

**InterLab<sup>®</sup>**

## RF Exposure and Maximum ERP/EIRP Assessment

For

**SARA-R510M8S**

CAT-M1 Data Module embedding

u-blox Chipset Model UBX-R5, HW: UBX-R5231 FW: 00.14

**FCC ID: XPYUBX19KM01**

**IC: 8595A-UBX19KM01**

**Assessment Reference:** MDE\_UBLOX\_1905\_MPE\_01\_rev02

**Test Laboratory:**

7layers GmbH  
Borsigstraße 11  
40880 Ratingen  
Germany

**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.

**7layers GmbH**  
Borsigstraße 11  
40880 Ratingen, Germany  
T +49 (0) 2102 749 0  
F +49 (0) 2102 749 350  
[www.7layers.com](http://www.7layers.com)

Registergericht registered in:  
Geschäftsführer /  
Managing Directors:  
Frank Spiller  
Bernhard Retka  
Alexandre Norré-Oudard

Düsseldorf, HRB 75554  
USt-IdNr VAT No.:  
DE203159652  
TAX No. 147/5869/0385  
A Bureau Veritas Group Company

## Table of Contents

<b>0</b>	<b>Summary</b>	<b>3</b>
0.1	Technical Report Summary	3
<b>1</b>	<b>Administrative Data</b>	<b>4</b>
1.1	Testing Laboratory	4
1.2	Project Data	4
1.3	Applicant Data	4
1.4	Manufacturer Data	4
<b>2</b>	<b>Test object Data</b>	<b>5</b>
2.1	General EUT Description	5
2.2	EUT Main components	5
2.3	Ancillary Equipment	5
2.4	Auxiliary Equipment	5
<b>3</b>	<b>Evaluation Results</b>	<b>6</b>
3.1	Maximum ERP / EIRP	6
3.2	RF Exposure Evaluation for Module	7

## 0 Summary

### 0.1 Technical Report Summary

#### Type of Report

RF Exposure and Maximum ERP/EIRP Assessment for a LTE CAT-M1 data 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 RSS-132, Issue 3  
 FCC 47 CFR §24.232  
 IC RSS-133 Issue 6  
 FCC 47 CFR §27.50(d)  
 RSS-139, Issue 2 / SRSP-513  
 FCC 47 CFR §90.635  
 RSS-140, Issue 1

Report version control			
Rev Version	Release date	Changes	Version validity
-	19.02.2020	Initial version	invalid
rev01	24.03.2020	Update for eFDD2, 13, 25 and 26	invalid
rev02	25.03.2020	Update of table header chapter 3.2.3	valid

Responsible for  
Accreditation Scope:



Responsible  
for Report:



## 1 Administrative Data

### 1.1 Testing Laboratory

Company Name:	7layers GmbH
Address	Borsigstr. 11 40880 Ratingen Germany
FCC accreditation	Designation Number: DE0015 Test Firm Registration #: 929146
Industry Canada Test Site Acceptance	CAB identifier: DE0007 Test Firm Registration #: 3699A
The test facility is also accredited by the following accreditation organisation: Laboratory accreditation no.:	D-PL-12140-01-01, D-PL-12140-01-02, D-PL-12140-01-03
Responsible for Accreditation Scope:	Dipl.-Ing. Bernhard Retka Dipl.-Ing. Robert Machulec Dipl.-Ing. Andreas Petz Dipl.-Ing. Marco Kullik
Report Template Version:	2020-02-19

### 1.2 Project Data

Responsible for assessment and report:	Mr. Sören Berentzen
Date of Report:	25.03.2020

### 1.3 Applicant Data

Company Name:	u-blox AG
Address:	Zürcherstrasse 68, CH-8800 Thalwil Switzerland
Contact Person:	Giulio Comar

### 1.4 Manufacturer Data

Company Name:	please see applicant data
Address:	
Contact Person:	

## 2 Test object Data

### 2.1 General EUT Description

<b>Equipment under Test</b>	SARA-R510M8S
<b>Type Designation:</b>	SARA-R510M8S
<b>Kind of Device:</b>	CAT-M1 Data Module embedding u-blox Chipset Model UBX-R5 HW: UBX-R5231 FW: 00.14
<b>GSM MSC/UMTS/LTE CAT</b>	CAT-M1
<b>FCC ID:</b>	XPYUBX19KM01
<b>IC Number:</b>	8595A-UBX19KM01

#### General product description:

The EUT is Cellular radio module supporting GSM/GPRS/WCDMA/HSDPA/HSUPA

### 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: DE1015116 ar11	SARA-R510M8S	R510M8S	357862090047590	352D00	00.11

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
NA						-

### 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	LTE FDD5, LTE FDD26
FCC 47 CFR §24.232 IC RSS-133 Issue 6	LTE FDD2, LTE FDD25
FCC 47 CFR §27.50(d) RSS-139, Issue 3 / SRSP-513	LTE FDD4, LTE FDD12, LTE FDD13
FCC 47 CFR §90.635 RSS-140, Issue 1	LTE FDD26

##### 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

**Maximum antenna gain to comply with EIRP limits for FCC and Industry Canada**

Band	Mode	Duty Cycle (%)	Frequency (MHZ)	Maximum Conducted output power (dBm)	Maximum Conducted output power (mW)	FCC EIRP limit (mW)	Maximum antenna gain to meet EIRP Limit (dBi)
eFDD 2	LTE	100.0%	1850-1910	22.67	184.92686	2000	10.3
eFDD 4	LTE	100.0%	1710-1755	23.17	207.49135	1000	6.8
eFDD 5	LTE	100.0%	824 - 849	23	199.52623	11484	17.6
eFDD 13	LTE	100.0%	777-787	22.62	182.81002	3000	12.2
eFDD 12	LTE	100.0%	699-716	22.21	166.34127	1000	7.8
eFDD 25	LTE	100.0%	1850-1915	22.62	182.81002	2000	10.4
eFDD 26	LTE	100.0%	814-849	22.64	183.65383	1000	7.4

##### 3.1.3 Conclusion

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	10.3	12.0	8.5	8.5
eFDD 4	6.8	12.0	8.3	6.8
eFDD 5	17.6	9.4	6.1	6.1
eFDD 13	12.2	9.2	5.9	5.9
eFDD 12	7.8	8.7	5.6	5.6
eFDD 25	10.4	12.0	8.5	8.5
eFDD 26	7.4	9.4	6.1	6.1

Gain expressed in dBi

### 3.2 RF Exposure Evaluation for Module

Standards
OET Bulletin 65 Edition 97-01 August 1997
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 <sup>2</sup> )
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 <sup>2</sup> )	Power density (mW/cm <sup>2</sup> )
300 – 6000	0.02619 f <sup>0.6834</sup>	mW/cm <sup>2</sup> = W/m <sup>2</sup> * 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

#### 3.2.2 Test Protocol

##### 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 <sup>2</sup> )	Maximum antenna gain to meet MPE Limit (dBi)	Separation distance (cm)
eFDD 2	LTE	100%	1850.7	25.0	316.23	316.23	0.4477	<b>8.5</b>	20
eFDD 4	LTE	100%	1710.7	25.0	316.23	316.23	0.4243	<b>8.3</b>	20
eFDD 5	LTE	100%	824.7	25.0	316.23	316.23	0.2577	<b>6.1</b>	20
eFDD 13	LTE	100%	777.7	25.0	316.23	316.23	0.2476	<b>5.9</b>	20
eFDD 12	LTE	100%	699.7	25.0	316.23	316.23	0.2303	<b>5.6</b>	20
eFDD 25	LTE	100%	1850.7	25.0	316.23	316.23	0.4477	<b>8.5</b>	20
eFDD 26	LTE	100%	814.7	25.0	316.23	316.23	0.2556	<b>6.1</b>	20

**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 <sup>2</sup> )	Maximum antenna gain to meet MPE Limit (dBi)	Separation distance (cm)
eFDD 2	LTE	100.0%	1850.7	25	316.23	316.23	1.0000	<b>12.0</b>	20
eFDD 4	LTE	100.0%	1710.7	25	316.23	316.23	1.0000	<b>12.0</b>	20
eFDD 5	LTE	100.0%	824.7	25	316.23	316.23	0.5498	<b>9.4</b>	20
eFDD 13	LTE	100.0%	777.0	25	316.23	316.23	0.5185	<b>9.2</b>	20
eFDD 12	LTE	100.0%	699.7	25	316.23	316.23	0.4665	<b>8.7</b>	20
eFDD 25	LTE	100.0%	1850.7	25	316.23	316.23	1.0000	<b>12.0</b>	20
eFDD 26	LTE	100.0%	814.7	25	316.23	316.23	0.5431	<b>9.4</b>	20

**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 MPE limits
eFDD 2	12.0	8.5	8.5
eFDD 4	12.0	8.3	8.3
eFDD 5	9.4	6.1	6.1
eFDD 13	9.2	5.9	5.9
eFDD 12	8.7	5.6	5.6
eFDD 25	12.0	8.5	8.5
eFDD 26	9.4	6.1	6.1

Gain expressed in dBi