Radio Frequency Exposure Evaluation Report

For:
CalAmp Wireless Networks Corp.

Model Number:
VLU11VMAB / VLU11VMA

Product Description:
Lojack vehicle recovery system

FCC ID: APV-VLU11B / APV-VLU11
IC ID: 5483C-VLU11B / 5483C-VLU11

Applied Rules and Standards:
CFR Part 1 (1.1307 & 1.1310), Part 2 (2.1091),
FCC KDB 447498 D01 General RF Exposure Guidance v06
Industry Canada RSS-102, Issue 5 of March 2015

Report number: EMC_CALAM_085_19001_MPE
DATE: 2019-05-10

A2LA Accredited

IC recognized # 3462B-2

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1. Assessment

This RF Exposure evaluation report provides information about 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, under given conditions (measured or rated RF output power, antenna gain, distance towards human body of more than 20cm and 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 rule parts based on available specifications.

Company Name	Product Description	Model #
CalAmp Wireless Networks Corp.	Lojack vehicle recovery system	VLU11VMAB / VLU11VMA

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2019-05-10	Compliance	Cindy Li (EMC Lab Manager)	Cindy Li Digitally signed by Cindy Li DN: cn=Cindy Li, o=Cetecom Inc., ou=EMC, email=cindy.li@cetecom.com, c=US Date: 2019.05.10 17:10:48 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2019-05-10	Compliance	Chin Ming Lui (Associate EMC Engineer)	Chin Ming Lui Digitally signed by: Chin Ming Lui DN: CN = Chin Ming Lui email = ChinMing.Lui@cetecom.com C = US O = CETECOM Date: 2019.05.10 15:52:37 -07'00'

Contents

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
Compliance Manager:	Cindy Li
Responsible Project Leader:	Cathy Palacios

2.2. Identification of the Client

Applicant's Name:	CalAmp Wireless Networks Corp.
Street Address:	2177 Salk Ave, Suite 200
City/Zip Code	Carlsbad, CA 92008
Country	USA

2.3. Identification of the Manufacturer

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

3. Equipment under Assessment

Model No	VLU11VMAB (for BTLE populated unit) VLU11VMA (for BTLE depopulated unit)
HW Version	REV 1
SW Version	11.00.01
FCC-ID	APV-VLU11B / APV-VLU11
IC-ID	5483C-VLU11B / 5483C-VLU11
Product Description	Lojack vehicle recovery system
Transceiver Technology / Type(s) of Modulation	LTE Module: UBLOX SARA R410M-52B Bluetooth Low Energy: Chip designed based on Texas Instruments chip CC2640 VHF Lojack: FSK
Frequency Range	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 Bluetooth LE: 2400-2483.5 MHz VHF Lojack: 173.075 MHz
Max. declared antenna gain	Cellular: Custom design, peak gain is 2.58dBi Bluetooth LE: Custom design, 2.4G, peak gain is 5.36dBi
Co-located Transmitters/ Antennas?	LTE / BTLE
Power Supply/ Rated Operating Voltage Range	Vmin: 7 VDC/ Vnom: 12-24 VDC / Vmax: 32 VDC
Operating Temperature Range	-20 ºC to +60 ºC
Sample Revision	☐ Prototype ☐ Production ■ Pre-Production

4. RF Exposure Limits and FCC

For the specific described radio apparatus the following basic limits and rules apply

4.1. Power Density Limits acc. to FCC 1.1310(e)

Frequency Range (MHz)	Power density (mW/cm²)	Averaging time (minutes)
30 – 300	0.2	30
300 – 1500	f (MHz) /1500	30
1500 – 100000	1.0	30

4.2. Power Density Limits acc. To RSS-102

Frequency Range (MHz)	Power density (W/m²)	Averaging time (minutes)
48 – 300	1.291	6
300 – 6000	$0.02619\ f^{0.6834}$	6

4.3. Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.1091(c)

Mobile devices that operate in the Commercial Mobile Radio Services pursuant to part 20 of this chapter; the Cellular Radiotelephone Service pursuant to part 22 of this chapter; the Personal Communications Services pursuant to part 24 of this chapter; the Satellite Communications Services pursuant to part 25 of this chapter; the Miscellaneous Wireless Communications Services pursuant to part 27 of this chapter; the Maritime Services (ship earth station devices only) pursuant to part 80 of this chapter; the Specialized Mobile Radio Service, and the 3650 MHz Wireless Broadband Service pursuant to part 90 of this chapter; and the Citizens Broadband Radio Service pursuant to part 96 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if:
(i) They operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more, or
(ii) They operate at frequencies above 1.5 GHz and their ERP is 3 watts or more.

4.4. Exemption Limits for Routine Evaluation — RF Exposure Evaluation RSS-102

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 as follows:

- At or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. 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;

4.5. 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/cm^2 or W/m^2)
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 centre of radiation of the antenna (cm or m)

5. Evaluations

5.1. Routine Environmental Evaluation Applicability Stand Alone transmission

Transmission Mode	EIRP dBm	Duty Cycle %	Limits for Routine Environmental Evaluation Applicability, EIRP dBm	Exempt from Routine evaluation (Yes/No)
LTE Band 2	27.38	100	34.77/33.54	Yes
LTE Band 4	26.48	100	34.77/33.26	Yes
LTE Band 5	27.58	100	31.76/31.11	Yes
LTE Band 12	26.88	100	31.76/30.68	Yes
LTE Band 13	26.98	100	31.76/30.93	Yes
BTLE	6.11	65.90	34.77/34.38	Yes
FSK	24.22	20Note 3	31.76/27.78	Yes

Note 1: EIRP power calculation is based on the maximum conducted output power and antenna gain per operational description for each transmission band.
Note 2: Maximum conducted output power for LTE bands obtained from grant of cellular module UBLOX SARA R410M (FCC ID: XPY2AGQN4NNN).
Note 3: 200 millisecond (ms) chirp every one second when in tracking mode as stated in operational description.

5.2. Compliance with MPE (Power Density) limits

Power Density Calculation							
Band of Operation MHz	EIRP dBm	Maximum Duty Cycle %	Distance cm	Power Density mW/cm^2	FCC / IC Limit mW/cm^2	percentage of limit used up	Verdict
LTE Band 2	27.38	100	20	0.10888	1.00/0.45	24.20%	Pass
LTE Band 4	26.48	100	20	0.08850	1.00/0.42	21.07%	Pass
LTE Band 5	27.58	100	20	0.11401	0.55/0.26	43.85%	Pass
LTE Band 12	26.88	100	20	0.09704	0.48/0.23	42.19%	Pass
LTE Band 13	26.98	100	20	0.09930	0.52/0.25	39.72%	Pass
BTLE	6.11	65.90	20	0.00054	1.00/0.55	0.10%	Pass
FSK	24.22	20	20	0.01052	0.2/0.129	8.16%	Pass

6. Routine Environmental Evaluation Applicability Simultaneous Transmission

Possible worst case simultaneous transmissions:

- LTE Band 5 + BTLE + FSK

Transmission Mode	Percentage of Power Density to Applicable limit for Stand Alone Operation	Sum of the percentage for the Highest Possible Simultaneous Operation	Exempt from Routine evaluation
LTE Band 5 + BTLE + FSK	43.85% + 0.10% + 8.16%	52.11%	No

Note: Power Density to Applicable limit for Stand Alone Operation are derived from table in section 5.2

Conclusion:

- The equipment meets the MPE requirements limits for simultaneous transmission for distance greater than 20cm

7. Revision History

Date	Report Name	Changes to report	Report prepared by
2019-05-10	EMC_CALAM_085_19001_MPE	Initial Version	Chin Ming Lui