

Radio Frequency Exposure Evaluation Report

FOR:

Rivian Automotive, LLC

Model Name:

Telematics Control Module

Product Description:

The Telematics Control Module (TCM) is a connectivity module integrated into a vehicular application.

FCC ID: 2AW3A-1NAT20TCM

Per:

CFR Part1 (1.1307 &1.1310), Part 2 (2.1091), FCC KDB 447498 D01 General RF Exposure Guidance v06

Report number: EMC_RIVIA_008_21001_FCC_MPE_Rev1_Rev1

DATE: 5/21/2021



CETECOM Inc.

411 Dixon Landing Road • Milpitas, CA 95035 • U.S.A.

Phone: + 1 (408) 586 6200 • Fax: + 1 (408) 586 6299 • E-mail: info@cetecom.com • http://www.cetecom.com CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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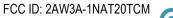
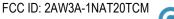




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1 Assessment

This RF Exposure evaluation report, provides evidence for compliance of the below identified device, with the RF Exposure limits for mobile devices, as defined in FCC CFR Part1 (1.1307 &1.1310), Part 2 (2.1091), under worst case conditions (measured or rated RF output power, antenna gain, distance towards human body. Multiple transmitter information as presented by the applicant).

In addition, maximum antenna gain, or minimum distance towards the human body calculated respectively where relevant.

The device meets the limits as stipulated by the above given FCC rule parts based on available specifications for worst-case conditions at 23cm distance to the body.

| Company | Description | Model Name |
|------------------------|---|------------------------------|
| Rivian Automotive. LLC | The Telematics Control Module (TCM) is a connectivity module integrated into a vehicular application. | Telematics Control Module |

Report reviewed by: TCB Evaluator

| I | Date | Section | Name | Signature |
|---|-----------|------------|---------------|-----------|
| | 5/21/2021 | Compliance | (Lab Manager) | |
| | | | Wang, Kevin | |

Responsible for the Report:

| | Ghanma, Issa | | | | |
|-----------|-------------------------------------|------|-----------|--|--|
| 5/21/2021 | 5/21/2021 Compliance (EMC Engineer) | | | | |
| Date | Section | Name | Signature | | |
| Bate | Ocolion | Nume | Oignature | | |



2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

| Company Name: | CETECOM Inc. |
|-----------------------------|------------------------|
| Department: | Compliance |
| Street Address: | 411 Dixon Landing Road |
| City/Zip Code | Milpitas, CA 95035 |
| Country | USA |
| Telephone: | +1 (408) 586 6200 |
| Fax: | +1 (408) 586 6299 |
| Lab Manager: | Wang, Kevin |
| Responsible Project Leader: | Saman, Rami |

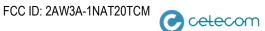
2.2 Identification of the Client / Manufacturer

| Applicant's Name: | Rivian Automotive. LLC |
|-------------------|------------------------|
| Street Address: | 607 Hansen Way |
| City/Zip Code | Palo Alto, CA 94304 |
| Country | USA |

2.3 Identification of the Manufacturer

| Manufacturer's Name: | Same as client. |
|------------------------|-----------------|
| Manufacturers Address: | |
| City/Zip Code | |
| Country | |

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3 Equipment under Assessment

| Model No: | Telematics Control Module | | | | | |
|--|---------------------------|--|--|--|--|--|
| FCC ID: | 2AW3A-1NAT20TCM | | | | | |
| Power Supply/ Rated Operating Voltage Range: | Low | ow 9.9 V DC, Nominal 13.5 V DC, High 16.0 V DC | | | | |
| | * | WLAN (Wi-Fi 2.4, 5 GHz) , Bluetooth BDR/EDR: | | | | |
| | | • FCC ID : XPYJODYW167 | | | | |
| | | Name / Number : UBLOX / JODY-W1 | | | | |
| | | Wi-Fi 2.4 and 5 GHz: 802.11 a/b/g/n/h/ac | | | | |
| | | Bluetooth BDR/EDR: Disabled. See Note 1 | | | | |
| Integrated Medule Info | * | Cellular Module: | | | | |
| Integrated Module Info: | | Name / Number : ALAS5-AM | | | | |
| | | • FCC ID : QIPALAS5-AM | | | | |
| | * | GPS/GNSS: | | | | |
| | | UBLOX NEO - M8L - 04A Standalone GNSS receiver | | | | |
| | | GEMALTO AIAS5 – GNSS receiver module integrated with the cellular modem. | | | | |
| | * | WLAN (Wi-Fi 2.4, 5 GHz) , Bluetooth BDR/EDR: | | | | |
| | | • Wi-Fi 2.4 GHz : Channels 1 – 11 | | | | |
| | | • Wi-Fi 5 GHz : | | | | |
| | | ■ UNII-1 5150 – 5250 : Channels 36 – 48 | | | | |
| | | UNII-2a 5250 – 5350 : Channels 52 – 64 | | | | |
| | | ■ UNII-2c 5470 – 5725 : Channels 100 – 140 | | | | |
| Regulatory Band: | | UNII-3 5725 – 5850 : Channels 149 – 165 | | | | |
| | | Bluetooth BDR/EDR : Disabled. See Note 1 | | | | |
| | * | Cellular Module: | | | | |
| | | • 4G – LTE: Bands 2, 4, 5, 7, 12, 13, 66 | | | | |
| | | 3G – UMTS/WCDMA: Bands II, IV, V | | | | |
| | | • 2G – GSM: 850, 1900 | | | | |
| | * | WLAN (Wi-Fi 2.4, 5 GHz) , Bluetooth BDR/EDR: | | | | |
| | | • Wi-Fi 2.4 GHz : 17.5 | | | | |
| | | • Wi-Fi 5 GHz : | | | | |
| | | ■ UNII-1 : 16.5 | | | | |
| Maximum Conducted Output Power (dBm): | | ■ UNII-2a : 16.7 | | | | |
| | | ■ UNII-2c : 16.3 | | | | |
| | | ■ UNII-3 : 19.8 | | | | |
| | | Bluetooth BDR/EDR : Disabled. <u>See Note 1</u> | | | | |
| | * | Cellular Module : 32.38 | | | | |

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| | ❖ WLAN (Wi-Fi 2.4, 5 GHz) , Bluetooth BDR/EDR: | | | | | |
|-----------------------------|---|--|--|--|--|--|
| | Wi-Fi 2.4/5 GHz : Antenna 1 (Spoiler) | | | | | |
| | ■ Type : External | | | | | |
| | ■ Manufacturer : TE | | | | | |
| | ■ Rivian part number : PT00039248 | | | | | |
| | ■ TE part number : 955-012-201 | | | | | |
| | ■ Maximum Gain : | | | | | |
| | o @2430 MHz : 4.1 dBi | | | | | |
| | o @5100 MHz : 3.9 dBi | | | | | |
| | Wi-Fi 2.4/5 GHz : Antenna 2 (Front) | | | | | |
| | ■ Type : External | | | | | |
| | ■ Manufacturer : TE | | | | | |
| | ■ Rivian part number : PT00014349 | | | | | |
| | ■ TE part number : 956-012-001 | | | | | |
| | Maximum Gain : | | | | | |
| Antenna Type and Peak gain: | o @2420 MHz : 6.2 dBi | | | | | |
| | o @5400 MHz : 4.8 dBi | | | | | |
| | Bluetooth BDR/EDR : Disabled. <u>See Note 1</u> | | | | | |
| | ❖ Cellular Module: | | | | | |
| | External: LTE Main | | | | | |
| | Rivian Part number : PT00039249 | | | | | |
| | ■ TE Part Number : 955-922-501 | | | | | |
| | ■ Maximum Gain : | | | | | |
| | o 738 MHz : 7.0 dBi | | | | | |
| | o 2315 MHz : 3.7 dBi | | | | | |
| | External: LTE Diversity (Rx only) | | | | | |
| | Rivian Part Number : PT00039250 | | | | | |
| | ■ TE Part Number : 955-922-401 | | | | | |
| | ■ Maximum Gain: | | | | | |
| | o 663 MHz : 2.5 dBi | | | | | |
| | o 2710 MHz : 6.1 dBi | | | | | |
| Sample Revision: | □ Prototype Unit; □ Production Unit; ■ Pre-Production | | | | | |

Note 1: Referring to "TCM Operational Description_11May2021.pdf" During TCM boot-up, the device does not load any Bluetooth drivers, which means that the firmware is not downloaded.



4 RF Exposure Limits and FCC Basic Rules

For the specific described radio apparatus the following basic limits and rules apply for both, FCC where not indicated differently.

4.1 Power Density Limits acc. to FCC 1.1310(e):

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| Frequency Range (MHz) | Power density (mW/cm²) | Averaging time (minutes) |
|-----------------------|------------------------|--------------------------|
| 300 – 1500 | f (MHz) /1500 | 30 |
| 1500 – 100.000 | 1.0 | 30 |

4.2 Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.1091(c) (rounded to 1 decimal point):

FCC

Operating frequency < 1.5GHz: excluded if ERP < 1.5W / 31.8 dBm (EIRP: 33.9); Operating frequency > 1.5GHz: excluded if ERP < 3.0W / 34.8 dBm (EIRP: 36.9);

4.3 RF Exposure Estimation (MPE Estimation)

Having available the source, based average output power, and peak antenna gain, or the ERP/EIRP of the specified device, and for a known minimum distance of its radiating structures from the body of persons. According to its use cases (at least 20cm) the power density at that distance can be estimated by the following formula for plane-wave equivalent conditions (far-field conditions), when ground reflection is neglected.

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

where: $S = power density (mW/cm^2 or W/m^2)$

P = power input to the antenna (mW or W)

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 (cm or m)

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5 **Evaluation**

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5.1 Analysis to Exclude Routine RF Exposure evaluation for Stand Alone Operation and Simultaneous transmission.

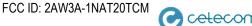
| Band | Lowest frequency [MHz] | Max.Power*1 [W] | EIRP*2 | EIRP*2 [dBm] | FCC EIRP limit [dBm] | @ 23 cm [W/m ²] | FCC Limit [W/m²] | Percentage of limit used | Verdict |
|--------------------|---------------------------|--------------------------|---------------|-----------------|----------------------------|--------------------------------|------------------|------------------------------------|----------|
| GSM 850 | 824.2 | 0.865 | 3.258 | 35.13 | 33.90 | 4.90 | 5.49 | 89.20 | Complies |
| GSM 1900 | 1852.2 | 0.460 | 1.079 | 30.33 | 36.90 | 1.62 | 10.00 | 16.23 | Complies |
| Band | Lowest frequency [MHz] | Max.Power [W] | EIRP [W] | EIRP [dBm] | FCC EIRP limit [dBm] | @ 23 cm [W/m2] | FCC Limit [W/m2] | Percentage of limit used [%] | Verdict |
| UMTS II | 1852.4 | 0.279 | 0.653 | 28.15 | 36.90 | 0.98 | 10.00 | 9.83 | Complies |
| UMTS IV | 1712.4 | 0.272 | 0.638 | 28.05 | 36.90 | 0.96 | 10.00 | 9.60 | Complies |
| UMTS V | 826.4 | 0.276 | 1.26 | 31.01 | 33.90 | 1.90 | 5.51 | 34.45 | Complies |
| LTE 2 | 1860.0 | 0.210 | 0.492 | 26.92 | 36.90 | 0.74 | 10.00 | 7.40 | Complies |
| LTE 4 | 1720.0 | 0.203 | 0.475 | 26.77 | 36.90 | 0.72 | 10.00 | 7.15 | Complies |
| LTE 5 | 825.5 | 0.208 | 1.045 | 30.19 | 33.90 | 1.57 | 5.50 | 28.56 | Complies |
| LTE 7 | 2560.0 | 0.267 | 0.627 | 27.97 | 36.90 | 0.94 | 10.00 | 9.43 | Complies |
| LTE 12 | 699.70 | 0.219 | 1.099 | 30.41 | 33.90 | 1.65 | 4.67 | 35.40 | Complies |
| LTE 13 | 799.50 | 0.208 | 1.042 | 30.18 | 33.90 | 1.57 | 5.20 | 30.17 | Complies |
| LTE 66 | 1711.50 | 0.207 | 0.485 | 26.86 | 36.90 | 0.73 | 10.00 | 7.30 | Complies |
| Band | Lowest frequency [MHz] | Max.Power MIMO [W] | EIRP*3 [W] | EIRP*3 [dBm] | FCC EIRP limit [dBm] | @ 23 cm [W/m2] | FCC Limit [W/m2] | Percentage of limit used [%] | Verdict |
| Wi-Fi 2.4 | 2412.0 | 0.056 | 0.374 | 25.72 | 36.90 | 0.56 | 10.00 | 5.62 | Complies |
| Wi-Fi 5 UNII-1 | 5180.0 | 0.045 | 0.244 | 23.87 | 36.90 | 0.37 | 10.00 | 3.67 | Complies |
| Wi-Fi 5 UNII-2a | 5260.0 | 0.047 | 0.255 | 24.07 | 36.90 | 0.38 | 10.00 | 3.84 | Complies |
| Wi-Fi 5 UNII-2c | 5500.0 | 0.043 | 0.233 | 23.67 | 36.90 | 0.35 | 10.00 | 3.50 | Complies |
| Wi-Fi 5 UNII-3 | 5755.0 | 0.095 | 0.521 | 27.17 | 36.90 | 0.78 | 10.00 | 7.84 | Complies |

^{*1:} GSM Power corrected for 50% duty cycle (4 Timeslot)

^{*2:}GSM850 E(I)RP value is corrected for cable loss @ 836 MHz ≈ 1.24 dB for 10 feet cable loss; based on BELDEN RG-58 9310 cable technical specification document.

^{*3:} Corrected for directional gain.

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The single radios are exempt from routine environmental evaluation.

- Calculation made for 23 cm.
- Evaluations are based on EIRP measured or calculated from known gain and conducted output power.
- Cellular can transmit simultaneously with Wi-Fi 2.4 GHz or Wi-Fi 5 GHz.

Conclusion:

• The worst-case simultaneous transmission is GSM850 simultaneous with Wi-Fi 5 GHz UNII-3, which is using 97.04% of a limit of 100 %. The equipment is passing RF exposure requirements for 23cm distance.

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Revision History 6

| Date | Report Name | Changes to report | Report prepared by |
|-----------|----------------------------------|--|--------------------|
| 5/6/2021 | EMC_RIVIA_008_21001_FCC_MPE | Initial Version | Issa Ghanma |
| 5/21/2021 | EMC_RIVIA_008_21001_FCC_MPE_Rev1 | Section 5.1: Apply 50% duty cycle for GSM850/GSM1900. Account for cable loss for GSM850 E(I)RP | Issa Ghanma |

<<< The End >>>