

InterLab[®]

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_rev03

Test Laboratory:

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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 Assessment for a LTE CAT-M1 data module.

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

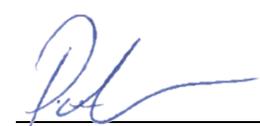
RSS-140, Issue 1

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	invalid
rev03	20.07.2020	Changed to only use Tune-up values for MPE calculation	valid

Reviewer:



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:	20.07.2020

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

Equipment under Test	SARA-R510M8S
Type Designation:	SARA-R510M8S
Kind of Device:	CAT-M1 Data Module embedding u-blox Chipset Model UBX-R5 HW: UBX-R5231 FW: 00.14
GSM MSC/UMTS/LTE CAT	CAT-M1
FCC ID:	XPYUBX19KM01
IC Number:	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 RF Exposure Evaluation for Module

Standards
OET Bulletin 65 Edition 97-01 August 1997
RSS-102 Issue 5 – March 2015

3.1.1 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

3.1.2 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 ²)	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	8.5	20
eFDD 4	LTE	100%	1710.7	25.0	316.23	316.23	0.4243	8.3	20
eFDD 5	LTE	100%	824.7	25.0	316.23	316.23	0.2577	6.1	20
eFDD 13	LTE	100%	777.7	25.0	316.23	316.23	0.2476	5.9	20
eFDD 12	LTE	100%	699.7	25.0	316.23	316.23	0.2303	5.6	20
eFDD 25	LTE	100%	1850.7	25.0	316.23	316.23	0.4477	8.5	20
eFDD 26	LTE	100%	814.7	25.0	316.23	316.23	0.2556	6.1	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 ²)	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	12.0	20
eFDD 4	LTE	100.0%	1710.7	25	316.23	316.23	1.0000	12.0	20
eFDD 5	LTE	100.0%	824.7	25	316.23	316.23	0.5498	9.4	20
eFDD 13	LTE	100.0%	777.0	25	316.23	316.23	0.5185	9.2	20
eFDD 12	LTE	100.0%	699.7	25	316.23	316.23	0.4665	8.7	20
eFDD 25	LTE	100.0%	1850.7	25	316.23	316.23	1.0000	12.0	20
eFDD 26	LTE	100.0%	814.7	25	316.23	316.23	0.5431	9.4	20

3.1.3 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