

March 24, 2021

CalAmp  
2200 Faraday Ave, Suite 220  
Carlsbad, CA 92008  
USA

Dear Imad Rizk,

Enclosed is the EMC Wireless test report for compliance testing of the CalAmp, LMU3040MB as tested to the requirements of the FCC Certification rules under Title 47 of the CFR Part 1 1.1310 RF Exposure.

Thank you for using the services of Eurofins E&E North America. If you have any questions regarding these results or if MET can be of further service to you, please contact me.

Sincerely yours,  
EUROFINS E&E NORTH AMERICA

A handwritten signature in black ink, appearing to read "Arsalan Hasan".

Arsalan Hasan  
Wireless Laboratory

Reference: (\CalAmp\WIRS111661-FCC-RF Exposure Rev 1)



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Eurofins MET Laboratories Inc. (Eurofins E&E North America) is part of the Eurofins Electrical & Electronics (E&E) global compliance network.

## **Electromagnetic Compatibility Criteria Test Report**

for the

**CalAmp  
LMU3040MB**

**Tested under  
FCC Certification Rules  
Title 47 of the CFR, Part 1 1.1310**

**Report: WIRS111661-FCC-RF Exposure Rev 1**

March 24, 2021

**Prepared For:**

**CalAmp  
2200 Faraday Ave, Suite 220  
Carlsbad, CA 92008  
USA**

**Prepared By:  
Eurofins E&E North America  
3162 Belick St.  
Santa Clara, CA 95054**

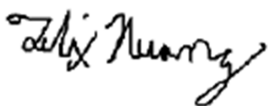
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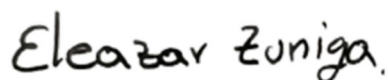


Felix Huang  
Engineer, Wireless Laboratory



Arsalan Hasan  
Manager, Wireless Laboratory

**Engineering Statement:** The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 1 of the FCC Rules under normal use and maintenance.



Eleazar Zuniga, PhD.  
Director, Wireless Technologies

## Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	March 16, 2021	Initial Issue.
1	March 24, 2021	TCB Review Updates.

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## List of Terms and Abbreviations

<b>AC</b>	<b>Alternating Current</b>
<b>ACF</b>	<b>Antenna Correction Factor</b>
<b>Cal</b>	<b>Calibration</b>
<b><i>d</i></b>	<b>Measurement Distance</b>
<b>dB</b>	<b>Decibels</b>
<b>dB<math>\mu</math>A</b>	<b>Decibels above one <b>micro</b>amp</b>
<b>dB<math>\mu</math>V</b>	<b>Decibels above one <b>micro</b>volt</b>
<b>dB<math>\mu</math>A/m</b>	<b>Decibels above one <b>micro</b>amp <b>per</b> meter</b>
<b>dB<math>\mu</math>V/m</b>	<b>Decibels above one <b>micro</b>volt <b>per</b> meter</b>
<b>DC</b>	<b>Direct Current</b>
<b>E</b>	<b>Electric Field</b>
<b>DSL</b>	<b>Digital Subscriber Line</b>
<b>ESD</b>	<b>Electrostatic Discharge</b>
<b>EUT</b>	<b>Equipment Under Test</b>
<b><i>f</i></b>	<b>Frequency</b>
<b>FCC</b>	<b>Federal Communications Commission</b>
<b>GRP</b>	<b>Ground Reference Plane</b>
<b>H</b>	<b>Magnetic Field</b>
<b>HCP</b>	<b>Horizontal Coupling Plane</b>
<b>Hz</b>	<b>Hertz</b>
<b>IEC</b>	<b>International Electrotechnical Commission</b>
<b>kHz</b>	<b>kilohertz</b>
<b>kPa</b>	<b>kilopascal</b>
<b>kV</b>	<b>kilovolt</b>
<b>LISN</b>	<b>Line Impedance Stabilization Network</b>
<b>MHz</b>	<b>Megahertz</b>
<b><math>\mu</math>H</b>	<b><b>micro</b>henry</b>
<b><math>\mu</math></b>	<b><b>micro</b>farad</b>
<b><math>\mu</math>s</b>	<b><b>micro</b>seconds</b>
<b>NEBS</b>	<b>Network Equipment-Building System</b>
<b>PRF</b>	<b>Pulse Repetition Frequency</b>
<b>RF</b>	<b>Radio Frequency</b>
<b>RMS</b>	<b>Root-Mean-Square</b>
<b>TWT</b>	<b>Traveling Wave Tube</b>
<b>V/m</b>	<b>Volts <b>per</b> meter</b>
<b>VCP</b>	<b>Vertical Coupling Plane</b>

# **I. Executive Summary**

## A. Purpose of Test

An EMC evaluation was performed to determine compliance of the CalAmp LMU3040MB, with the requirements of Part 1. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the LMU3040MB. CalAmp should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the LMU3040MB, has been **permanently** discontinued.

## B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 1, in accordance with CalAmp, purchase order number 403321.

Reference	Description	Compliance
§1.1310	RF Exposure	Compliant

**Table 1. Executive Summary of EMC Compliance Testing**



## **II. Equipment Configuration**

## A. Overview

Eurofins E&E North America was contracted by CalAmp to perform testing on the LMU3040MB, under CalAmp's purchase order number 403321.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the CalAmp, LMU3040MB.

The results obtained relate only to the item(s) tested.

<b>Model(s) Tested:</b>	LMU3040MB	
<b>Model(s) Covered:</b>	LMU3040MB	
<b>Filing Status:</b>	Original	
<b>EUT Specifications:</b>	Primary Power: 12VDC	
	FCC ID: APV-3040MB	
	Module Original Report Number(s): Report: R2007A0435-M1	
	Type of Modulations:	GFSK, BPSK, QPSK, 16QAM
	Equipment Code:	DTS, PCB
	Technology	TX Frequency Range
	GSM 850	824 – 849 MHz
	GSM 1900	1850 – 1910 MHz
	LTE CAT-M1 Band 2	1850 – 1910 MHz
	LTE CAT-M1 Band 4	1710 – 1755 MHz
	LTE CAT-M1 Band 5	824 – 849 MHz
	LTE CAT-M1 Band 12	699 – 716 MHz
	LTE CAT-M1 Band 13	777 – 787 MHz
	LTE CAT-M1 Band 25	1850 – 1915 MHz
	BLE	2402 – 2480 MHz
<b>Analysis:</b>	The results obtained relate only to the item(s) tested.	
<b>Environmental Test Conditions:</b>	Temperature: 15-35° C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
<b>Evaluated by:</b>	Arsalan Hasan	
<b>Date(s):</b>	March 24, 2021	

**Table 2. EUT Summary Table**

## B. References

<b>CFR 47, Part 22, Subpart H</b>	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 22: Rules and Regulations for Cellular Devices.
<b>CFR 47, Part 24, Subpart E</b>	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 24: Rules and Regulations for Personal Communications Services
<b>CFR 47, Part 27</b>	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 27: Rules and Regulations for Advanced Wireless Services
<b>KDB 996369 D04</b>	Modular Transmitter Integration Guide – Guidance For Host Product Manufacturers
<b>ANSI C63.4:2014</b>	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
<b>ANSI C63.26: 2015</b>	Compliance Testing of Transmitters Used in Licensed Radio Services
<b>ISO/IEC 17025:2017</b>	General Requirements for the Competence of Testing and Calibration Laboratories
<b>EIA/TIA-603-A-2001</b>	Land Mobile FM or PM Communication Equipment Measurement and Performance Standards
<b>KDB 971168 v02r02</b>	Measurement Guidance For Certification Of Licensed Digital Transmitters

**Table 3. Standard References**

## C. Test Site

All testing was performed at Eurofins E&E North America, 3162 Belick St, Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at Eurofins E&E North America.

Eurofins E&E North America is a ISO/IEC 17025 accredited site by A2LA, California #0591.02.

## D. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty (dB)	K	Confidence Level
<b>Radiated Emissions, (30 MHz – 1 GHz)</b>	±3.24	2	95%
<b>Radiated Emissions, (1 - 18 GHz)</b>	±3.92	2	95%
<b>Conducted Emission</b>	±3.53	2	95%
<b>CEV Telecom Port</b>	±2.44	2	95%

**Table 4. Uncertainty Calculations Summary**

## E. Description of Test Sample

The LMU3040MB is an OBD-II Asset tracker with Comprehensive I/O Capabilities.

It is a single box enclosure incorporating a processor, a wireless data modem, vehicle-rated power supply and a BLE chip. The LMU3040MB also supports inputs and outputs to monitor and react to the vehicular environment and driver actions utilizing a triple-axis accelerometer.

## F. Equipment Configuration

Ref. ID	Slot #	Name / Description	Model Number	Part Number	Serial Number	Revision
1		Asset Tracker	LMU3040MB	LMU3040MB	NA	1

Table 5: Equipment Configuration

## G. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number	*Customer Supplied Calibration Data
3	Serial Adaptor	CalAmp	NA	NA
4	Laptop	Dell	Latitude	NA

Table 6: Support Equipment

## H. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
2	Power/Data Port	12 wire BUS	1	1m	1m	n	na

Table 7: Ports and Cabling Information

## I. Mode of Operation During Testing

The LMU3040MB was paired with CMW500 and the callbox on screen indication was used to monitor proper connection.

## J. Method of Monitoring EUT Operation

The signal will be displayed on a spectrum analyzer.

## **K. Modifications**

### **a) Modifications to EUT**

No modifications were made to the EUT.

### **b) Modifications to Test Standard**

No modifications were made to the test standard.

## **L. Disposition of EUT**

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to CalAmp upon completion of testing.

### **III. Electromagnetic Compatibility Criteria for Intentional Radiators**

## Maximum Permissible Exposure

**RF Exposure Requirements:** §1.1307(b)(1) and §1.1307(b)(2): 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 levels in excess of the Commission's guidelines.

**RF Radiation Exposure Limit:** §1.1310: As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(i) Limits for Occupational/Controlled Exposure</b>				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f <sup>2</sup> )	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
<b>(ii) Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

**Table 8. RF Exposure Limits**

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where, S = Power Density (mW/cm<sup>2</sup>)  
P = Power Input to antenna (mW)  
G = Antenna Gain (numeric value)  
R = Distance (cm)

For Antenna Gain → dBi = 10log(Numeric)

Technology	TX Frequency Range (MHz)	Peak Gain (dBi)	Type
GSM 850	824 – 849	0.65	LDS
GSM 1900	1850 – 1910	2.10	LDS
LTE CAT-M1 Band 2	1850 – 1910	2.10	LDS
LTE CAT-M1 Band 4	1710 – 1755	2.84	LDS
LTE CAT-M1 Band 5	824 – 849	0.65	LDS
LTE CAT-M1 Band 12	699 – 716	-1.80	LDS
LTE CAT-M1 Band 13	777 – 787	0.67	LDS
LTE CAT-M1 Band 25	1850 – 1915	2.10	LDS
BLE	2402 – 2480	0.39	LDS

**Table 9. EUT Antenna Gain Specification**

Technology	TX Frequency Range (MHz)	Time-average maximum tune-up procedure (dBm)	Division Factor (dB)	Frame-Average Power (dBm)
GSM 850	824 – 849	32 (-3 ~ +1dB)	-9.03	23.97
GSM 1900	1850 – 1910	29 (-3 ~ +1dB)	-9.03	20.97

**Table 10. Tune up Power**

Technology	TX Frequency Range (MHz)	Maximum Conducted Output Power (dBm)
GSM 850	824 – 849	23.97
GSM 1900	1850 – 1910	20.97
LTE CAT-M1 Band 2	1850 – 1910	23 (-3 ~ +1dB) = 24
LTE CAT-M1 Band 4	1710 – 1755	22 (-3 ~ +1dB) = 23
LTE CAT-M1 Band 5	824 – 849	23 (-3 ~ +1dB) = 24
LTE CAT-M1 Band 12	699 – 716	23 (-3 ~ +1dB) = 24
LTE CAT-M1 Band 13	777 – 787	23 (-3 ~ +1dB) = 24
LTE CAT-M1 Band 25	1850 – 1915	24 (-3 ~ +1dB) = 25
BLE	2402 – 2480	5 (-1 ~ +1dB) = 6

**Table 11. Maximum Conducted Power adjusted for tune up tolerance.**



## Bands covered under FCC Part 22 / FCC Part 24

### Test Results:

Band	Frequency (MHz)	Maximum Conducted Power (dBm)	Conducted Power (mW)	Antenna Gain (dBi)	Antenna Gain (Numeric)	Power Density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Margin	Distance (cm)	Result
GSM 850	848.8	23.97	249.45	0.65	1.161	0.0576	0.565	-0.507	20	Pass
GSM 1900	1850.2	20.97	125.02	2.10	1.621	0.0403	1	-0.959	20	Pass
LTE Band 2	1905.0	24	251.18	2.10	1.621	0.0810	1	-0.918	20	Pass
LTE Band 5	829.0	24	251.18	0.65	1.161	0.0580	0.552	-0.493	20	Pass
LTE Band 25	1910.0	25	316.22	2.10	1.621	0.1020	1	-0.897	20	Pass

**Table 12. MPE Calculation for Bands under Part 22 and Part 24**

The safe distance where Power Density is less than the MPE limit listed above was found to be 20 cm.

## Bands covered under FCC Part 27

### Test Results:

Band	Frequency (MHz)	Maximum Conducted Power (dBm)	Conducted Power (mW)	Antenna Gain (dBi)	Antenna Gain (Numeric)	Power Density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Margin	Distance (cm)	Result
LTE Band 4	1750	23	199.52	3.84	2.421	0.961	1	-0.903	20	Pass
LTE Band 12	711.0	24	251.18	-1.80	0.660	0.033	0.474	-0.441	20	Pass
LTE Band 13	782.0	24	251.18	0.67	1.667	0.083	0.521	-0.437	20	Pass

**Table 13 MPE Calculation for Bands under Part 27**

The safe distance where Power Density is less than the MPE limit listed above was found to be 20 cm.

## Bands covered under FCC Part 15.247

### Test Results:

Band	Frequency (MHz)	Maximum Conducted Power (dBm)	Conducted Power (mW)	Antenna Gain (dBi)	Antenna Gain (Numeric)	Power Density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Margin	Distance (cm)	Result
BLE	2402	6	3.98	0.39	1.093	0.0008	1	-0.999	20	Pass

**Table 14. MPE Calculation for Bands under Part 15.247**

The safe distance where Power Density is less than the MPE limit listed above was found to be 20 cm.

**Note: Results are based on KDB 447498 D01 (Section 7.2) Transmitters used in mobile devices exposure conditions for simultaneous transmission operations.**

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is  $\leq 1.0$ , according to calculated/estimated, numerically modeled, or measured field strengths or power density. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to the MPE limit at the test frequency.

Both BLE and Cellular can transmit simultaneously, the formula for calculating the simultaneous MPE is

$$\text{CPD1/LPD1} + \text{CPD2/LPD2} + \dots, \text{CPDn/LPDn} < 1$$

CPD: Calculated Power Density

LPD: Limit of Power Density

Therefore worst case scenario is as below:

$$\begin{aligned}\text{Simultaneous MPE} &= 0.083/0.521 + 0.0008/1 \\ &= 0.1593 + 0.0008 \\ &= 0.1601\end{aligned}$$

**Result:**  $0.1601 < 1$  (Pass)

## **IV. Test Equipment**

## Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S4075	RADIO COMMUNICATION TESTER	ROHDE & SCHWARZ	CMW500	09/20/2020	09/20/2022
1S2399	TURNTABLE/MAST CONTROLLER	SUNOL SCIENCES	SC99V	SEE NOTE 1	
1S2600	BILOG ANTENNA	TESEQ	CBL6112D	03/19/2019	03/19/2021
1S2733	BILOG ANTENNA	TESEQ	CBL6112D	06/05/2019	06/05/2021
1S3826	DRG HORN ANTENNA	ETS-LINDGREN	3117	12/03/2020	12/03/2022
1S2198	DRG HORN ANTENNA	ETS-LINDGREN	3117	10/07/2019	10/07/2021
1S2003	PXA Signal Analyzer	Keysight	N9030B	09/15/2020	09/15/2021
1S2587	PRE AMPLIFIER	AML COMMUNICATIONS	AML0126L3801	SEE NOTE 1	
1S2653	AMPLIFIER	SONOMA INSTRUMENT	310 N	SEE NOTE 1	
1S2486	5 METER CHAMBER	PANASHIELD - ETS	5M	SEE NOTE 2	
1S3824	SIGNAL GENERATOR	ROHDE & SCHWARZ	SMA100B	11/06/2019	05/06/2021

**Table 15. Test Equipment List**

Note 1: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

Note 2: Latest NSA and VSWR data available upon request.

**End of Report**