Radio Frequency Exposure Evaluation Report

For:
Motive Technologies, Inc.

Model No:
ES-2

PMN:
Environmental Sensor ES-2

Product Description:
Environmental Sensor, will gather temperature and humidity data and broadcast it via BLE to companion device

FCC ID: 2AQM7-ES2
IC ID: 24516-ES2

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

Report name: EMC_KPTRK-029-22001_FCC_ISED_MPE

DATE: 2022-05-10

ACCREDITED
TESTING LABORATORY
Certificate #2135.01

***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 IC 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 IC rule parts based on available specifications for worst case conditions at 20cm distance to the body.

Company	Description	Model #
Motive Technologies, Inc.	Environmental Sensor, will gather temperature and humidity data and broadcast it via BLE to companion device	ES-2

Report reviewed by: TCB Evaluator

Date	Section	Name	Signature
2022-05-10	Compliance	Kevin Wang (EMC Lab Manager)	kevin.wang@cetecom.com Digitally signed by: kevin.wang@cetecom.com DN: CN = kevin.wang@cetecom.com Date: 2022.05.12 09:49:24 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2022-05-10	Compliance	Cheng Song (EMC Engineer)	cheng.song@cetecom.com Digitally signed by: cheng.song@cetecom.com DN: CN = cheng.song@cetecom.com Date: 2022.05.10 18:02:01 -07'00'

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
Lab Manager:	Kevin Wang
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

Identification of the Manufacturer

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

3 Equipment under Assessment

Model No:	ES-2
HW Version :	1
SW Version :	1
FCC-ID :	2AQM7-ES2
IC-ID:	24516-ES2
PMN:	Environmental Sensor ES-2
Product Description:	Environmental Sensor, will gather temperature and humidity data and broadcast it via BLE to companion device
Radio Information:	**Bluetooth Low Energy (BLE):** • Module Name: Nordic NRF52833 • Module Number: NRF52833-QIAA-R • Modes of operation: LE 1 Mbps & LE 2 Mbps in advertising mode.
Antenna Information:	**Main Antenna:** • Type: Inverted-F Antenna (IFA) • Location: Internal • Maximum Gain: 5.2 dBi • Frequency Band: 2.4 GHz ISM
Max. Peak Output Power:	Conducted Power 8.48 dBm
Power Supply/ Rated Operating Voltage Range:	muRata CR2477X coin cell, 3 volts (operates down to 2 volts)
Operating Temperature Range	-40 ºC to 85 ºC
Sample Revision	☐Prototype Unit; ☐Production Unit; ■Pre-Production

4 RF Exposure Limits and FCC and IC Basic Rules

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

4.1 Power Density Limits acc. to FCC 1.1310(e) / RSS-102 i5, cl. 4:

FCC

Frequency Range (MHz)	Power density (mW/cm²)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100000	1.0	30

IC

300 – 6000	0.02619 x f (MHz) $^{0.6834}$	6

4.2 Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.1091(c) / RSS-102, cl. 2.5 (rounded to 1 decimal point):

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

IC
300MHz < = operating frequency < 6 GHz: excluded if EIRP < 0.0131 x f (MHz) $^{0.6834}$ W

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 Evaluations

5.1 Analysis of RF Exposure for simultaneous transmission

- Evaluations are based on worst case power density limits for Canada.
- Calculations are made for 20cm.
- Evaluations are based on ERP/EIRP measured or calculated from known gain and conducted output power.

Radio	freq MHz	MaxPower W conducted	MaxPower convert to dBm	Ant Gain dbi	Ant Gain lin	EIRP W calculated	Max Duty Cycle	IC W/m2	FCC W/m2	Actual W/m2	How much of IC limit is used up	How much of FCC limit is used up
BLE	2400	0.007	8.480	5.2	3.31	0.023	100.00%	5.348	10.000	0.046	0.86%	0.46%
									Distance(m)=	0.200		

Note： The calculation is based on the distance of 20cm

5.2 Conclusion:

The worst-case transmission is BLE, which is using 0.46% of FCC limit and 0.86% of IC limit. The equipment is passing RF exposure requirements for 20cm distance.

6 Revision History

Date	Report Name	Changes to report	Prepared by
2022-05-10	EMC_KPTRK-029-22001_FCC_ISED_MPE	Initial Release	Cheng Song

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