology and Frequency Range	WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2 : 1850 MHz ~ 1910 MHz LTE Band 4 : 1710 MHz ~ 1755 MHz LTE Band 5 : 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12 : 699 MHz ~ 716 MHz LTE Band 13 : 777 MHz ~ 787 MHz LTE Band 14: 788 MHz ~ 798 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 25 : 1850 MHz ~ 1915 MHz LTE Band 26 : 814 MHz ~ 849 MHz LTE Band 66 : 1710 MHz ~ 1780 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	RMC 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+(16QAM uplink is supported) LTE: QPSK, 16QAM, 64QAM WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
Antenna Gain	WCDMA Band II: 4.00 dBi WCDMA Band IV: 3.80 dBi WCDMA Band V: 4.50 dBi LTE Band 2 : 4.00 dBi LTE Band 4 : 3.80 dBi LTE Band 5 : 4.50 dBi LTE Band 7 : 5.10 dBi LTE Band 12 : 1.50 dBi LTE Band 13 : 4.70 dBi LTE Band 14 : 4.70 dBi LTE Band 17 : 1.50 dBi LTE Band 25 : 4.00 dBi LTE Band 26 : 4.50 dBi LTE Band 38 : 4.60 dBi LTE Band 41: 4.60 dBi LTE Band 66: 4.00 dBi Bluetooth: 5.40 dBi WLAN2.4GHz: 5.40 dBi WLAN5.2GHz: 5.50 dBi WLAN5.3GHz: 5.29 dBi WLAN5.5GHz: 6.52 dBi WLAN5.8GHz: 6.89 dBi



Antenna Type	WWAN: PIFA Antenna WLAN/Bluetooth: PIFA Antenna
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Comments and Explanations:

1. The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.
2. The maximum RF output tune up power, antenna gain also the safe distance used for evaluate RF exposure were declared by manufacturer.

3. Maximum RF average output tune up power among production units**<WCDMA>**

Mode		Maximum Average power(dBm)
WCDMA	Band II	25.0
	Band IV	25.0
	Band V	25.0

<LTE>

Mode		Maximum Average power(dBm)
LTE	Band 2	25.0
	Band 4	25.0
	Band 5	25.0
	Band 7	24.0
	Band 12	25.0
	Band 13	25.0
	Band 14	25.0
	Band 17	25.0
	Band 25	25.0
	Band 26	25.0
	Band 38	22.0
	Band 41	23.0
	Band 66	25.0

<2.4GHz WLAN >

Mode		Maximum Average Power (dBm)
2.4GHz	802.11b	17.5
	802.11g	16.0
	802.11n-HT20	15.0
	802.11n-HT40	13.0

<Bluetooth>

Mode		Maximum Average power(dBm)
Bluetooth	BR/EDR	11.5
	LE	7.0

<5GHz WLAN >

Mode		Maximum Average Power (dBm)
5.2GHz	802.11a	15.0
	802.11n-HT20	14.5
	802.11n-HT40	14.5
	802.11ac-VHT20	15.0
	802.11ac-VHT40	15.0
	802.11ac-VHT80	13.0
5.3GHz	802.11a	15.5
	802.11n-HT20	14.5
	802.11n-HT40	14.5
	802.11ac-VHT20	15.5
	802.11ac-VHT40	15.0
	802.11ac-VHT80	13.0
5.5GHz	802.11a	15.0
	802.11n-HT20	14.0
	802.11n-HT40	14.0
	802.11ac-VHT20	15.0
	802.11ac-VHT40	14.0
	802.11ac-VHT80	12.0
5.8GHz	802.11a	15.0
	802.11n-HT20	14.0
	802.11n-HT40	14.0
	802.11ac-VHT20	15.0
	802.11ac-VHT40	14.0
	802.11ac-VHT80	12.0

4. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) 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
1500-100,000			1.0	30

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna

5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculation

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit
WCDMA Band 2	1850	4.00	25.00	29.000	794.328	0.158	1.000	0.158
WCDMA Band 4	1710	3.80	25.00	28.800	758.578	0.151	1.000	0.151
WCDMA Band 5	824	4.50	25.00	29.500	891.251	0.177	0.549	0.323
LTE Band 2	1850	4.00	25.00	29.000	794.328	0.158	1.000	0.158
LTE Band 4	1710	3.80	25.00	28.800	758.578	0.151	1.000	0.151
LTE Band 5	824	4.50	25.00	29.500	891.251	0.177	0.549	0.323
LTE Band 7	2500	5.10	24.00	29.100	812.831	0.162	1.000	0.162
LTE Band 12	699	1.50	25.00	26.500	446.684	0.089	0.466	0.191
LTE Band 13	777	4.70	25.00	29.700	933.254	0.186	0.518	0.359
LTE Band 14	788	4.70	25.00	29.700	933.254	0.186	0.525	0.354
LTE Band 17	704	1.50	25.00	26.500	446.684	0.089	0.469	0.189
LTE Band 25	1850	4.00	25.00	29.000	794.328	0.158	1.000	0.158
LTE Band 26	814	4.50	25.00	29.500	891.251	0.177	0.543	0.327
LTE Band 38	2570	4.60	22.00	26.600	457.088	0.091	1.000	0.091
LTE Band 41	2496	4.60	23.00	27.600	575.440	0.115	1.000	0.115
LTE Band 66	1710	4.00	25.00	29.000	794.328	0.158	1.000	0.158
Bluetooth	2402	5.40	11.50	16.900	48.978	0.010	1.000	0.010
2.4GHz WLAN	2412	5.40	17.50	22.900	194.984	0.039	1.000	0.039
5.2GHz WLAN	5180	5.50	15.00	20.500	112.202	0.022	1.000	0.022
5.3GHz WLAN	5260	5.29	15.50	20.790	119.950	0.024	1.000	0.024
5.5GHz WLAN	5500	6.52	15.00	21.520	141.906	0.028	1.000	0.028
5.8GHz WLAN	5745	6.89	15.00	21.890	154.525	0.031	1.000	0.031

Note:

1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
2. Chose the maximum power to do MPE analysis.

**5.2. Collocated Power Density Calculation**

WWAN Power Density / Limit	Bluetooth Power Density / Limit	Σ (Power Density / Limit) of WWAN + Bluetooth
0.359	0.010	0.369
WWAN Power Density / Limit	WLAN 2.4GHz Power Density / Limit	Σ (Power Density / Limit) of WWAN + WLAN 2.4GHz
0.359	0.039	0.398
WWAN Power Density / Limit	WLAN 5GHz Power Density / Limit	Σ (Power Density / Limit) of WWAN + WLAN 5GHz
0.359	0.031	0.390

Note:

1. According to the EUT characteristic, WLAN (2.4GHz or 5GHz) and Bluetooth cannot transmit simultaneously, WLAN 2.4GHz and WLAN 5GHz cannot transmit simultaneously
2. Σ (Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WWAN + Bluetooth/WLAN 2.4GHz/WLAN 5GHz.
3. Considering all transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 2 collocated transmitters is compliant

Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.

-----THE END-----