

TEST REPORT

Applicant: Motive Technologies, Inc.
Address: 55 Hawthorne St. Suite #400, San Francisco, CA 94105
Equipment Type: Engine Immobilizer
Model Name: ENGIMM-01
Brand Name: Motive
FCC ID: 2AQM7-EI1
Test Standard: 47 CFR Part 2.1091
KDB 447498 D01 v07
Sample Arrival Date: Dec. 20, 2023
Test Date: Dec. 26, 2023 - Jan. 04, 2024
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ISSUED BY:

Kunshan Balun Communications Technology Co., Ltd.

Tested by: Yang Wenting **Checked by:** Huang Chengkun **Approved by:** Zhang Yanqing
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Yang Wenting

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Revision History		
Version	Issue Date	Revisions Content
<u>Rev. 01</u>	<u>Jan. 16, 2024</u>	<u>Initial Issue</u>

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1 GENERAL INFORMATION

1.1 Test Laboratory

Name	Kunshan Balun Communications Technology Co., Ltd.
Address	Room 101, Building 5, No. 1689, Zizhu Road, Yushan, Kunshan, Jiangsu, China

1.2 Test Location

Name	Kunshan Balun Communications Technology Co., Ltd.
Location	Room 101, Building 5, No. 1689, Zizhu Road, Yushan, Kunshan, Jiangsu, China

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Motive Technologies, Inc.
Address	55 Hawthorne St. Suite #400, San Francisco, CA 94105

2.2 Manufacturer Information

Manufacturer	Motive Technologies, Inc.
Address	55 Hawthorne St. Suite #400, San Francisco, CA 94105

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	Engine Immobilizer
Model Name Under Test	ENGIMM-01
Series Model Name	N/A
Description of Model name differentiation	N/A
Sample No.	SC-EC23B0740-S08
Hardware Version	V1.01
Software Version	R00A01V16
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Technical Information

Network and Wireless connectivity	2G Network GPRS/EGPRS 850/ 900/ 1800/ 1900 MHz; 4G Network FDD LTE-M1 Band 1/2/3/4/5/8/12/13/18/19/20/25/27/28/66 /85; FDD NB-IoT Band 1/2/3/4/5/8/12/13/18/19/20/25/28/71/66 /85 GPS, GLONASS, Beidou
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The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	WWAN		
Frequency Range	LTE-M1 B2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	LTE-M1 B4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	LTE-M1 B5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE-M1 B12	TX: 699 ~ 716 MHz	RX: 729 ~ 746 MHz
	LTE-M1 B13	TX: 777 ~ 787 MHz	RX: 746 ~ 756 MHz
	LTE-M1 B25	TX: 1850 ~1915 MHz	RX: 1930 ~ 1995 MHz
	LTE-M1 B66	TX: 1710 ~ 1780 MHz	RX: 2110 ~ 2200 MHz
	LTE-M1 B85	TX: 698 ~ 716 MHz	RX:728 ~ 746 MHz
	NB-IoT B2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	NB-IoT B4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	NB-IoT B5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	NB-IoT B12	TX: 699 ~ 716 MHz	RX: 729 ~ 746 MHz
	NB-IoT B13	TX: 777 ~ 787 MHz	RX: 746 ~ 756 MHz
	NB-IoT B25	TX: 1850 ~1915 MHz	RX: 1930 ~ 1995 MHz
	NB-IoT B66	TX: 1710 ~ 1780 MHz	RX: 2110 ~ 2200 MHz
	NB-IoT B71	TX: 663 ~ 698 MHz	RX:617 ~ 652 MHz
	NB-IoT B85	TX: 698 ~ 716 MHz	RX:728 ~ 746 MHz
Antenna Type	WWAN	PIFA	
Exposure Category	General Population/Uncontrolled Exposure		
EUT Stage	Portable Device		

3 SUMMARY OF TEST RESULT

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2.1091	Radiofrequency radiation exposure evaluation: mobile devices
2	KDB 447498 D01 v07	KDB 447498 D01 General RF Exposure Guidance

4 DEVICE CATEGORY AND LEVELS LIMITS

Mobile Device:

CFR Title 47 §2.1091(b)

(b) For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

FCC KDB 447498 D01 General RF Exposure Guidance v07 Limit

Devices operating in standalone mobile exposure conditions may contain a single transmitter or multiple transmitters that do not transmit simultaneously. A minimum test separation distance ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons to apply mobile device exposure limits. The distance must be fully supported by the operating and installation configurations of the transmitter and its antenna(s), according to the source-based time-averaged maximum power requirements of § 2.1091(d)(2). In cases where cable losses or other attenuations are applied to determine compliance, the most conservative operating configurations and exposure conditions must be evaluated. The minimum test separation distance required for a device to comply with mobile exposure conditions must be clearly identified in the installation and operating instructions, for all installation and exposure conditions, to enable users and installers to comply with RF exposure requirements. For mobile devices that have the potential to operate in portable device exposure conditions, similar to the configurations described in § 2.1091(d)(4), a KDB inquiry is required to determine the SAR test requirements for demonstrating compliance.

When the categorical exclusion provision of § 2.1091(c) applies, the minimum test separation distance may be estimated, when applicable, by simple calculations according to plane-wave equivalent conditions, to ensure the transmitter and its antenna(s) can operate in manners that meet or exceed the estimated distance. The source-based time-averaged maximum radiated power, according to the maximum antenna gain, must be applied to calculate the field strength and power density required to establish the minimum test separation distance. When the estimated test separation distance becomes overly conservative and does not support compliance, MPE measurement or computational modeling may be used to determine the required minimum separation distance.

According to FCC Part 1.1307, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the commission's guidelines.

Limits for General Population/ Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength(E)(V/m)	Magnetic Field Strength (H)(A/m)	Power Density (S)(mW/cm ²)
0.3-1.34	614	1.63	(100)*
1.34-30	824/f	2.19/f	(180/f ²)*
30-300	27.5	0.073	0.2
300-1500			f/1500
1500-100,000			1.0

MPE calculation formula

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

P = output power (mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = Separation distance between radiator and human body (cm)

5 ASSESSMENT RESULT

5.1 Output Power

GSM		
Mode	GPRS850	GPRS1900
Conducted Power (dBm)	33.21	30.95
Antenna Gain (dBi)	-2.0	-1.5
EIRP/ ERP (dBm)	29.06	29.45

Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC23B1098-501 for more details.

LTE-M1					
Mode	Band 2	Band 4	Band 5	Band 12	Band 13
Conducted Power (dBm)	22.07	21.55	22.92	22.49	22.41
Antenna Gain (dBi)	-1.5	-1.0	-2.0	-3.0	-2.5
EIRP/ ERP (dBm)	20.57	20.55	18.82	17.34	17.76
Mode	Band 25	Band 66	Band 85	/	/
Conducted Power (dBm)	21.99	22.46	22.42	/	/
Antenna Gain (dBi)	-1.5	-1.0	-3.0	/	/
EIRP/ ERP (dBm)	20.49	21.46	17.27	/	/

NB-IoT					
Mode	Band 2	Band 4	Band 5	Band 12	Band 13
Conducted Power (dBm)	22.30	22.01	21.94	22.28	22.25
Antenna Gain (dBi)	-1.5	-1.0	-2.0	-3.0	-2.5
EIRP/ ERP (dBm)	20.80	21.01	17.79	17.13	17.60
Mode	Band 25	Band 66	Band 71	Band 85	/
Conducted Power (dBm)	21.91	21.78	21.36	21.78	/
Antenna Gain (dBi)	-1.5	-1.0	-3.8	-3.0	
EIRP/ ERP (dBm)	20.41	20.78	15.41	16.63	/

Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC23B1098-501 for more details.

5.2 Turn-up power

Mode		Conducted Power Range
GSM	GPRS 850	30.50-33.50
	GPRS 1900	28.00-31.0
LTE-M1	Band 2	20.00-23.00
	Band 4	20.00-23.00
	Band 5	20.00-23.00
	Band 12	20.00-23.00
	Band 13	20.00-23.00
	Band 25	20.00-23.00
	Band 66	20.00-23.00
	Band 85	20.00-23.00
NB-IoT	Band 2	20.00-23.00
	Band 4	20.00-23.00
	Band 5	20.00-23.00
	Band 12	20.00-23.00
	Band 13	20.00-23.00
	Band 25	20.00-23.00
	Band 66	20.00-23.00
	Band 71	20.00-23.00
	Band 85	20.00-23.00

5.3 RF Exposure Evaluation Result

Evolution mode	Maximum peak output power (dBm)	Antenna Gain (typical) (dBi):	Total Power (mw)	Distance (cm)	Limit of Power Density (mW/cm ²)	Power Density (mW/cm ²)	Verdict
GPRS 850	33.50	-2.0	860.99	20	0.549	0.171	Pass
GPRS 1900	31.00	-1.5	891.25	20	1.000	0.177	Pass
LTE-M1 Band 2	23.00	-1.5	141.25	20	1.000	0.028	Pass
LTE-M1 Band 4	23.00	-1.0	158.49	20	1.000	0.032	Pass
LTE-M1 Band 5	23.00	-2.0	76.74	20	0.549	0.015	Pass
LTE-M1 Band 12	23.00	-3.0	60.95	20	0.466	0.012	Pass
LTE-M1 Band 13	23.00	-2.5	68.39	20	0.518	0.014	Pass
LTE-M1 Band 25	23.00	-1.5	141.25	20	1.000	0.028	Pass
LTE-M1 Band 66	23.00	-1.0	158.49	20	1.000	0.032	Pass
LTE-M1 Band 85	23.00	-3.0	60.95	20	0.465	0.012	Pass
NB-IoT Band 2	23.00	-1.5	141.25	20	1.000	0.028	Pass
NB-IoT Band 4	23.00	-1.0	158.49	20	1.000	0.032	Pass
NB-IoT Band 5	23.00	-2.0	76.74	20	0.549	0.015	Pass
NB-IoT Band 12	23.00	-3.0	60.95	20	0.466	0.012	Pass
NB-IoT Band 13	23.00	-2.5	68.39	20	0.518	0.014	Pass
NB-IoT Band 25	23.00	-1.5	141.25	20	1.000	0.028	Pass
NB-IoT Band 66	23.00	-1.0	158.49	20	1.000	0.032	Pass
NB-IoT Band 71	23.00	-3.8	50.70	20	0.442	0.010	Pass
NB-IoT Band 85	23.00	-3.0	60.95	20	0.465	0.012	Pass

5.4 Conclusion

This EUT is deemed to comply with the reference level limits , therefore the basic restrictions are compliant with human exposure limits.

Statement

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--END OF REPORT--