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

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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

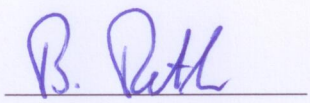
For RF Exposure:
OET Bulletin 65 Edition 97-01 August 1997
FCC 47 CFR §1.1307
FCC 47 CFR §1.1310
RSS-102 Issue 4 – March 2010

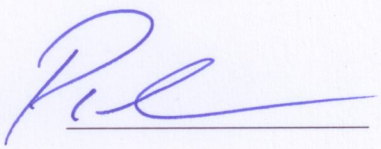
For Maximum ERP/EIRP:

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: 

Responsible for Report: 

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 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-12140-01-01
Responsible for Accreditation Scope:	Dipl.-Ing. Bernhard Retka Dipl.-Ing. Robert Machulec Dipl.-Ing. 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 Test	SARA-U260 Module
Type Designation:	SARA-U260
Kind of Device: GPRS/EDGE MSC	GSM/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: DE1015001 AA02	SARA U260	U260	352252060028 89	188BA1	23.05	2014-04-16

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
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 Description	Equipment under Test	Type Designation	Serial no.	HW Status	SW Status	FCC ID
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)
850	GSM / GPRS	848.8	34	2511.89	11484	6.6
1900	GSM / GPRS	1850.2	31	1258.93	2000	2.0
FDD 5	W-CDMA	846.6	24	251.19	11484	16.6
	HSDPA	846.6	24	251.19	11484	16.6
	HSUPA	836.6	24	251.19	11484	16.6
FDD 2	W-CDMA	1852.4	24	251.19	2000	9.0
	HSDPA	1907.6	24	251.19	2000	9.0
	HSDPA	1880.0	24	251.19	2000	9.0

* 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: $S = \frac{PG}{4\pi R^2} = \frac{EIRP}{4\pi R^2}$

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 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 5	W-CDMA	100%	846.6	31	1258.93	251.19	0.5644	**10.5**	20
	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 2	W-CDMA	100%	1852.4	24	251.19	251.19	1.0000	**13.0**	20
	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

* 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**

**** 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.

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

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 ≥ 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 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

* 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

Relative exposure for SARA U260 Module							
OP-Mode	Mode	EIRP	Frequency (MHZ)	S_{eq} (mW/cm²)	S_{lin} (mW/cm²)	$\frac{S_{eq}}{S_{Lin}}$ (mW/cm²)	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
FDD 5	W-CDMA	**316.2278**	846.6	**0.0629**	0.5644	0.11146628	Pass
	HSDPA	**316.2278**	846.6	**0.0629**	0.5644	0.11146628	Pass
	HSUPA	**316.2278**	836.6	**0.0629**	0.5577	0.11279865	Pass
FDD 2	W-CDMA	**316.2278**	1852.4	**0.0792**	1.0000	0.07920097	Pass
	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

Simultaneous exposure or Primary and Secondary transmitter installed in generic host device					
OP-Mode	Transmitter	Frequency (MHZ)	Maximum S_{eq} / S_{Lin} (mW/cm²)	Maximum $(S_{pri}/S_{lim\_pri}) + (S_{sec} / S_{lin\_Sec})$ (mW/cm²)	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
	op-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.