

InterLab®

RF Exposure and Maximum ERP/EIRP Assessment

For

EMS31-US LTE CAT-M1 Module

FCC ID: QIPEMS31-US

IC: 7830A-EMS31US

Assessment Reference: MDE_GEMALTO_1707_MPEa_rev1

Test Laboratory:

7layers GmbH
Borsigstrasse 11
40880 Ratingen
Germany



Deutsche
Akkreditierungsstelle
D-PL-12140-01-00

Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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0 Summary

0.1 Technical Report Summary

Type of Report

RF Exposure and Maximum ERP/EIRP Assessment for a LTE CAT-M1 radio module. Including RF Exposure for use with co-located radios on generic host device.

Applicable FCC and ISED Rules

For RF Exposure:

OET Bulletin 65 Edition 97-01 August 1997

FCC 47 CFR §1.1307

FCC 47 CFR §1.1310

RSS-102 Issue 5 – March 2015

For Maximum ERP/EIRP:

FCC 47 CFR §22.913

IC SRSP-503 Issue 7, September 2008

FCC 47 CFR §24.232

IC SRSP-510 Issue 5, February 2009

FCC 47 CFR §27.50(d)

RSS-139, Issue 2 / SRSP-513

Report version control			
Version	Release date	Changes	Version validity
01	11.22.2017	Initial version	Notvalid
Rev1	12.12.2017	Calculation revised at page 6	valid

Responsible for
Accreditation Scope:


 Bernhard Retka

Responsible
for Report:



1 Administrative Data

1.1 Testing Laboratory

Company Name: 7Layers GmbH

Address: Borsigstr. 11
40880 Ratingen
Germany

This facility has been fully described in a report submitted to the FCC and accepted under the registration number 96716.

The test facility is also accredited by the following accreditation organisation:
Laboratory accreditation no.: DAkkS D-PL-12140-01-00

Responsible for Accreditation Scope: Dipl.-Ing. Bernhard Retka
Dipl.-Ing. Robert Machulec
Dipl.-Ing. Andreas Petz
Dipl.-Ing. Marco Kullik

Report Template Version: 2016-08-30

1.2 Project Data

Responsible for assessment and report: Mr. Andreas Tübel

Date of Report: 12.12.2017

1.3 Applicant Data

Company Name: Gemalto M2M GmbH

Address: Siemensdamm 50
13629 Berlin
Germany

Contact Person: Mr. Axel Heike

1.4 Manufacturer Data

Company Name: please see applicant data

Address:

Contact Person:

2 Test object Data

2.1 General EUT Description

Equipment under Test	LTE CAT-M1
Type Designation:	EMS31-US
Kind of Device:	LTE CAT-M1
LTE CAT	M1
FCC ID:	QIPEMS31-US
IC Number:	7830A-EMS31US

General product description:

The EUT is Cellular radio module supporting LTE CAT-M1

2.2 EUT Main components

Type, S/N, Short Descriptions etc. used in this Test Report

Short Description	Equipment under Test	Type Designation	Serial No.	HW Status	SW Status
EUT A (Code: DE1034027ba02)	LTE Module	EMS31-US	004401082059714	B2.2.1	REVISION 4.9.5.0
Remark: EUT A is equipped with a temporary antenna connector. The Module is not sold with a predefined antenna.					

NOTE: The short description is used to simplify the identification of the EUT in this test report.

2.3 Ancillary Equipment

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

Short Description	Equipment under Test	Type Designation	HW Status	SW Status	Serial no.	FCC ID
AE 1	DSB75 Development Board		-	-		-
AE 2	Module Adapter Plate AHS6-DSB75			-	-	-

2.4 Auxiliary Equipment

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Auxiliary Equipment can influence the test results.

Short Description	Equipment under Test	Type Designation	Serial no.	HW Status	SW Status	FCC ID
N/A						-

3 Evaluation Results

3.1 Maximum ERP / EIRP

Standard	Frequency Band
FCC 47 CFR §22.913 IC RSS-132, Issue 3	Not supported
FCC 47 CFR §24.232 IC RSS-133 Issue 6	(FDD2 WCDMA/HSUPA/HSDPA/LTE)
FCC 47 CFR §27.50(d) RSS-139, Issue 2 / SRSP-513	(FDD4,12 LTE)

3.1.1 Test Limits

For the 850MHz band, FCC §22.913 states that the maximum ERP of this device shall not exceed 7 Watts. IC SRSP-503 Issue 7, states that this device shall not exceed a maximum EIRP of 11.5 Watts

For the purposes of this test report, the 7 Watt ERP limit stipulated in FCC §22.913 has been converted to an equivalent EIRP value of 11.5 Watts.

For all other limits, refer to the values stipulated in the corresponding tables.

3.1.2 Test Protocol

Band	Mode	Duty Cycle (%)	Frequency (MHz)	Maximum Conducted output power (dBm)	Maximum Conducted output power (mW)	Freq of highest power (MHz)	FCC / IC EIRP limit (mW)	Maximum antenna gain to meet EIRP Limit (dBi)
eFDD 2	LTE	100.0%	1850-1910	24.34	271.64393	1850.70	2000	8.7
eFDD 4	LTE	100.0%	1710-1755	24.53	283.7919	1710.70	1000	5.5
eFDD12	LTE	100.0%	699.7-715.5	23.84	242.1029	699.70	4921	13.1

3.1.3 Conclusion

All gains in (dBi)				
Band	Max gain to be used to comply with EIRP Limits	Max gain to be used to comply with FCC MPE Limits	Max gain to be used to comply with IC MPE Limits	Maximum gain to be compliant with all limits
eFDD 2	8.7	12.0	8.5	8.5
eFDD 4	5.5	12.0	8.3	5.5
eFDD 12	13.1	8.7	5.6	5.6

3.2 RF Exposure Evaluation for Module

Standards
OET Bulletin 65 Edition 97-01 August 1997
FCC 47 CFR §1.1307
FCC 47 CFR §1.1310
RSS-102 Issue 5 – March 2015

3.2.1 Test limits

As specified in Table 1B of 47 CFR 1.1310 – Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure.

Frequency range (MHz)	Power density (mW/cm ²)
300 – 1,500	f/1500
1,500 – 100,000	1.0

Limits specified per RSS-102, Issue 5.

Frequency range (MHz)	Power density (W/m ²)	Power density (mW/cm ²)
300 – 6000	$0.02619 f^{0.6834}$	$mW/cm^2 = W/m^2 * 0.1$

Equation OET bulletin 65, page 18, edition 97-01:
$$S = \frac{PG}{4\pi R^2} = \frac{EIRP}{4\pi R^2}$$

Where:

S = power density

P = power input to the antenna

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

MPE Calculation using antenna gain which meets MPE and EIRP Limits for RSS-102, Annex A **Informational only**

Band	Mode	Frequency (MHz)	Maximum Conducted output power (dBm)	Max Cond output power (mW)	FCC MPE Limit (mW/cm ²)	IC MPE Limit (mW/cm ²)	Separation distance (cm)	MPE using gain for overall compliance
eFDD 2	LTE	1850.0	25	316.23	1.0000	0.4476	20	0.4476
eFDD 4	LTE	1710.0	25	316.23	1.0000	0.4242	20	0.4242
eFDD12	LTE	699.0	25	316.23	0.4660	0.2302	20	0.2302

3.2.2 Test Protocol

Maximum antenna gain to comply with MPE limits for FCC									
Band	Mode	Duty Cycle	Frequency (MHZ)	Maximum Conducted output power (dBm)	Maximum Conducted output power (mW)	Equivalent conducted output power (mW)	MPE Limit (mW/cm ²)	Maximum antenna gain to meet MPE Limit (dBi)	Separation distance (cm)
eFDD 2	LTE	100.0%	1850.0	25	316.23	316.23	1.0000	12.0	20
eFDD 4	LTE	100.0%	1710.0	25	316.23	316.23	1.0000	12.0	20
eFDD12	LTE	100.0%	699.0	25	316.23	316.23	0.4660	8.7	20

* Conducted output power values bases on "Tune-up" information provided by manufacturer.

Maximum antenna gain to comply with MPE limits for Industry Canada									
Band	Mode	Duty Cycle	Frequency (MHZ)	Maximum Conducted output power (dBm)	Maximum Conducted output power (mW)	Equivalent conducted output power (mW)	MPE Limit (mW/cm ²)	Maximum antenna gain to meet MPE Limit (dBi)	Separation distance (cm)
eFDD 2	LTE	100.0%	1850.0	25	316.23	316.23	0.4476	8.5	20
eFDD 4	LTE	100.0%	1710.0	25	316.23	316.23	0.4242	8.3	20
eFDD12	LTE	100.0%	699.0	25	316.23	316.23	0.2302	5.6	20

* Conducted output power values bases on "Tune-up" information provided by manufacturer.

3.2.3 Conclusion

Band	Max gain for FCC MPE Limits	Max gain for Industry Canada MPE Limits	Maximum gain to be compliant with all limits
eFDD 2	12.0	8.5	8.5
eFDD 4	12.0	8.3	8.3
eFDD12	8.7	5.6	5.6