

TEST REPORT

Applicant: Siren Marine, Inc.

EUT Description: Data Communication Module

Model: Siren 3

Brand: Siren Marine and Connected Boat

FCC ID: 2BMMJSIREN3

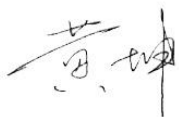
Standards: FCC 47 CFR Part 2.1091

Date of Receipt: 2024/11/12

Date of Issue: 2024/12/12

TOWE. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

the results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of the model are manufactured with identical electrical and mechanical components. All sample tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise. without written approval of TOWE, the test report shall not be reproduced except in full.



Huang Kun
Approved By:



Chen Chengfu
Reviewed By:

Revision History

Rev.	Issue Date	Description	Revised by
01	2024/12/12	Original	Chen Chengfu

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1 General Description

1.1 Lab Information

1.1.1 Testing Location

These measurements tests were conducted at the Sushi TOWE Wireless Testing(Shenzhen) Co., Ltd. facility located at F401 and F101, Building E, Hongwei Industrial Zone, Liuxian 3rd Road, Bao'an District, Shenzhen, China. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014

Tel.: +86-755-27212361

Contact Email: info@towewireless.com

1.1.2 Test Facility / Accreditations

A2LA (Certificate Number: 7088.01)

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

FCC Designation No.: CN1353

Sushi TOWE Wireless Testing(Shenzhen) Co., Ltd. has been recognized as an accredited testing laboratory. Designation Number: CN1353.

ISED CAB identifier: CN0152

Sushi TOWE Wireless Testing(Shenzhen) Co., Ltd. has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0152

Company Number: 31000

1.2 Client Information

1.2.1 Applicant

Applicant:	Siren Marine, Inc.
Address:	221 3rd St, Suite 300, Newport, RI 02840, United States

1.2.2 Manufacturer

Manufacturer:	Siren Marine, Inc.
Address:	221 3rd St, Suite 300, Newport, RI 02840, United States

1.3 Product Information

EUT Description:	Data Communication Module			
Model:	Siren 3			
Brand:	Siren Marine and Connected Boat			
Hardware Version:	V1.0			
Software Version:	S3_App-0.1.19			
Antenna Type:	☐ External, ☒ Integrated			
Antenna gain:	Band	ANT Gain(dBi)	Band	ANT Gain(dBi)
	Cat M1 Band 2:	1.58	Cat M1 Band 4:	1.29
	Cat M1 Band 5:	1.36	Cat M1 Band 12:	-3.24
	Cat M1 Band 13:	0.96	Cat M1 Band 25:	1.58
	Cat M1 Band 26: (814 ~ 824 MHz)	1.54	Cat M1 Band 26: (824 ~ 849 MHz)	1.36
	Cat M1 Band 66:	1.29	Cat M1 Band 85:	-3.24
	NTN Band 23:	2.54	NTN Band 255:	2.38
	BLE:	3.31	Wi-Fi 2.4G:	3.31
	Sub-G:	0.1		
Remark: The above EUT's information was declared by applicant, please refer to the specifications or user manual for more detailed description.				

2 Maximum Permissible RF Exposure

2.1 RF Exposure Limit Introduction

§1.1310 the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b).

- (1) Table 1 to § 1.1310(e)(1) sets forth limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

Table 1 to § 1.1310(e)(1) - Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
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
1500~100000			5	<6
(ii) 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

Note: f = frequency in MHz. * = Plane-wave equivalent power density.

- (2) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. The phrase *fully aware* in the context of applying these exposure limits means that an exposed person has received written and/or verbal information fully explaining the potential for RF exposure resulting from his or her employment. With the exception of transient persons, this phrase also means that an exposed person has received appropriate training regarding work practices relating to controlling or mitigating his or her exposure. In situations when an untrained person is transient through a location where occupational/controlled limits apply, he or she must be made aware of the potential for exposure and be supervised by trained personnel pursuant to § 1.1307(b)(2) of this part where use of time averaging is required to ensure compliance with the general population exposure limit. The phrase exercise control means that an exposed person is allowed and also knows how to reduce or avoid exposure by administrative or engineering work practices, such as use of personal protective equipment or time averaging of exposure.
- (3) General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure. For example, RF sources intended for consumer use shall be subject to the limits for general population/uncontrolled exposure in this section.

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

2.2 Equations

Power Density is given by:

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

Where:

S = Power density in mW/cm²

EIRP= Equivalent isotropic Radiated power in mW

R = Distance from transmitting antenna in cm

Power density in units of mW/cm² is converted to units of W/m² by multiplying by 10.

Distance:

$$R = \sqrt{\frac{\text{EIRP}}{4\pi S}}$$

Where:

S = Power density in mW/cm²

EIRP= Equivalent isotropic Radiated power in mW

R = Distance from transmitting antenna in cm

EIRP:

$$\text{EIRP} = P + G$$

Where:

EIRP = Equivalent isotropic Radiated power in Mw

P = Output power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

Source-Based Duty Cycle:

Where applicable (for example, multi-slot cell phone applications) a duty cycle factor may be applied.

Source-based time-averaged EIRP = (DC / 100)* EIRP

Where:

DC = Duty Cycle in %, as applicable

EIRP= Equivalent isotropic Radiated power in mW

MIMO and colocated transmitters (identical limit for all transmitters):

For multiple chain devices, and colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the PG (in linear units) of each transmitter.

Total EIRP = (EIRP 1) + (EIRP 2) + ... + (EIRP n)

MIMO and colocated transmitters:

For multiple colocated transmitters operating simultaneously in frequency bands where different limit apply:

The power density at the specified separation distance is calculated for each transmitter chain or transmitter.

The fraction of the exposure limit is calculated for each chain or transmitter as

Power density of chain or transmitter / limit applicable to the chain or transmitter.

The fractions are summed.

Compliance is established if the sum of the fractions is less than or equal to one.

3 RF Exposure Results

3.1 Standalone Exposure Calculations

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

The manufacturing configures output power so that the maximum power, after accounting for manufacturing tolerances, will never exceed the maximum power level measured.

The antenna gain in the tables below is the maximum antenna gain among various channels within the specified band.

Operating Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	EIRP/ERP (dBm)	EIRP/ERP (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Results
Cat M1 Band 2	1850.7	1.58	25.00	26.58	454.9881	0.1302	1.0000	Pass
Cat M1 Band 4	1710.7	1.29	25.00	26.29	425.5984	0.1140	1.0000	Pass
Cat M1 Band 5	824.7	1.36	25.00	24.21	263.6331	0.0717	0.5498	Pass
Cat M1 Band 12	699.7	-3.24	25.00	19.61	91.4113	0.0086	0.4665	Pass
Cat M1 Band 13	779.50	0.96	24.00	22.81	190.9853	0.0474	0.5197	Pass
Cat M1 Band 25	1850.7	1.58	25.00	26.58	454.9881	0.1302	1.0000	Pass
Cat M1 Band 26 (814~824)	814.7	1.54	25.00	24.39	274.7894	0.0779	0.5431	Pass
Cat M1 Band 26 (824~849)	824.7	1.36	25.00	24.21	263.6331	0.0717	0.5498	Pass
Cat M1 Band 66	1710.7	1.29	25.00	26.29	425.5984	0.1140	1.0000	Pass
Cat M1 Band 85	700.5	-3.24	25.00	19.61	91.4113	0.0086	0.4670	Pass
NTN Band 23	2000.1	2.54	25.00	27.54	567.5446	0.2026	1.0000	Pass
NTN Band 255	1626.6	2.38	25.00	27.38	547.0160	0.1882	1.0000	Pass
BLE	2402	3.31	7.50	10.81	12.0504	0.0051	1.0000	Pass
2.4GWIFI	2412	3.31	23.50	26.81	479.7334	0.2045	1.0000	Pass
Sub-G	906	0.1	8.70	6.65	4.6238	0.0009	0.6040	Pass

Remark: "Maximum Power" comes from the largest "Tune-up" provided by the customer.

3.2 Multiple Sources Exposure Calculations

The product also has multiple transmitters The Simultaneous Transmission Possibilities are as below:

Simultaneous Tx Combination	Configuration
1	WWAN + WLAN + Sub-G
2	WWAN + BLE + Sub-G
3	WWAN + WLAN
4	WWAN + BLE
5	WWAN + Sub-G
6	WLAN + Sub-G
7	BLE + Sub-G

TER (Total exposure ratio) = Power Density (mW/cm²) / Limit (mW/cm²)

Operating Band	Frequency (MHz)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	TER
Cat M1 Band 2	1850.7	0.1302	1.0000	0.1302
Cat M1 Band 4	1710.7	0.1140	1.0000	0.1140
Cat M1 Band 5	824.7	0.0717	0.5498	0.1305
Cat M1 Band 12	699.7	0.0086	0.4665	0.0185
Cat M1 Band 13	779.50	0.0474	0.5197	0.0912
Cat M1 Band 25	1850.7	0.1302	1.0000	0.1302
Cat M1 Band 26 (814~824)	814.7	0.0779	0.5431	0.1435
Cat M1 Band 26 (824~849)	824.7	0.0717	0.5498	0.1305
Cat M1 Band 66	1710.7	0.1140	1.0000	0.1140
Cat M1 Band 85	700.5	0.0086	0.4670	0.0185
NTN Band 23	2000.1	0.2026	1.0000	0.2026
NTN Band 255	1626.6	0.1882	1.0000	0.1882
BLE	2402	0.0051	1.0000	0.0051
2.4GWIFI	2412	0.2045	1.0000	0.2045
Sub-G	906	0.0009	0.6040	0.0016

The worst-case combination: **WWAN + WLAN + Sub-G**

Combination	TER	Total TER	Limit	Conclusion
NTN Band 23	0.2026	0.4087	<1	PASS
WLAN 2.4GHz	0.2045			
Sub-G	0.0016			

~The End~