

# InterLab RF Exposure and Maximum ERP/EIRP Assessment

For

SARA-U260 GSM/UMTS Module

FCC ID: XPYSARAU260

IC: 8595A-SARAU260

Assessment Reference: MDE\_UBLOX\_1404\_MPEa

## **Test Laboratory:**

Borsigstrasse 11 Germany 7Layers AG 40880 Ratingen

#### Note

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7 layers AG Borsigstrasse 11 40880 Ratingen, Germany Phone: +49 (0) 2102 749 0 Fax: +49 (0) 2102 749 350 www.7Layers.com Aufsichtsratsvorsitzender • Chairman of the Supervisory Board: Peter Mertel Vorstand • Board: Dr. H.-J. Meckelburg Dr. H. Ansorge

Registergericht • registered in: Düsseldorf, HRB 44096 USt-IdNr • VAT No.: DE 203159652 TAX No. 147/5869/0385



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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 radio module. Including RF Exposure for use with co-located radios on generic host device.

## **Applicable FCC 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 4 – March 2010

## 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

Note:

None

		Report version control	
Version	Release date	Changes	Version validity
001	22.04.2014	Initial version	Valid

Responsible for Accreditation Scope:

Responsion for Rep



# 1 Administrative Data

# 1.1 Testing Laboratory

Company Name:	7Layers AG
Address	Borsigstr. 11 40880 Ratingen Germany
This facility has been fully described in a report sub number 96716.	mitted to the FCC and accepted under the registration
The test facility is also accredited by the following a Laboratory accreditation no.:	occreditation organisation: DAkkS D-PL-12140-01-01
Responsible for Accreditation Scope:	DiplIng. Bernhard Retka DiplIng. Robert Machulec DiplIng. Andreas Petz
Report Template Version:	2014-05-15
1.2 Project Data	
Responsible for assessment and report:	Mr. Patrick Lomax
Date of Report:	2014-05-16
1.3 Applicant Data	
Company Name:	u-blox Italia S.p.A.
Address:	Via Stazione di Prosecco, 15 34010 Sgonico (Trieste) Italy
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 TestSARA-U260 ModuleType Designation:SARA-U260Kind of Device: GPRS/EDGE MSCGSM/UMTS Module

GPRS Multi-slot class 12

 FCC ID:
 XPYSARAU260

 IC Number:
 8595A-SARAU260

#### 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	Date of Receipt
EUT A Code:	SARA U260	U260	352252060028	188BA1	23.05	2014-04-16
DE1015001	JANA 0200	0200		IOODAI	23.03	2014-04-10
			89			
AA02						

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

### 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	Equipment	Туре	Serial no.	<b>HW Status</b>	SW Status	FCC ID
Description	under Test	Designation				
N/A						-



## 2.5 Operating Modes

This chapter describes the operating modes of the EUTs used for testing.

Op. Mode	Description of Operating Modes	Remarks	
Op-mode 1	EUT transmitting in standalone configuration	Antenna-to-person distance > 20cm	
Op-mode 2	EUT transmitting in co-location with hypothetical Bluetooth radio where the separation distance between co-located transmitter's antennas is < 20cm.	Antenna-to-person distance > 20cm	
Op-mode 3 EUT transmitting in co-location with hypothetical WLAN radio where the separation distance between co-located transmitter's antennas is < 20cm.		Antenna-to-person distance > 20cm	
Op-mode 4	EUT transmitting in co-location with hypothetical Bluetooth and WLAN radios where the separation distance between co-located transmitter's antennas is < 20cm.	Antenna-to-person distance > 20cm	



## 3 Evaluation Results

### 3.1 Maximum ERP / EIRP

Standard	Frequency Band
FCC 47 CFR §22.913	(850MHZ GSM/GPRS) (FDD5 WCDMA/HSUPA/HSDPA)
IC SRSP-503 Issue 7, September 2008	(850MHZ GSM/GPRS) (FDD5 WCDMA/HSUPA/HSDPA)
FCC 47 CFR §24.232	(1900MHZ GSM/GPRS) (FDD2 WCDMA/HSUPA/HSDPA)
IC SRSP-510 Issue 5, February 2009	(1900MHZ GSM/GPRS) (FDD2 WCDMA/HSUPA/HSDPA)

## 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 the 1900MHz band, FCC §24.232 and IC SRSP-510 Issue 5 states that the maximum EIRP of this device shall not exceed 2 Watts.

#### 3.1.2 Test Protocol

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

Band	Mode	Frequency (MHZ)	Maximum Conducted output power (dBm) *	Maximum Conducted output power (mW)	FCC / IC EIRP limit (mW)	Maximum antenna gain to meet EIRP Limit (dBi)
Dallu	Mode	(IVITZ)	(ubili)	(IIIVV)	(IIIVV)	(UDI)
850	GSM / GPRS	848.8	34	2511.89	11484	6.6
1900	GSM / GPRS	1850.2	31	1258.93	2000	2.0
	W-CDMA	846.6	24	251.19	11484	16.6
FDD 5	HSDPA	846.6	24	251.19	11484	16.6
	HSUPA	836.6	24	251.19	11484	16.6
	W-CDMA	1852.4	24	251.19	2000	9.0
FDD 2	HSDPA	1907.6	24	251.19	2000	9.0
	HSDPA	1880.0	24	251.19	2000	9.0

<sup>\*</sup> Conducted output power values bases on "Tune-up" information provided by manufacturer.

## 3.1.3 Conclusion

Max antenna gain for EIRP Limit	Band	Gain (dBi)
	850 MHz	6.6
	1900 MHz	2.0



## 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 4 – March 2010

#### 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

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

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

Maxim	Maximum antenna gain to comply with MPE limits for FCC and 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 / GPRS	50%	848.8	34	2511.89	1256.03	0.5659	3.5	20
1900	GSM / GPRS	50%	1850.2	31	1258.93	629.51	1.0000	9.0	20
FDD	W-CDMA	100%	846.6	31	1258.93	251.19	0.5644	10.5	20
5	HSDPA	100%	846.6	24	251.19	251.19	0.5644	10.5	20
	HSUPA	100%	836.6	24	251.19	251.19	0.5577	10.5	20
FDD	W-CDMA	100%	1852.4	24	251.19	251.19	1.0000	13.0	20
2	HSDPA	100%	1907.6	24	251.19	251.19	1.0000	13.0	20
	HSDPA	100%	1880.0	24	251.19	251.19	1.0000	13.0	20

<sup>\*</sup> Conducted output power values bases on "Tune-up" information provided by manufacturer.

#### 3.2.3 Conclusion

Maximum antenna gain for MPE compliance	Frequency Band	Gain (dBi)	Maximum gain to be used
	850 MHz	3.5 **	3.5 dBi
•	1900 MHz	9.0 **	2.0 dBi

<sup>\*\*</sup> That actual maximum gain shall be the highest value which meets both RF exposure and EIRP limitations.



#### 3.3 RF Exposure Evaluation for multiple transmitters in co-location

Standards
OET Bulletin 65 Edition 97-01 August 1997
FCC 47 CFR §1.1307
FCC 47 CFR §1.1310
RSS-102 Issue 4 – March 2010

#### 3.3.1 Co-Location Considerations

The calculation below is used to consider situations in which simultaneous exposure to fields of different frequencies occur. The calculation is performed by the sum of each relative exposure for each equipment according to the following criteria.

$$\sum_{1}^{N} \frac{S_{eqn}}{S_{Limn}} = \frac{S_{eq1}}{S_{Lim1}} + \frac{S_{eq2}}{S_{Lim2}} + \dots + \frac{S_{eqN}}{S_{LimN}} \le 1$$

Where:

 $S_{eq}$  is the power density of the electromagnetic field at a given distance by a specific transmitter and a defined frequency.

 $S_{lin}$  is the MPE limit for the frequency being evaluated.

### 3.3.2 Assumptions

- 1. SARA U260 Module does not support power reduction for multiple time slots on the uplink.
- 2. Antenna separation from is  $\geq$  20cm.
- 3. Separation distance between co-located transmitting antennas is 0cm.
- 4. Hypothetical Bluetooth radio is assumed to have an EIRP of 100mW.
- 5. Hypothetical WLAN radio is assumed to have an EIRP of 2000mW.

#### 3.3.3 Test Protocol

OP mode-1

MPE Calc	MPE Calculation for Primary Transmitter using Maximum antenna gain determined from relative exposure of co-located transmitters										
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)	Max antenna gain (dBi)	MPE Value using Max gain (mW/cm²)	Separation distance (cm)	Verdict
850	GSM / GPRS	50%	848.8	34	2511.89	1256.03	0.5659	1.0	0.3146	20	Pass
1900	GSM / GPRS	50%	1850.2	31	1258.93	629.51	1.0000	2.0	0.1985	20	Pass
FDD 5	W- CDMA	100%	846.6	31	1258.93	251.19	0.5644	1.0	0.0792	20	Pass
	HSDPA	100%	846.6	24	251.19	251.19	0.5644	1.0	0.0792	20	Pass
	HSUPA	100%	836.6	24	251.19	251.19	0.5577	1.0	0.0792	20	Pass
FDD 2	W- CDMA	100%	1852.4	24	251.19	251.19	1.0000	2.0	0.0792	20	Pass
	HSDPA	100%	1907.6	24	251.19	251.19	1.0000	2.0	0.0792	20	Pass
	HSDPA	100%	1880.0	24	251.19	251.19	1.0000	2.0	0.0792	20	Pass

<sup>\*</sup> Conducted output power values bases on "Tune-up" information provided by manufacturer.



\*The above table is to determine the MPE values using the maximum gain values obtained in section 3.3.4 of this document.

MPE Calculation for Single Transmitter installed in Generic host								
Radio type	Duty Cycle	EIRP (mW)	EIRP Equivalent (mW)	MPE Limit (mW/cm²)	Maximum antenna gain (dBi)	Power density (mW/cm²)	Separation distance (cm)	Verdict
Bluetooth	25%	100.00	76.43	1.0000	0.0	0.0152	20	Pass
WLAN	100%	2000.00	2000.00	1.0000	0.0	0.3979	20	Pass

## OP mode-1

OF IIIOUE-1									
	Relative exposure for SARA U260 Module								
						S <sub>eq</sub>			
OD Mada	Mada	FIDD	Frequency	S <sub>eq</sub>	Slin	S <sub>Lin</sub>	Mandiak		
OP-Mode	Mode	EIRP	(MHZ)	(IIIVV/CIII)	(mW/cm²)	(IIIVV/CIII)	Verdict		
GSM 850	GSM / GPRS	1581.2480	848.8	0.3146	0.5659	0.55592525	Pass		
GSM 1900	GSM / GPRS	792.5013	1850.2	0.1985	1.0000	0.19848629	Pass		
	W-CDMA	316.2278	846.6	0.0629	0.5644	0.11146628	Pass		
FDD 5	HSDPA	316.2278	846.6	0.0629	0.5644	0.11146628	Pass		
	HSUPA	316.2278	836.6	0.0629	0.5577	0.11279865	Pass		
	W-CDMA	316.2278	1852.4	0.0792	1.0000	0.07920097	Pass		
FDD 2	HSDPA	316.2278	1907.6	0.0792	1.0000	0.07920097	Pass		
	HSDPA	316.2278	1880.0	0.0792	1.0000	0.07920097	Pass		

Relative exposure for Secondary transmitter							
OP-Mode	Transmitter	EIRP	Seq (mW/cm²)	Slin (mW/cm²)	Seq  SLin		
2	Bluetooth	76.43	0.0152	1.0000	0.015205278		
3	WLAN	2000.00	0.3979	1.0000	0.397887694		
4	Bluetooth	76.43	0.0152	1.0000	0.015205278		
	WLAN	2000.00	0.3979	1.0000	0.397887694		



Simultaneo	us exposure or F	Primary and Se	condary transm	itter installed in generic hos	t device	
OP-Mode	Transmitter	Frequency (MHZ)	Maximum  S <sub>eq</sub> / S <sub>Lin</sub> (mW/cm <sup>2</sup> )	Maximum (Spri/Slim_pri) + (Ssec / Slin_Sec) (mW/cm²)	$\frac{Compliance}{Maximum} \\ (S_{pri}/S_{lim\_pri}) + (S_{sec}/S_{lin\_Sec}) < 1$	
2	Bluetooth	2441	0.0152	0.5711	Compliant	
	SARA U260	850	0.5559			
2	Bluetooth	2441	0.0152	0.2137	Compliant	
	SARA U260	1900	0.1985			
3	WLAN	2437	0.3979	0.9538	Compliant	
	SARA U260	850	0.5559			
3	WLAN	2437	0.3979	0.5964	Compliant	
	SARA U260	1900	0.1985			
4	Bluetooth	2441	0.0152	0.9690	Compliant	
	WLAN	2437	0.3979			
	SARA U260	850	0.5559			
4	Bluetooth	2441	0.0152	0.6116	Compliant	
	WLAN	2437	0.3979			
	SARA U260	1900	0.1985			

## 3.3.4 Conclusion

FCC Part 15, Subpart C	Op. Mode	Result	
	op-mode 2	Compliant	
	op-mode 3	Compliant	
	on-mode 4	Compliant	

Frequency Band	Maximum gain for co-location compliance
850 MHz	1.0 dBi
1900 MHz	2.0 dBi

Maximum gain for SARA U260 for use in a generic host in a co-located environment with a Bluetooth radio operating at 100mW and WLAN transmitter operating at 2000mW.