RF Exposure and Maximum ERP/EIRP Assessment

For

LARA-R6001 / LARA-R6001D

FCC ID: XPYUBX21BE01

IC ID: 8595A-UBX21BE01

Assessment Reference: MDE_UBLOX_2029_MPE_01

Test Laboratory:
7layers GmbH
Borsigstraße 11
40880 Ratingen
Germany

Deutsche Akkreditierungsstelle
D-PL-12140-01-01
D-PL-12140-01-02
D-PL-12140-01-03

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0 Summary

0.1 Technical Report Summary

Type of Report
RF Exposure and Maximum ERP/EIRP Assessment for a GSM/UMTS/LTE/NB-IoT 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
ISED RSS-132, Issue 3
FCC 47 CFR §24.232
ISED RSS-133 Issue 6, Amendment 1
FCC 47 CFR §27.50(b), (c), (d)
ISED RSS-139, Issue 2 / SRSP-513, RSS-130, Issue 3
FCC 47 CFR §90.635
ISED RSS-140, Issue 1

Report version control			
Rev Version	**Release date**	**Changes**	**Version validity**
-	2021-12-14	Initial version	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.:	DAkkS D-PL-12140-01-01 DAkkS D-PL-12140-01-02 DAkkS 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:	2021-08-02

1.2 Project Data

Responsible for assessment and report:	Mr. Sören Berentzen
Date of Report:	2021-12-14

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	LARA-R6001 / LARA-R6001D
Kind of Device:	2G / 3G / LTE module
GSM MSC/UMTS/LTE CAT	11/33/8/Cat 1
FCC ID:	XPYUBX21BE01
IC ID:	8595A-UBX21BE01

General product description:

The EUT is Cellular radio module supporting GSM/GPRS/WCDMA/HSDPA/HSUPA/LTE.
LARA-R6001D is a data only product, LARA-R6001 is supporting voice and data.

2.2 EUT Main components

Short Descriptions etc. used in this Test Report

Short Description	Equipment under Test	HW Status	SW Status
EUT Code: DE1015143	LARA-R6001	UBX-379C01	00.09, A00.01
EUT Code: DE1015151	LARA-R6001D	UBX-379C01	00.09, A00.01

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 ISED RSS-132, Issue 3	GSM 850 FDD5 WCDMA/HSUPA/HSDPA eFDD5/26 LTE
FCC 47 CFR §24.232 ISED RSS-133 Issue 6, Amendment 1	GSM 1900 FDD2 WCDMA/HSUPA/HSDPA eFDD2 LTE
FCC 47 CFR §27.50(d) ISED RSS-139, Issue 3 / SRSP-513	eFDD4/7 LTE eTDD 38/41 LTE
FCC 47 CFR §27.50(c) ISED RSS-130, Issue 3	eFDD12
FCC 47 CFR §27.50(b) ISED RSS-130, Issue 3	eFDD13
FCC 47 CFR §90.635	eFDD26 LTE
FCC 47 CFR §27.1507(a)	eFDD8

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 ERIP 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 Range (MHZ)	Maximum Conducted output power (dBm)	Maximum Conducted output power (mW)	FCC EIRP limit (mW)	Maximum antenna gain to meet EIRP Limit (dBi)
850	GSM	50.0%	824.2 - 848.8	31.55	1428.89396	11484	9.1
1900	GSM	50.0%	1850.2 - 1909.8	28.55	716.14341	2000	4.5
FDD 2	UMTS	100.0%	1850 - 1907.6	23.08	203.235701	2000	9.9
FDD 5	UMTS	100.0%	824 - 846.6	23.27	212.324446	11484	17.3
eFDD 2	LTE	100.0%	1850-1910	23.47	222.330989	2000	9.5
eFDD 4	LTE	100.0%	1710-1755	23.96	248.885732	1000	6.0
eFDD 5	LTE	100.0%	824 - 849	24.04	253.512863	11484	16.6
eFDD 7	LTE	100.0%	2500-2570	22.7	186.208714	2000	10.3
eFDD 13	LTE	100.0%	777-787	24.07	255.27013	4920	12.8
eFDD 12	LTE	100.0%	699-716	24.39	274.789415	4920	12.5
eTDD 41	LTE	100.0%	2496-2690	24.26	266.685866	2000	8.8
eFDD 26	LTE	100.0%	814–849	24.13	258.821292	11484	16.5
eFDD 8	LTE	100.0%	898-890	22.81	190.985326	4920	14.1
eTDD 38	LTE	100.0%	2570–2620	23.52	224.905461	2000	9.5

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
850	9.1	3.9	0.6	0.6
1900	4.5	9.5	6.0	4.5
FDD 2	9.9	13.0	9.5	9.5
FDD 5	17.3	10.4	7.1	7.1
eFDD 2	9.5	13.0	9.5	9.5
eFDD 4	6.0	13.0	9.3	6.0
eFDD 5	16.6	10.4	7.1	7.1
eFDD 7	10.3	13.5	10.9	10.3
eFDD 13	12.8	10.2	7.0	7.0
eFDD 12	12.5	9.7	6.6	6.6
eTDD 41	8.8	13.0	10.4	8.8
eFDD 26	16.5	10.4	7.1	7.1
eFDD 8	14.1	10.8	7.4	7.4
eTDD 38	9.5	13.0	10.5	9.5

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/cm²)*
300 – 1,500	f/1500
1,500 – 100,000	1.0

Limits specified per RSS-102, Issue 5.

Frequency range (MHz)	*Power density (W/m²)*	*Power density (mW/cm²)*
300 – 6000	$0.02619\ f^{0.6834}$	*mW/cm² = W/m² * 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/cm²)	Maximum antenna gain to meet MPE Limit (dBi)	Separation distance (cm)
850	GSM	50%	824.2	33.5	2238.72	1119.44	0.2576	**0.6**	20
1900	GSM	50%	1850.2	30.5	1122.02	561.05	0.4477	**6.0**	20
FDD 2	UMTS	100%	1852.4	24.0	251.19	251.19	0.4480	**9.5**	20
FDD 5	UMTS	100%	826.4	24.0	251.19	251.19	0.2581	**7.1**	20
eFDD 2	LTE	100%	1850.7	24.0	251.19	251.19	0.4477	**9.5**	20
eFDD 4	LTE	100%	1710.7	24.0	251.19	251.19	0.4243	**9.3**	20
eFDD 5	LTE	100%	824.7	24.0	251.19	251.19	0.2577	**7.1**	20
eFDD 7	LTE	100%	2502.5	23.5	223.87	223.87	0.5503	**10.9**	20
eFDD 13	LTE	100%	779.5	24.0	251.19	251.19	0.2480	**7.0**	20
eFDD 12	LTE	100%	699.7	24.0	251.19	251.19	0.2303	**6.6**	20
eTDD 41	LTE	100%	2498.5	24.0	251.19	251.19	0.5497	**10.4**	20
eFDD 26	LTE	100%	824.7	24.0	251.19	251.19	0.2577	**7.1**	20
eFDD 8	LTE	100%	898.0	24.0	251.19	251.19	0.2732	**7.4**	20
eTDD 38	LTE	100%	2572.5	24.0	251.19	251.19	0.5608	**10.5**	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/cm²)	Maximum antenna gain to meet MPE Limit (dBi)	Separation distance (cm)
850	GSM	50%	824.2	33.5	2238.72	1119.44	0.5495	**3.9**	20
1900	GSM	50%	1850.2	30.5	1122.02	561.05	1.0000	**9.5**	20
FDD 2	UMTS	100.0%	1852.4	24	251.19	251.19	1.0000	**13.0**	20
FDD 5	UMTS	100.0%	826.4	24	251.19	251.19	0.5509	**10.4**	20
eFDD 2	LTE	100.0%	1850.7	24	251.19	251.19	1.0000	**13.0**	20
eFDD 4	LTE	100.0%	1710.7	24	251.19	251.19	1.0000	**13.0**	20
eFDD 5	LTE	100.0%	824.7	24	251.19	251.19	0.5498	**10.4**	20
eFDD 7	LTE	100.0%	2502.5	23.5	223.87	223.87	1.0000	**13.5**	20
eFDD 13	LTE	100.0%	779.5	24	251.19	251.19	0.5197	**10.2**	20
eFDD 12	LTE	100.0%	699.7	24	251.19	251.19	0.4665	**9.7**	20
eTDD 41	LTE	100.0%	2498.5	24	251.19	251.19	1.0000	**13.0**	20
eFDD 26	LTE	100.0%	824.7	24	251.19	251.19	0.5498	**10.4**	20
eFDD 8	LTE	100.0%	898.0	24	251.19	251.19	0.5987	**10.8**	20
eTDD 38	LTE	100.0%	2572.5	24	251.19	251.19	1.0000	**13.0**	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
850	3.9	0.6	0.6
1900	9.5	6.0	6.0
FDD 2	13.0	9.5	9.5
FDD 5	10.4	7.1	7.1
eFDD 2	13.0	9.5	9.5
eFDD 4	13.0	9.3	9.3
eFDD 5	10.4	7.1	7.1
eFDD 7	13.5	10.9	10.9
eFDD 13	10.2	7.0	7.0
eFDD 12	9.7	6.6	6.6
eTDD 41	13.0	10.4	10.4
eFDD 26	10.4	7.1	7.1
eFDD 8	10.8	7.4	7.4
eTDD 38	13.0	10.5	10.5

Gain expressed in dBi