



TEST REPORT

No. I16D00226-SAR

For

Client for FCC: CalAmp

Client for IC: CalAmp wireless networks corporation

Marketing name : LMU-200 GPRS

Model Name : LMU0200G

FCC ID: APV-200G

IC: 5843C-200G

Issued date: 2016-11-24

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of ECIT Shanghai.

Test Laboratory:

ECIT Shanghai, East China Institute of Telecommunications

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Revision Version

Report Number	Revision	Date	Memo
I16D00226-SAR	00	2016-11-24	Initial creation of test report

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1. Test Laboratory

1.1. Testing Location

Company Name:	ECIT Shanghai, East China Institute of Telecommunications
Address:	7-8F, G Area, No. 668, Beijing East Road, Huangpu District, Shanghai, P. R. China
Postal Code:	200001
Telephone:	(+86)-021-63843300
Fax:	(+86)-021-63843301
FCC Registration NO.:	489729

1.2. Project Data

Project Leader:	Wang Yaqiong
Testing Start Date:	2016-11-24
Testing End Date:	2016-11-24

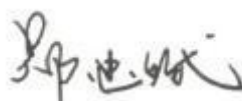
1.3. Signature



Yan Hang
(Prepared this test report)



Song Kaihua
(Reviewed this test report)



Zheng Zhongbin
Director of the laboratory
(Approved this test report)

2. Client Information

2.1. Applicant Information for FCC

Company Name: CalAmp
Address: 2177 Salk Ave, Suite 200, Carlsbad, CA 92008 United States
Telephone: (760)8149697
Postcode: 92008

2.2. Manufacturer Information for FCC

Company Name: AsiaTelco Technologies Co.
Address: #289 Bisheng Road, Building-8, 3F, Zhangjiang Hi-Tech Park,
Pudong, Shanghai-201204
Telephone: +86-21-51688806-213
Postcode: 201204

2.3. Applicant Information for IC

Company Name: CALAMP WIRELESS NETWORKS CORPORATION
Address: 2177 Salk Ave. Carlsbad CA 92008 USA
Telephone: (760)8149697
Postcode: 92008

2.4. Manufacturer Information for IC

Company Name: AsiaTelco Technologies Co.
Address: #289 Bisheng Road, Building-8, 3F, Zhangjiang Hi-Tech Park,
Pudong, Shanghai-201204
Telephone: +86-21-51688806-213
Postcode: 201204

3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

EUT Description	LMU-200 GPRS
Model name	LMU0200G
Frequency Band	GSM850/1900
Antenna Type	Internal Antenna
FCC ID:	APV-200G
IC:	5843C-200G

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	Date of receipt
N04	863867026003739	P1	2016-10-31

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	RF cable	N/A	N/A	N/A
AE2	Dummy Battery	N/A	N/A	N/A

*AE ID: is used to identify the test sample in the lab internally.

4. Reference Documents for FCC

4.1. Applicable Standards

The MPE report was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Part 2.1091.

The limits standard is based on the Council Recommendation 1999/519/EC.

FCC CFR 47, Part 2, FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS, Oct 1, 2011

Section 2.1091 Radiofrequency radiation exposure evaluation: mobile devices, June 23, 2015

4.2. Test Limits

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 limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

Limits for Occupational / Controlled Exposure

Frequency Range [MHz]	Electric Field Strength (E) [V/m]	Magnetic Field Strength (H) [A/m]	Power Density (S) [mW/cm ²]	Averaging Times E ² , H ² or S [minutes]
0.3 – 3.0	614	1.63	(100)*	6
3.0 – 30	1824/f	4.89/f	(900/f)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	--	--	F/300	6
1500 - 100000	--	--	5	6

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]	Averaging Times E ² , H ² or S [minutes]
0.3 – 1.34	614	1.63	(100)*	30
1.34 – 30	824/f	2.19/f	(180/f)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	--	--	F/1500	30
1500 - 100000	--	--	1.0	30

Note: f=frequency in MHz; *Plane-wave equivalent power density

For the DUT, the limits for General Population / Uncontrolled Exposure are applicable.

5. Test Results

5.1. RF Power Output

Frequency Band	Highest Frame-Averaged Output Power (dBm)	Antenna Gain(dBi)
GSM850	23.47	0
GSM850 1 TS	23.47	
GSM850 2 TS	25.48	
GSM850 3 TS	26.24	
GSM850 4 TS	26.49	
GSM1900	20.47	1
GSM1900 1 TS	20.47	
GSM1900 2 TS	22.48	
GSM1900 3 TS	23.24	
GSM1900 4 TS	23.49	

5.2. Calculation Information

For conservative evaluation consideration, only maximum power of each frequency band based on the tighter limits respectively are used to calculate the boundary power density.

Based on the FCC KDB 447498 D01 and 47 CFR §2.1091, the DUT is evaluated as a mobile device.

$$\text{Given } S = \frac{P \times G}{4\pi d^2} \quad \text{Equation 1}$$

Where

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

5.3. Result of GSM850

Test Results: MPE Limit Calculation: the EUT's operating frequencies @ 824 – 849 MHz; as per the original test report the highest power is 446.684 mW,. The maximum gain is 0dBi(numeric gain 1).The resulted power density at a distance of 20cm can be deducted as follows:

$$\text{Power Density} = P \times G \times \text{Duty Cycle} / (4 \pi R^2) = 446.684 \times 1 \times 1 / (4 \pi \times 20^2) = 0.089 \text{ mW/cm}^2$$

The MPE limit for Occupational/Controlled Exposure is shown in the FCC KDB 447498 D01 and 47 CFR §2.1091, can be calculated as follows:

$$\text{MPE limit} = F/1500 = 850/1500 = 0.567 \text{ mW/cm}^2$$

As we can see the resulted power density is below the MPE limit, therefore the DUT in this band is compliant with the FCC rules on RF exposure.

5.4. Result of GSM1900

Test Results: MPE Limit Calculation: the EUT's operating frequencies @ 1850 – 1910 MHz; as per the original test report the highest power is 223.872 mW,. The maximum gain is 1dBi(numeric gain 1.259).The resulted power density at a distance of 20cm can be deducted as follows:

$$\text{Power Density} = P * G * \text{Duty Cycle} / (4 * \pi * R^2) = 223.872 * 1.259 * 1 / (4 * \pi * 20^2) = 0.056 \text{ mW/cm}^2$$

The MPE limit for Occupational/Controlled Exposure is shown in the FCC KDB 447498 D01 and 47 CFR §2.1091, can be calculated as follows:

$$\text{MPE limit} = 1 \text{ mW/cm}^2$$

As we can see the resulted power density is below the MPE limit, therefore the DUT in this band is compliant with the FCC rules on RF exposure.

Note: $\pi=3.1416$

So the product is under the MPE limits. All is pass.

6. Reference Documents for IC

6.1. Applicable Standards

RSS 102 Issue 5 :Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)

6.2. Test Limits

RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10 ⁻⁴ $f^{0.5}$	6.67 x 10 ⁻⁵ f	616000/ $f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

RF Field Strength Limits for Controlled Use Devices (Controlled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²³	170	180	-	Instantaneous*
0.1-10	-	1.6/ f	-	6**
1.29-10	193/ $f^{0.5}$	-	-	6**
10-20	61.4	0.163	10	6
20-48	129.8/ $f^{0.25}$	0.3444/ $f^{0.25}$	44.72/ $f^{0.5}$	6
48-100	49.33	0.1309	6.455	6
100-6000	15.60 $f^{0.25}$	0.04138 $f^{0.25}$	0.6455 $f^{0.5}$	6
6000-15000	137	0.364	50	6
15000-150000	137	0.364	50	616000/ $f^{1.2}$
150000-300000	0.354 $f^{0.5}$	9.40 x 10 ⁻⁴ $f^{0.5}$	3.33 x 10 ⁻⁴ f	616000/ $f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

6.3. RF Power Output

Frequency Band	Highest Frame-Averaged Output Power (dBm)	Antenna Gain(dBi)	Highest EIRP (W)
GSM850	23.47	0	0.222
GSM850 1 TS	23.47		0.222
GSM850 2 TS	25.48		0.353
GSM850 3 TS	26.24		0.421
GSM850 4 TS	26.49		0.446

GSM1900	20.47	1	0.140
GSM1900 1 TS	20.47		0.140
GSM1900 2 TS	22.48		0.223
GSM1900 3 TS	23.24		0.265
GSM1900 4 TS	23.49		0.281

6.4. Calculation Information

For conservative evaluation consideration, only maximum power of each frequency band based on the tighter limits respectively are used to calculate the boundary power density.

Based on the FCC KDB 447498 D01 and 47 CFR §2.1091, the DUT is evaluated as a mobile device.

$$\text{Given } S = \frac{P \times G}{4\pi d^2} \quad \text{Equation 1}$$

Where

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

6.5. Result of GSM850

Test Results: MPE Limit Calculation: the EUT's operating frequencies @ 824 – 849 MHz; as per the original test report the highest power is 446.684 mW,. The maximum gain is 0dBi(numeric gain 1).The resulted power density at a distance of 20cm can be deducted as follows:

$$\text{Power Density} = P \times G \times \text{Duty Cycle} / (4\pi R^2) = 446.684 \times 1 \times 1 / (4\pi \times 20^2) = 0.089 \text{ mW/cm}^2$$

The MPE limit for Occupational/Controlled Exposure is shown in the RSS102 issue5, can be calculated as follows:

$$\text{MPE limit} = 0.02619 f^{0.6834} = 0.02619 \times 850^{0.6834} = 2.631 \text{ mW/cm}^2$$

As we can see the resulted power density is below the MPE limit, therefore the DUT in this band is compliant with the IC rules on RF exposure.

6.6. Result of GSM1900

Test Results: MPE Limit Calculation: the EUT's operating frequencies @ 1850 – 1910 MHz; as per the original test report the highest power is 223.872 mW,. The maximum gain is 1dBi(numeric gain 1.259).The resulted power density at a distance of 20cm can be deducted as follows:

$$\text{Power Density} = P \times G \times \text{Duty Cycle} / (4\pi R^2) = 223.872 \times 1.259 \times 1 / (4\pi \times 20^2) = 0.056 \text{ mW/cm}^2$$

The MPE limit for Occupational/Controlled Exposure is shown in the RSS102 issue5, can be calculated as follows:

$$\text{MPE limit} = 0.02619 f^{0.6834} = 0.02619 \times 1900^{0.6834} = 4.559 \text{ mW/cm}^2$$

As we can see the resulted power density is below the MPE limit, therefore the DUT

in this band is compliant with the IC rules on RF exposure.

Note: $\pi=3.1416$

So the product is under the MPE limits. All is pass.

*******End The Report*******