



# Radio Frequency Exposure Evaluation Report

**FOR:**  
CalAmp

**Model Number:**  
TTU2900MB

**Product Description:**  
Solar-based telematics gateway

**FCC ID:** APV-2900MB  
**IC ID:** 5843C-2900MB

**Per:**

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

**Report number:** EMC\_CALAM-118-21001\_FCC\_ISED\_MPE

**DATE:** 2021-02-19



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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 #
CalAmp	Solar-based telematics gateway	TTU2900MB

### Report reviewed by: TCB Evaluator

2021-02-19	Compliance	Cindy Li (Lab Manager)	
Date	Section	Name	Signature

### Responsible for the Report:

2021-02-19	Compliance	Yuchan Lu (Test Engineer)	
Date	Section	Name	Signature

## 2 Administrative Data

### 2.1 Identification of the Testing Laboratory Issuing the Test Report

<b>Company Name:</b>	CETECOM Inc.
<b>Department:</b>	Compliance
<b>Street Address:</b>	411 Dixon Landing Road
<b>City/Zip Code</b>	Milpitas, CA 95035
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<b>Lab Manager:</b>	Cindy Li
<b>Responsible Project Leader:</b>	Cathy Palacios

### 2.2 Identification of the Client / Manufacturer

<b>Client's Name:</b>	CalAmp
<b>Street Address:</b>	2200 Faraday Avenue, Suite 220
<b>City/Zip Code</b>	Carlsbad, CA 92008
<b>Country</b>	USA

### 2.3 Identification of the Manufacturer

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

### 3 Equipment under Assessment

Marketing name:	TTU2900MB
HW Version :	REV A
SW Version :	8.5
Hardware Version Identification Number (HVIN):	TTU2900MB
Product Marketing Name (PMN):	TTU2900MB
Regulatory Band:	<p>❖ <b><u>Cellular Module:</u></b></p> <ul style="list-style-type: none"> <li>▪ LTE BAND 2: 1850.7 ~ 1909.3 MHz</li> <li>▪ LTE BAND 4: 1710.7 ~ 1754.3 MHz</li> <li>▪ LTE BAND 5: 824.7 ~ 848.3 MHz</li> <li>▪ LTE BAND 12: 699.7 ~ 715.3 MHz</li> <li>▪ LTE BAND 13: 779.5 ~ 784.5 MHz</li> <li>▪ LTE BAND 25: 1850.7 ~ 1914.3 MHz</li> <li>▪ LTE BAND 26: 814.7 ~ 848.3 MHz</li> </ul> <p>❖ <b><u>BLE:</u></b></p> <ul style="list-style-type: none"> <li>▪ Nominal band: 2400 MHz – 2483.5 MHz;</li> <li>▪ Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 39), 40 channels</li> </ul>
Integrated Module Info:	<p>❖ <b><u>GSM, LTE</u></b></p> <ul style="list-style-type: none"> <li>▪ Manufacture: Quectel</li> <li>▪ Module name/number: BG96</li> <li>▪ FCC ID: XMR201707BG96</li> <li>▪ IC ID: 10224A-201709BG96</li> </ul> <p>❖ <b><u>BLE</u></b></p> <ul style="list-style-type: none"> <li>▪ Manufacture: Texas Instruments</li> <li>▪ Module name/number: CC2640</li> </ul>
Antenna Type:	<p>❖ <b><u>Cellular:</u></b></p> <ul style="list-style-type: none"> <li>▪ Antenna maximum gain:                             <ul style="list-style-type: none"> <li>○ LTE Band 2: 3.1 dBi</li> <li>○ LTE Band 4: 3.1 dBi</li> <li>○ LTE Band 5: 1.6 dBi</li> <li>○ LTE Band 12: 1.6 dBi</li> <li>○ LTE Band 13: 1.6 dBi</li> <li>○ LTE Band 25: 3.1 dBi</li> </ul> </li> </ul>

	<p>○ LTE Band 26: 1.6 dBi</p> <p>❖ <b><u>BLE:</u></b></p> <ul style="list-style-type: none"> <li>▪ Antenna gain: 1.88 dBi</li> </ul>
<b>Maximum Conducted Output Power:</b>	<p>❖ <b><u>Cellular:</u></b> From modular grant [Watts]:</p> <ul style="list-style-type: none"> <li>▪ LTE Band 2: 0.247</li> <li>▪ LTE Band 4: 0.175</li> <li>▪ LTE Band 5: 0.242</li> <li>▪ LTE Band 12: 0.233</li> <li>▪ LTE Band 13: 0.246</li> <li>▪ LTE Band 25: 0.284</li> <li>▪ LTE Band 26: 0.239</li> </ul> <p>❖ <b><u>BLE:</u></b> From measurement [Watts]: 0.00324</p>
<b>Power Supply/ Rated Operating Voltage Range:</b>	Vmin: 8 VDC/ Vnom: 12 VDC / Vmax: 32 VDC
<b>Operating Temperature Range:</b>	Low -30°C, Nominal 25°C, High 70°C
<b>Sample Revision:</b>	<input type="checkbox"/> Prototype Unit; <input type="checkbox"/> Production Unit; <input checked="" type="checkbox"/> 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/cm <sup>2</sup> )	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100000	1.0	30

IC

300 – 6000	0.02619 x f (MHz) <sup>0.6834</sup>	6
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##### 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)<sup>0.6834</sup> 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/cm<sup>2</sup> or W/m<sup>2</sup>)

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.
- Cellular can transmit simultaneously with BLE.

Radio	freq [MHz]	Max Conducted power [W]	Max Conducted power+Tune up[W]	Gain [dBi]	Gain [lin]	EIRP [W]	IC Limit [W/m2]	FCC Limit [W/m2]	Actual [W/m2] <sup>2</sup>	How much of limit is used up
GSM 850	824	1.702	1.995	1.6	1.45	0.721	2.576	5.493	1.434	55.69%
GSM 1900	1850	0.946	1	3.1	2.04	0.510	4.476	10.000	1.015	22.68%
LTE 2	1850	0.247	0.251	3.1	2.04	0.512	4.476	10.000	1.020	22.77%
LTE 4	1710	0.175	0.2	3.1	2.04	0.408	4.242	10.000	0.812	19.15%
LTE 5	824	0.242	0.251	1.6	1.45	0.363	2.576	5.493	0.722	28.00%
LTE 12	699	0.233	0.251	1.6	1.45	0.363	2.302	4.660	0.722	31.33%
LTE 13	777	0.246	0.251	1.6	1.45	0.363	2.474	5.180	0.722	29.14%
LTE 25	1850	0.284	0.316	3.1	2.04	0.645	4.476	10.000	1.284	28.66%
LTE 26	814	0.239	0.251	1.6	1.45	0.363	2.554	5.427	0.722	28.23%
BTLE	2402	0.00324	0.00324	1.88	1.54	0.005	5.351	10.000	0.010	0.17%

Note1: The calculation is based on the distance of 20cm

Note2: EIRP of GSM850 and GSM1900 are corrected for worst case DC 25%

### 5.2 Conclusion:

The worst-case simultaneous transmission is GSM 850 simultaneous with BLE, which is using 55.86 of a limit of 100%. The equipment is passing RF exposure requirements for 20cm distance.

## 6 Revision History

Date	Report Name	Changes to report	Prepared by
2021-02-19	EMC_CALAM-118-21001_FCC_ISED_MPE	Initial Release	Yuchan Lu

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