RF Exposure Evaluation Report

FOR:

Gemalto M2M GmbH

Model Number: ELS31-V

Product Description: LTE Module

FCC ID: QIPELS31-V
IC ID: 7830A-ELS31V

FCC CFR 47 Part 1.1310, 2.1091
IC RSS-102, Issue 5

TEST REPORT #: EMC_CETEC-139-15001_FCCICMPE_v1.1
DATE: 12-08-2015

FCC Recognized
A2LA Accredited
IC recognized # 3462E-1

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1 Assessment

The following equipment, as detailed in section 3 of this test report, meets the RF exposure limits and/or the conditions for exemption from routine evaluation as defined in the following standards.

Standard	Version
FCC CFR 47 Part 1.1310	Current as of 10-13-2015
FCC CFR 47 Part 2.1091	Current as of 10-13-2015
FCC KDB 447498	v05r02
OET Bulletin 65	Edition 97-01, August 1997
RSS 102	Issue 5

Responsible for Testing Laboratory:

Date	Section	Name	Signature
12-08-2015	Compliance	Milton Ponce de Leon (Test Lab Manager)	Milton Ponce de Leon Digitally signed by Milton Ponce de Leon DN: cn=Milton Ponce de Leon, c=US, o=Cetecom Inc., ou=OTA, email=milton.deleon@cetecom.com Date: 2015.12.08 16:06:04 -08'00'

Responsible for the Report:

Date	Section	Name	Signature
12-08-2015	Compliance	Anthony Planinac (EMC Engineer)	Anthony Planinac Digitally signed by Anthony Planinac DN: cn=Anthony Planinac, c=US, o=CETECOM, ou=EMC SD, email=anthony.planinac@cetecom.com Reason: release Date: 2015.12.08 18:24:30 -08'00'

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name	CETECOM Inc.
Department	Compliance
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Test Lab Manager	Milton Ponce de Leon
Project Manager	
Test Engineer	Anthony Planinac

2.2 Identification of the Client

Applicant's Name:	Gemalto M2M GmbH
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2.3 Identification of the Manufacturer

Applicant's Name:	Gemalto M2M GmbH
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Country	Thorsten Liebig
Contact Person:	+49 30 31102 8241
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3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	Cinterion®
Model Number:	ELS31-V
FCC-ID :	QIPELS31-V
IC-ID:	7830A-ELS31V
Product Description:	CAT 1 LTE Module
Operating Frequency Ranges (MHz) / Channels:	LTE Band 13 (700MHz): 777 MHz – 787 MHz LTE Band 4 (1700 MHz): 1710 -1755 MHz
Rated Max power:	LTE Band 13=24dBm. LTE Band4=24dBm
Type(s) of Modulation:	QPSK and 16 QAM
Antenna info (antenna presented for testing with the development board):	LTE Band 4 (1700): Antenna gain = 2 dBi LTE Band 13 (700MHz): Antenna gain = -8 dBi
Rated Operating Voltage Range:	Vmin: 3.3V/ **Vnom: 3.8V** / Vmax: 4.5V
Rated Operating Temperature Range:	–10°C ~ +55°C
Test Sample Status:	Prototype
Device Category	☐ Fixed Installation ☒ Mobile ☐ Portable
Exposure Category	☐ Occupational/ Controlled ☒ General Population/ Uncontrolled

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	Sample	HW/SW Version
1	EVR15082100122	Radiated/Conducted	1.0/LR4.3.1.0

3.3 Identification of Accessory Equipment

AE #	Type	Model	HW Version	SW Version	
1	External Antenna	OmniLOG 90200	NA	NA	700MHz – 2.4GHz

3.4 Miscellaneous Information

4 RF Exposure Evaluation Requirements

4.1 FCC:

Calculations can be made to predict RF field strength and power density levels around typical RF sources using the general equations (3) and (4) on page 19 of the following FCC document:
"OET Bulletin 65, Edition 97-01 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields".

The table below is excerpted from Table 1B of CFR 47 1.1310 titled Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure:

Frequency Range (MHz)	Power density (mW/cm^2)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100.000	1.0	30

Using the equation from page 19 of OET Bulletin 65, Edition 97-01:

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW)
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 (appropriate units, e.g., cm)

Additionally, according to § 2.1091:
The limit for <1.5 GHz mobile operations where no routine evaluation is required is: 1.5W ERP
The limit for >1.5 GHz mobile operations where no routine evaluation is required is: 3W ERP

Note:
1. This device is to be used only for fixed and mobile applications.
2. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all the persons

4.2 IC:

RSS-102 Section 2.5.2
RF exposure evaluation is required if the separation distance between the user and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- 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 0.0131 x $f(MHz)^{0.6834}$ W.

RSS-102 4: RF Field strength limits for devices used by the General Public (Uncontrolled Environment):
Power density
300MHz- 6000 MHz = 0.02619 x $f(MHz)^{0.6834}$ W/m^2

5 Measurement Summary

Peak radiated power is calculated as

EIRP (dBm) = Maximum average output power (including tune-up tolerance) (dBm) + Antenna Gain (dBi)

ERP (dBm) = EIRP (dBm) – 2.15

Tune-up tolerance is obtained from Gemalto tune-up procedure document -> +23dBm +0.5/-1 dB
Antenna gain is taken from Aaronia OmniLOG_90200 datasheet.
Max rated power according to tune-up procedure above = +23.5dBm
Antenna gain from datasheet: 2dBi @ 700MHz, -8dBi@1700MHz

Analysis to Exclude Routine RF Exposure Evaluation for Stand Alone Operation						
Band of Operation	**EIRP**		**IC Limit**	**ERP**		**FCC Limit**
MHz	**dBm**	**W**	**W**	**dBm**	**W**	**W**
Band IV 1710 to 1755	25.50	0.35	2.16	23.35	0.22	3
Band XIII 777 to 787	15.5	0.035	1.25	13.35	0.022	1.5

Since the EIRP is less than the IC limit and the ERP is less than the FCC limit, this device is exempt from routine evaluation.

For modular approvals only:

Maximum Antenna Gain Analysis to Comply With Limits

Band XIII Frequency Band

Maximum output power considerations:

Mode	Maximum conducted output power (dBm)	Maximum conducted output power (mW)	Duty cycle	Equivalent conducted output power (Maximum conducted output power x duty cycle) (mW)	Distance (cm)
LTE	23.5	0.22	100%	0.22	20

IC Analysis

S	MPE limit for uncontrolled exposure	2.496	W/m^2
G_1	Antenna gain to comply with MPE limits:	7.48	dBi
G_2	Antenna gain to exclude routine RF Exposure Analysis According to RSS-102 §2.5.2	7.46	dBi
G_3	Antenna gain to comply with EIRP limits according to RSS-130, issue 1	23.49	dBi

FCC Analysis

S	MPE limit for uncontrolled exposure:	0.525	mW/cm^2
G_1	Antenna gain to comply with MPE limits:	10.71	dBi
G_2	Antenna gain to exclude routine RF Exposure Analysis According to §2.1091	10.41	dBi
G_3	Antenna gain to comply with ERP limits according to 47 CFR Part 27	13.42	dBi

The maximum antenna gain for mobile operation to comply with MPE and ERP limits shall not exceed **7.46 dBi**.

For modular approvals only:

LTE Band IV frequency band

Maximum output power considerations:

Mode	Maximum conducted output power (dBm)	Maximum conducted output power (mW)	Duty cycle	Equivalent conducted output power (Maximum conducted output power x duty cycle) (mW)	Distance (cm)
LTE	23.5	0.22	100%	0.22	20

IC Analysis

S	MPE limit for uncontrolled exposure	4.318	W/m^2
G_1	Antenna gain to comply with MPE limits:	9.86	dBi
G_2	Antenna gain to exclude routine RF Exposure Analysis According to RSS-102 §2.5.2	9.84	dBi
G_3	Antenna gain to comply with EIRP limits according to RSS-139, issue 2	6.50	dBi

FCC Analysis

S	MPE limit for uncontrolled exposure:	1	mW/cm^2
G_1	Antenna gain to comply with MPE limits:	13.51	dBi
G_2	Antenna gain to exclude routine RF Exposure Analysis According to §2.1091	13.42	dBi
G_3	Antenna gain to comply with ERP limits according to 47 CFR Part 27	6.50	dBi

The maximum antenna gain for mobile operation to comply with MPE and EIRP limits shall not exceed **6.50 dBi**.

6 Revision History

Date	Report Number – Changes to Report	Report prepared by
12-03-2015	EMC_CETEC-139-15001_FCCICMPE_v1.0	MPDL
12-08-2105	EMC_CETEC-139-15001_FCCICMPE_v1.1- update FCC, IC rules	MPDL