



RF EXPOSURE EXEMPTION REPORT

FCC Part 1 Subpart I
FCC Part 2 Subpart J
RSS 102 ISSUE 5

For
Electric Bicycle

FCC ID: 2AUQP-EB16MM
IC Certification ID: IC:25514- EB16MM
Model Name: Merge and Meld

Report Number: 13001719-S1V4
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REVISION HISTORY

Rev.	Date	Revisions	Revised By
V1	12/9/2019	Initial Issue	--
V2	12/18/2019	Removed references to LTE Band 41	Dave Weaver
V3	1/14/2020	Removed references to LTE Band 7 Updated antenna gains	Dave Weaver
V4	1/29/2020	Section 5.3 – Replaced photograph of eBike with a drawing	Dave Weaver

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1. ATTESTATION OF TEST RESULTS

Applicant Name	General Motors LLC
FCC ID	2AUQP-EB16MM
IC Certification ID	IC:25514- EB16MM
Model Name	Merge and Meld
Applicable Standards	FCC Part 1 Subpart I FCC Part 2 Subpart J RSS 102 ISSUE 5
Test Results	Pass
UL Verification Services Inc. assessed the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment assessed is capable of demonstrating compliance with the requirements as documented in this report.	
The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components.	
This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.	
Approved & Released By: 	
Dave Weaver Operations Leader UL Verification Services Inc.	

2. TEST METHODOLOGY

All calculations/exemptions were made in accordance with

- FCC Parts 1.1310, 2.1091, 2.1093
- KDB 447498 D01 v06
- KDB 447498 D03 V01
- IEEE Std C95.1-2005
- IEEE Std C95.3-2002
- IC Safety Code 6
- RSS 102 Issue 5.

3. REFERENCES

Output power, Duty cycle and Antenna gain data is excerpted from product documentation provided by the applicant.

4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

5. Device Under Test (DUT) Information

5.1. DUT Description

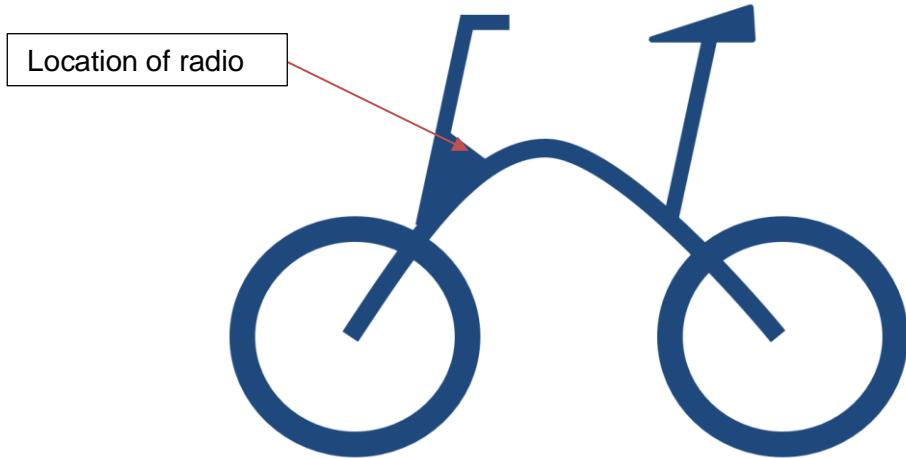
Device Dimension	Overall (Length x Width): NA The DUT an electric bicycle.
Battery Options	The rechargeable battery is not user accessible.
Hardware Version	Display PCB - rev 6.1; Tracker PCBA – rev 4.2
Software Version	Display – 4611815; Tracker – 5421207

5.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode
W-CDMA (UMTS)	Band II Band V	UMTS Rel. 99 HSDPA (Rel. 5) HSUPA (Rel. 6)
LTE	FDD Band 2 FDD Band 4 FDD Band 5 FDD Band 17	QPSK 16QAM Rel. 10 Does not support Carrier Aggregation (CA)
BLE	2.45GHz	Version 4.1

5.3. SAR test exclusion Rationale

The DUT is an electric bicycle (eBike) that supports a radio module mounted in the display module on the frame just below the handlebars. The location is the same for the two models, Merge and Meld.



There are two scenarios that result in a transmission from the licensed radio.

1. Startup – The licensed transmitter only transmits briefly during start up. The message length is about 7 kB.
2. Parking mode – If the user places the eBike into parking mode the eBike will transmit only if its onboard accelerometer detects movement. This is an anti-theft mechanism. A warning message will be sent to the user's phone. This is repeated every thirty seconds or until no movement has been detected for 10 minutes after which the radio is disabled. The repetition rate is coded into the eBike's operating firmware. The message length is also about 7 kB.

Of the two scenarios the user is very unlikely to be starting up the eBike more than once every few minutes. If SAR exclusion can be demonstrated for parking mode then this represents the worst case scenario.

Assuming a 3G upload data rate of 384kb/s then a data transmission time of 0.2s for 7kB of data is conservative ($384/7 = 0.02$). The rate of transmission is once every 30 seconds. This gives a duty cycle of 150:1. For the determination of SAR exclusion the conducted power including tune-up tolerance was divided by 150.

It is very unlikely that the user will be close to the radio module when it is transmitting but a separation distance of 5mm was used to determine 10g SAR test exclusion based upon FCC guidance via a KDB inquiry.

6. STANDALONE SAR TEST EXCLUSION CONSIDERATIONS

6.1. FCC

SAR test exclusion in accordance with KDB 447498.

a) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$, for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- $f_{(\text{GHz})}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

The RF power in the following table is the maximum from the tune-up procedure for the device including tolerances. The Bluetooth radio has been assessed for continuous operation.

RF Air interface	Band	Frequency (GHz)	Max. tune-up tolerance Power		Duty Cycle corrected power P/150	Min. test separation distance (mm)	SAR test exclusion Result*	Estimated 10-g SAR (W/kg)
			(dBm)	(mW)				
W-CDMA	B2	1.990	23.0	200	1	5	0.3	0.015
W-CDMA	B5	0.849	22.0	158	1	5	0.2	0.010
LTE	B2	1.912	25.0	316	2	5	0.6	0.029
LTE	B4	1.755	24.0	251	2	5	0.5	0.028
LTE	B5	0.849	24.0	251	2	5	0.4	0.020
LTE	B17	0.716	24.0	251	2	5	0.3	0.018
BLE	ISM 2.4	2.48	3	2	2	5	0.6	0.034

*When assessed against the extremity thresholds the SAR test exclusion result shall be less than 7.5 to qualify for SAR test exclusion.

Conclusion:

The computed value is ≤ 7.5 ; therefore, EUT qualifies for Standalone 10-gm extremity SAR test exclusion.

6.2. Simultaneous Transmission

The BLE radio can transmit simultaneously with the licensed radio. The worst case estimated SAR for the licensed radio is 0.029 W/kg. The BLE estimated SAR is 0.034 W/kg. The sum of the SAR values is 0.063 W/kg therefore further simultaneous transmission evaluation is not required.

6.3. ISED

RSS-102 Issue 5 Clause 2.5.1 Exemption Limits for Routine Evaluation – SAR Evaluation

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation - exemption limits for routine evaluation based on frequency and separation distance.

Frequency MHz	Exemption Limits (mW)				
	At separation distance of ≤5mm	At separation distance of 10mm	At separation distance of 15mm	At separation distance of 20mm	At separation distance of 25mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency MHz	Exemption Limits (mW)				
	At separation distance of 30mm	At separation distance of 35mm	At separation distance of 40mm	At separation distance of 45mm	At separation distance of ≥50mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

Note(s):

- (1) Transmitters operating between 0.003-10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in Section 4.
- (2) Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p) source-based, time-averaged output power.
- (3) For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5.
- (4) If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.
- (5) For medical implants devices, the exemption limit for routine evaluation is set to 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p. to determine whether the device is exempt from the SAR evaluation.

6.4. Exemption Table

The DUT has been evaluated against the 10g limits. As such the exemption limits have been multiplied by 2.5.

RF Air interface	Band	Frequency (GHz)	Max. tune-up tolerance Power		Antenna Gain	EIRP ¹ (mW)	Duty Cycle corrected power P/150	Exemption limit (mW)
			(dBm)	(mW)				
W-CDMA	B2	1.990	23.0	200	1.7	295	2	18
W-CDMA	B5	0.849	22.0	158	-6.6	158	1	40
LTE	B2	1.912	25.0	316	1.7	468	3	18
LTE	B4	1.755	24.0	251	1.7	372	2	20
LTE	B5	0.849	24.0	251	-6.6	251	2	43
LTE	B17	0.716	24.0	251	-6.5	251	2	69
Bluetooth	ISM 2.4	2.48	3	2	-0.2	2	2	10

¹ The higher of conducted power or EIRP is recorded here

Conclusion:

The transmitted powers are below the exemption limits; therefore the DUT qualifies for Standalone 10-gm SAR test exclusion.

END OF TEST REPORT