



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



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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

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

Responsible for the Report:

5/21/2021	Compliance	Ghanma, Issa (EMC Engineer)	
Date	Section	Name	Signature

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
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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	-----

3 Equipment under Assessment

Model No:	Telematics Control Module
FCC ID:	2AW3A-1NAT20TCM
Power Supply/ Rated Operating Voltage Range:	Low 9.9 V DC, Nominal 13.5 V DC, High 16.0 V DC
Integrated Module Info:	<ul style="list-style-type: none"> ❖ WLAN (Wi-Fi 2.4, 5 GHz) , Bluetooth BDR/EDR: <ul style="list-style-type: none"> • FCC ID : XPYJODYW167 • Name / Number : UBLOX / JODY-W1 <ul style="list-style-type: none"> ▪ Wi-Fi 2.4 and 5 GHz : 802.11 a/b/g/n/h/ac ▪ Bluetooth BDR/EDR : Disabled. <u>See Note 1</u> ❖ Cellular Module: <ul style="list-style-type: none"> • Name / Number : ALAS5-AM • FCC ID : QIPALAS5-AM ❖ GPS/GNSS: <ul style="list-style-type: none"> • UBLOX NEO - M8L - 04A Standalone GNSS receiver • GEMALTO AIAS5 – GNSS receiver module integrated with the cellular modem.
Regulatory Band:	<ul style="list-style-type: none"> ❖ WLAN (Wi-Fi 2.4, 5 GHz) , Bluetooth BDR/EDR: <ul style="list-style-type: none"> • Wi-Fi 2.4 GHz : Channels 1 – 11 • Wi-Fi 5 GHz : <ul style="list-style-type: none"> ▪ UNII-1 5150 – 5250 : Channels 36 – 48 ▪ UNII-2a 5250 – 5350 : Channels 52 – 64 ▪ UNII-2c 5470 – 5725 : Channels 100 – 140 ▪ UNII-3 5725 – 5850 : Channels 149 – 165 • Bluetooth BDR/EDR : Disabled. <u>See Note 1</u> ❖ Cellular Module: <ul style="list-style-type: none"> • 4G – LTE: Bands 2, 4, 5, 7, 12, 13, 66 • 3G – UMTS/WCDMA: Bands II, IV, V • 2G – GSM: 850, 1900
Maximum Conducted Output Power (dBm):	<ul style="list-style-type: none"> ❖ WLAN (Wi-Fi 2.4, 5 GHz) , Bluetooth BDR/EDR: <ul style="list-style-type: none"> • Wi-Fi 2.4 GHz : 17.5 • Wi-Fi 5 GHz : <ul style="list-style-type: none"> ▪ UNII-1 : 16.5 ▪ 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

<p>Antenna Type and Peak gain:</p>	<ul style="list-style-type: none"> ❖ WLAN (Wi-Fi 2.4, 5 GHz) , Bluetooth BDR/EDR: <ul style="list-style-type: none"> • Wi-Fi 2.4/5 GHz : Antenna 1 (Spoiler) <ul style="list-style-type: none"> ▪ Type : External ▪ Manufacturer : TE ▪ Rivian part number : PT00039248 ▪ TE part number : 955-012-201 ▪ Maximum Gain : <ul style="list-style-type: none"> ○ @2430 MHz : 4.1 dBi ○ @5100 MHz : 3.9 dBi • Wi-Fi 2.4/5 GHz : Antenna 2 (Front) <ul style="list-style-type: none"> ▪ Type : External ▪ Manufacturer : TE ▪ Rivian part number : PT00014349 ▪ TE part number : 956-012-001 ▪ Maximum Gain : <ul style="list-style-type: none"> ○ @2420 MHz : 6.2 dBi ○ @5400 MHz : 4.8 dBi • Bluetooth BDR/EDR : Disabled. See Note 1 ❖ Cellular Module: <ul style="list-style-type: none"> • External: LTE Main <ul style="list-style-type: none"> ▪ Rivian Part number : PT00039249 ▪ TE Part Number : 955-922-501 ▪ Maximum Gain : <ul style="list-style-type: none"> ○ 738 MHz : 7.0 dBi ○ 2315 MHz : 3.7 dBi • External: LTE Diversity (Rx only) <ul style="list-style-type: none"> ▪ Rivian Part Number : PT00039250 ▪ TE Part Number : 955-922-401 ▪ Maximum Gain: <ul style="list-style-type: none"> ○ 663 MHz : 2.5 dBi ○ 2710 MHz : 6.1 dBi
<p>Sample Revision:</p>	<p><input type="checkbox"/> Prototype Unit; <input type="checkbox"/> Production Unit; <input checked="" type="checkbox"/> Pre-Production</p>

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):

FCC

Frequency Range (MHz)	Power density (mW/cm ²)	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/cm² or W/m²)

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)

5 Evaluation

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 [W]	EIRP* ² [dBm]	FCC EIRP limit [dBm]	@ 23 cm [W/m ²]	FCC Limit [W/m ²]	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/m ²]	FCC Limit [W/m ²]	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/m ²]	FCC Limit [W/m ²]	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 \approx 1.24 dB for 10 feet cable loss; based on BELDEN RG-58 9310 cable technical specification document.

*3: Corrected for directional gain.

- 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.**

6 Revision History

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: <ul style="list-style-type: none">○ Apply 50% duty cycle for GSM850/GSM1900.○ Account for cable loss for GSM850 E(I)RP	Issa Ghanma

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