Radio Frequency Exposure Evaluation Report

FOR:
Motive Technologies, Inc.

Model Name:
LBB-3.6CA-b

Product Description:
LBB-3.6CA-b is a Vehicle Gateway. Its purpose is to act as the primary gateway between various pieces of hardware and software in a motor vehicle and the Motive Technologies database back-end in the cloud.

FCC ID: 2AQM7-36B
IC: 24516-36B

Applied Rules and Standards:
CFR Part Part1 (1.1307 &1.1310), Part 2 (2.1091),
FCC KDB 447498 D01 General RF Exposure Guidance v06
ISED RSS-102 Issue 5

Report number: EMC_KPTRK-036-23001_FCC_ISED_MPE

DATE: 2-28-2023

CETECOM **Inc.**
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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 Part 1 (1.1307 &1.1310), Part 2 (2.1091) and ISED standard RSS-102 issue 5 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 is calculated respectively, where relevant.

The device meets the limits as stipulated by the above given FCC and ISED rule parts based on available specifications for worst-case conditions at 20 cm distance to the body.

Company	Description	Model #
Motive Technologies, Inc.	LBB-3.6CA-b is a Vehicle Gateway. Its purpose is to act as the primary gateway between various pieces of hardware and software in a motor vehicle and the Motive Technologies database back-end in the cloud.	LBB-3.6CA-b

Report reviewed by: TCB Evaluator

Date	Section	Name	Signature
2-28-2023	Compliance	Arndt Stoecker (Director of Regulatory Services)	Arndt Stoecker Digitally signed by: Arndt Stoecker DN: CN = Arndt Stoecker email = arndt.stoecker@cetecom.com C = US O = CETECOM Inc Date: 2023.03.01 17:55:29 -08'00'

Responsible for the Report:

Date	Section	Name	Signature
2-28-2023	Compliance	Kris Lazarov (Test Engineer)	Kris Lazarov Digitally signed by Kris Lazarov Date: 2023.03.01 17:21:00 -08'00'

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
Director of Regulatory Services:	Arndt Stoecker
Responsible Project Leader:	Akanksha Baskaran

2.2 Identification of the Client / Manufacturer

Client's Name:	Motive Technologies, Inc.
Street Address:	55 Hawthorne Street #400
City/Zip Code	San Francisco, California 94105
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Client
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment under Assessment

Marketing name:	LBB-3.6CA-b
HW Version :	3
SW Version :	75012
Hardware Version Identification Number (HVIN):	LBB-3.6CA-b
Product Marketing Name (PMN):	Vehicle Gateway
Regulatory Band:	❖ **Cellular Module:** ▪ WCDMA/UMTS FDD BAND II: 1852.4 ~ 1907.6 MHz ▪ WCDMA/UMTS FDD BAND IV: 1712.4 ~ 1752.6 MHz ▪ WCDMA/UMTS FDD BAND V: 826.4 ~ 846.6 MHz ▪ LTE BAND 2: 1850 ~ 1910 MHz ▪ LTE BAND 4: 1710 ~ 1755 MHz ▪ LTE BAND 5: 824 ~ 849 MHz ▪ LTE BAND 12: 699 ~ 716 MHz ▪ LTE BAND 13: 777 ~ 787 MHz ❖ **BT:** ▪ Nominal band: 2400 MHz – 2483.5 MHz ▪ Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 78), 79 Channels ❖ **WLAN :** ▪ Nominal band: 2400 MHz – 2483.5 MHz; ▪ Center to center: 2412 MHz (ch 1) – 2462 MHz (ch 11), 11 channels
Integrated Module Info:	❖ **WCDMA, LTE** ▪ Manufacture: Sierra Wireless ▪ Module name/number: RC7612 ▪ FCC ID: N7NRC76C ▪ IC: 2417C-RC76C ❖ **WLAN, BT** ▪ Manufacture: Laird Connectivity ▪ Module name/number: LSR 450-0159R ▪ FCC ID: TFB-1003 ▪ IC: 5969A-1003
Antenna Type:	❖ **Cellular:** ▪ Model Name : WCDMA/LTE Main Antenna ▪ Part No. : WAG F LTE12 00 077 ▪ Type & Gain : Inverted–F Antenna (IFA), Max Gain 2.51dBi ❖ **BT, WLAN:** ▪ Model Name : LTE Diversity with GPS & Wi-Fi Antenna ▪ Part No. : WA-C2-LTAE12LBG1-12-001 ▪ BT/WiFi Type & Gain: Inverted F Antenna (IFA), 2.59 dBi
Maximum Conducted Output Power:	❖ **Cellular:** From operational description: ▪ WCDMA Band II: 24 dBm ▪ WCDMA Band IV: 24 dBm ▪ WCDMA Band V: 24 dBm ▪ LTE Band 2: 24 dBm ▪ LTE Band 4: 24 dBm ▪ LTE Band 5: 24 dBm ▪ LTE Band 12: 24 dBm ▪ LTE Band 13: 24 dBm ❖ **BT:** From modular grant: 7.8 mW ❖ **WLAN:** From operational description: 14 dBm
Power Supply/ Rated Operating Voltage Range:	Vmin: 6 VDC/ Vnom: 12 VDC / Vmax: 32 VDC
Operating Temperature Range:	Low -20ºC, Nominal 20ºC, High 85ºC
Sample Revision:	☐Prototype Unit; ☐Production Unit; ■Pre-Production

4 RF Exposure Evaluation Methods

4.1 RF Exposure Test Exemptions for Single Source

4.1.1 FCC § 2.1091 Radiofrequency radiation exposure evaluation: mobile devices.

Single RF sources as defined in paragraph (b)(2) of FCC § 2.1091 is exempt if the ERP (watts) is no more than the calculated value prescribed for that frequency. General frequency and separation-distance dependent MPE-based effective radiated power ERP thresholds are in Table B.1 [Table 1 of § 1.1307(b)(3)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

TABLE B.1—THRESHOLDS FOR SINGLE RF SOURCES
SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	–	1.34	159 m	–	35.6 m	1,920 R^2
1.34	–	30	35.6 m	–	1.6 m	3,450 R^2/f^2
30	–	300	1.6 m	–	159 mm	3.83 R^2
300	–	1,500	159 mm	–	31.8 mm	0.0128 R^2f
1,500	–	100,000	31.8 mm	–	0.5 mm	19.2R2
Subscripts L and H are low and high; λ is wavelength. From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.						

4.1.2 Exemption Limits for Routine Evaluation to RSS-102 2.5.2

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $1.31 \times 10^{-2}\ f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

4.2 RF Exposure Test Exemptions for Simultaneous Transmission Sources

Multiple RF sources are exempt if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation:

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Where:
a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(B) of this section for P_{th}, including existing exempt transmitters and those being added.
b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.
c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.
P_i = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source *i* at a distance between 0.5 cm and 40 cm (inclusive).
$P_{th,i}$ = the exemption threshold power (P_{th}) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source *i.*
ERP_j = the ERP of fixed, mobile, or portable RF source *j.*
$ERP_{th,j}$ = exemption threshold ERP for fixed, mobile, or portable RF source *j,* at a distance of at least λ/2π according to the applicable formula of paragraph (b)(3)(i)(C) of this section.
$Evaluated_k$ = the maximum reported SAR or MPE of fixed, mobile, or portable RF source *k* either in the device or at the transmitter site from an existing evaluation at the location of exposure.
$Exposure\ Limit_k$ = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source *k,* as applicable from § 1.1310 of this chapter.

4.3 RF Exposure evaluation flow chart

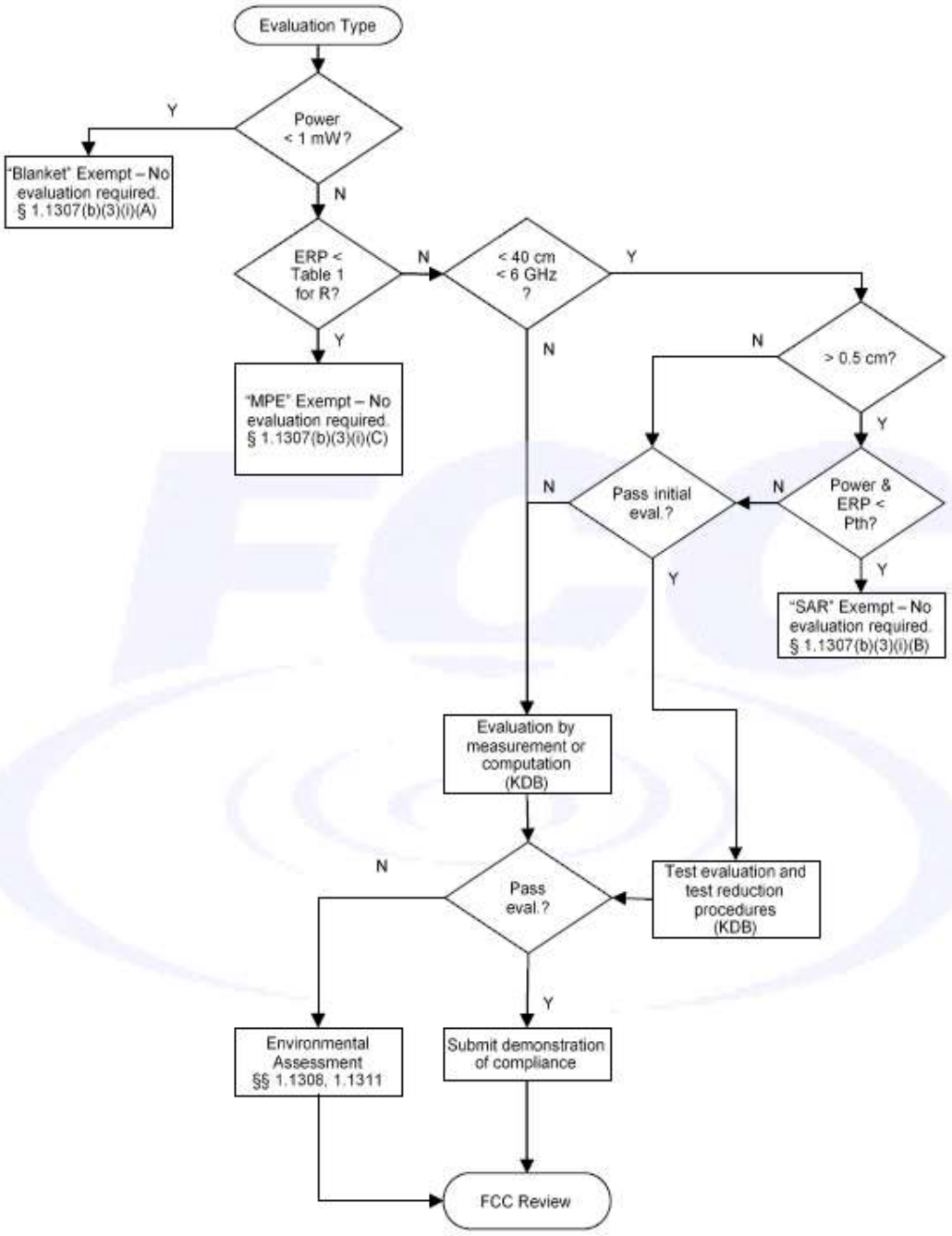

Figure A.1 – General Sequence for Determination of Procedure (exemption or evaluation) to Establish Compliance with Exposure Limits for a Single RF Source[39]

5. Evaluations

5.1. RF Exposure Test Exemptions for Single Source

Compliance with FCC Table 1 of § 1.1307(b)(3)(i)(C) and RSS-102 2.5.2 exemption limits								
Band of Operation	**Frequency (GHz)**	**ERP (mW)**	**EIRP (mW)**	**FCC Pth Threshold (mW)**	**ISED Threshold EIRP (mW)**	**FCC ERP/PTH Ratio**	**ISED EIRP / Limit Ratio**	**MPE Exempt No evaluation required Ratios < 1**
FDD II	1.85	445.6	447.7	3060.00	2240	0.15	0.20	Yes
FDD IV	1.71	445.6	447.7	3060.00	2120	0.15	0.21	Yes
FDD V	0.824	445.6	447.7	1680.96	1290	0.27	0.35	Yes
LTE 2	1.85	445.6	447.7	3060.00	2240	0.15	0.20	Yes
LTE 4	1.71	445.6	447.7	3060.00	2120	0.15	0.21	Yes
LTE 5	0.824	445.6	447.7	1680.96	1290	0.27	0.35	Yes
LTE 12	0.699	445.6	447.7	1425.96	1150	0.31	0.39	Yes
LTE 13	0.777	445.6	447.7	1585.08	1240	0.28	0.36	Yes
Wi-Fi	2.4	43.5	45.6	3060.00	2675	0.014	0.02	Yes
BT	2.4	11.9	14	3060.00	2675	0.004	0.005	Yes

Note: All calculations are with the manufacturer declared distance R = 20 cm minimum separation between the antenna and the human body.

Conclusion:

- The maximum RF emissions from this equipment fulfills the MPE exclusion threshold limits for separation distance between the antenna and the human body greater than 20 cm. No MPE evaluation is required.

5.2. RF Exposure Test Exemptions for Simultaneous Transmission Sources

- Theoretically, the worst case of simultaneous transmission is with the LTE and Wi-Fi transmitters operating at the highest output power mode, within the nearest frequency bands (Wi-Fi 2.4 + LTE B2).

Regulation Authority	Applicable Simultaneous Transmission Sources	Sum of the ratios of the applicable terms	Limit	MPE Exempt No evaluation required
FCC	Wi-Fi + LTE B12	0.014 + 0.31 = 0.324	< 1	Yes
ISED	Wi-Fi + LTE B12	0.02 + 0.39 = 0.41	< 1	Yes

Note:

Conclusion:

- The equipment is excluded from simultaneous transmission MPE test.

5 Revision History

Date	Report Name	Changes to report	Prepared by
2-28-2023	EMC_KPTRK-036-23001_FCC_ISED_MPE	Initial Release	Kris Lazarov

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