

RF Exposure Report

Report Number: 208726-3**Revision Level:** 2**Client:** Comma.ai, inc.

3900 Harney St., San Diego, CA92110

Equipment Under Test: 2.4/5 GHz WiFi module**Model Name:** LightningHard SOM**Model Number:** N/A**FCC ID:** 2BFC6-LIGHTNINGH**Module Model:** N/A**Contains FCC ID:** N/A**Applicable Standards:** 47 CFR §§ 2.1091

FCC KDB 447498 D01 General RF Exposure Guidance v06

FCC OET Bulletin 65

Report issued on: June 20, 2024**Result:** Compliant

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01

Report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

Prepared by:

Andreas Gillmeier, Sr. Engineer, Wireless**Reviewed by:**

Alex Chang, Sr. Regulatory Laboratory Manager –
EMC/RF

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1 General Information

1.1 Client Information

Name: Comma.ai, inc.
Address: 3900 Harney St.
City, State, Zip, Country: San Diego, CA92110, USA

1.2 Test Laboratory

Name: SGS North America, Inc.
Address: 12310 World Trade Drive, Suite 106/107
City, State, Zip, Country: San Diego, CA 92128, USA

Accrediting Body: A2LA
Type of lab: Testing Laboratory
Certificate Number: 1935.01

1.3 General Information of EUT

Type of Product: 2.4/5 GHz WiFi module
Model Number: LightningHard SOM
Serial Number: N/A
Module Models: N/A

Frequency Ranges: 2412 – 2462 MHz (WLAN 2.4GHz)
5180 – 5240 MHz (WLAN 5GHz U-NII-1)
5260 – 5320 MHz (WLAN 5GHz U-NII-2A)
5500 – 5700 MHz (WLAN 5GHz U-NII-2C)
5745 – 5825 MHz (WLAN 5GHz U-NII-3)
Antenna Gain: PCB Omnidirectional Antenna (TE 2344654-7)
peak gain 2.4GHz: 1.5dBi*
peak gain 5GHz: 5.7 dBi*
Max Conducted Output Power: WLAN 2.4GHz, 802.11b NOHT: 8.93 dBm
WLAN 2.4GHz, 802.11b CCK: 10.02 dBm
WLAN 2.4GHz, 802.11g: 12.48 dBm
WLAN 2.4GHz, 802.11n20: 12.34 dBm
WLAN 2.4GHz, 802.11n40: 11.17 dBm
WLAN 5GHz U-NII-1: 17.29 dBm
WLAN 5GHz U-NII-2A: 17.15 dBm
WLAN 5GHz U-NII-2C: 16.56 dBm
WLAN 5GHz U-NII-3: 13.01 dBm

*Data was not measured by SGS laboratory and therefore SGS is not responsible for accuracy. Data obtained via customer, specification sheet, previous filing or other.

1.4 Operating Modes and Conditions

Maximum power levels were utilized for all calculations. Simultaneous transmission is not possible.

2 RF Exposure

2.1 Test Results

Test Description	Product Specific Standard	Test Result
RF Exposure	FCC Part 1.1310	Compliant

2.2 Test Method

The formula below calculates power density.

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

Where;

S = Power density (mW/cm²)

P = Maximum sourced based average power delivered to antenna port (mW)

G = Maximum power gain of the antenna in the direction of interest relative to an isotropic radiator (dBi) (numerical value)

R = Distance between by-stander and antenna (cm)

EIRP = Equivalent (or effective) isotropically radiated power

2.3 Limits

The table below shows the limits applicable for equipment subject to FCC §15.247 and §2.1091.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
0.3 – 1.34	614	20.4	*(100)	30
1.34 - 30	824/f	26.97	*(180/f ²)	30
30 - 300	27.5	33.62	0.2	30
300 - 1500	/	/	f/1500	30
1500 – 100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

2.4 Single transmission RF Exposure Levels (mW/cm²)

2.4 GHz band, IEEE 802.11b NOHT mode

Freq. (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	numerical	(dBm)	(mW)			
2437	1.5	1.41	8.93	7.82	20	0.002	1

2.4 GHz band, IEEE 802.11b CCK mode

Freq. (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	numerical	(dBm)	(mW)			
2437	1.5	1.41	10.02	10.05	20	0.003	1

2.4 GHz band, IEEE 802.11g mode

Freq. (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	numerical	(dBm)	(mW)			
2462	1.5	1.41	12.48	17.70	20	0.005	1

2.4 GHz band, IEEE 802.11n20 mode

Freq. (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	numerical	(dBm)	(mW)			
2462	1.5	1.41	12.34	17.14	20	0.005	1

2.4 GHz band, IEEE 802.11n40 mode

Freq. (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	numerical	(dBm)	(mW)			
2452	1.5	1.41	11.17	13.09	20	0.004	1

5 GHz band, UNII1 band

Freq. (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	numerical	(dBm)	(mW)			
5240	5.7	3.72	17.29	53.58	20	0.040	1

5 GHz band, UNII2A band

Freq. (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	numerical	(dBm)	(mW)			
5280	5.7	3.72	17.15	51.88	20	0.038	1

5 GHz band, UNII2C band

Freq. (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	numerical	(dBm)	(mW)			
5600	5.7	3.72	16.56	45.29	20	0.033	1

5 GHz band, UNII3 band

Freq. (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	numerical	(dBm)	(mW)			
5795	5.7	3.72	13.01	20.00	20	0.015	1

2.5 Simultaneous Conditions

N/A

3 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	May 15, 2024
1	Removed 2.1093 from cover page and corrected 5720 MHz to 5700 MHz in chapter 1.3	June 14, 2024
2	Corrected the max. antenna gain for 2.4 GHz to 1.5 dBi	June 20, 2024