

InterLab[®]

RF Exposure and Maximum ERP/EIRP Assessment

For

SARA-U280 GSM/UMTS Module

FCC ID: XPYSARAU280

IC: 8595A-SARAU280

Assessment Reference: MDE_UBLOX_1501_MPEa

Test Laboratory:

Borsigstrasse 11
Germany
7Layers AG
40880 Ratingen



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 and Maximum ERP/EIRP Assessment for an 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

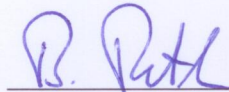
For Maximum ERP/EIRP:

FCC 47 CFR §22.913
 IC SRSP-503 Issue 7, September 2008
 FCC 47 CFR §24.232
 IC SRSP-510 Issue 5, February 2009

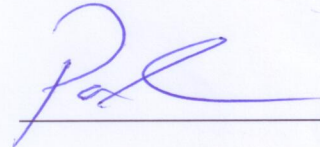
Note:
 None

Report version control			
Version	Release date	Changes	Version validity
01	22.01.2015	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: 2015-01-26

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-U280 Module
Type Designation:	SARA-U280
Kind of Device: GPRS/EDGE MSC	UMTS Module
GPRS Multi-slot class	NA
FCC ID:	XPYSARAU280
IC Number:	8595A-SARAU280

General product description:

The EUT is Cellular radio module supporting 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: DE1015012 AA02	SARA U280	U280	355922060011 141	188BB0	23.28	2015-01-19

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	UMTS Band	Remarks
Op-mode 1	EUT transmitting in standalone configuration	FDD2/FDD5	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.	FDD 5	Antenna-to-person distance > 20cm
Op-mode 3	EUT transmitting in co-location with hypothetical Bluetooth radio where the separation distance between co-located transmitter's antennas is < 20cm.	FDD 2	Antenna-to-person distance > 20cm
Op-mode 4	EUT transmitting in co-location with hypothetical WLAN radio where the separation distance between co-located transmitter's antennas is < 20cm.	FDD 5	Antenna-to-person distance > 20cm
Op-mode 5	EUT transmitting in co-location with hypothetical WLAN radio where the separation distance between co-located transmitter's antennas is < 20cm.	FDD 2	Antenna-to-person distance > 20cm
Op-mode 6	EUT transmitting in co-location with hypothetical Bluetooth and WLAN radios where the separation distance between co-located transmitter's antennas is < 20cm.	FDD 5	Antenna-to-person distance > 20cm
Op-mode 7	EUT transmitting in co-location with hypothetical Bluetooth and WLAN radios where the separation distance between co-located transmitter's antennas is < 20cm.	FDD 2	Antenna-to-person distance > 20cm

3 Evaluation Results

3.1 Maximum ERP / EIRP

Standard	Frequency Band
FCC 47 CFR §22.913	(FDD5 WCDMA/HSUPA/HSDPA)
IC SRSP-503 Issue 7, September 2008	(FDD5 WCDMA/HSUPA/HSDPA)
FCC 47 CFR §24.232	(FDD2 WCDMA/HSUPA/HSDPA)
IC SRSP-510 Issue 5, February 2009	(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 EIRP 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	Duty Cycle (%)	Frequency (MHZ)	Maximum Conducted output power (dBm)	Maximum Conducted output power (mW)	Freq of highest power	FCC / IC EIRP limit (mW)	Maximum antenna gain to meet EIRP Limit (dBi)
FDD 2	UMTS	100.0%	1850 - 1907.6	22.72	187.068214	1907.60	2000	10.3
FDD 5	UMTS	100.0%	824 - 846.6	22.93	196.3360277	836.00	11484	17.7

3.1.3 Conclusion

Max antenna gain for EIRP Limit	Band	Gain (dBi)
	FDD 2	10.3
	FDD 5	17.7

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/cm ²)
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/cm ²)	Maximum antenna gain to meet MPE Limit (dBi)	Separation distance (cm)
FDD 2	UMTS	100.0%	1907.6	24	251.19	251.19	1.0000	13.0	20
FDD 5	UMTS	100.0%	836.0	24	251.19	251.19	0.5573	10.5	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) for overall compliance	Maximum gain (dBi) for MPE compliance
	FDD 2	10.3	13.0
	FDD 5	10.0	10.5

* The actual maximum gain shall be the highest value which meets both RF exposure and EIRP limitations.

MPE Calculation using antenna gain which meets MPE and EIRP Limits (Informational)

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)	Separation distance (cm)	MPE using gain for overall compliance
FDD 2	UMTS	100.0%	1907.6	24	251.19	251.19	1.0000	20	0.5354643
FDD 5	UMTS	100.0%	836.0	24	251.19	251.19	0.5573	20	0.4997243

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.

$$\sum_{i=1}^N \frac{S_{eqi}}{S_{Lim i}} = \frac{S_{eq1}}{S_{Lim1}} + \frac{S_{eq2}}{S_{Lim2}} + \dots + \frac{S_{eqN}}{S_{LimN}} \leq 1$$

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 U280 Module does not support power reduction for multiple time slots on the uplink.
2. Antenna separation from is ≥ 20 cm.
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

Band	Mode	Duty Cycle	Frequency (MHZ)	Maximum Conducted output power (dBm)	Equivalent conducted output power (mW)	MPE Limit (mW/cm ²)	MPE Value using Max gain	Separation distance (cm)	Verdict
FDD 2	UMTS	100.0%	1907.6	24	251.19	1.0000	0.2746	20	Pass
FDD 5	UMTS	100.0%	836.0	24	251.19	0.5573	0.3081	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/cm ²)	Maximum antenna gain (dBi)	Power density (mW/cm ²)	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 Primary Transmitter							
OP-Mode	Mode	EIRP	Frequency (MHZ)	S_{seq}	S_{lin} (mW/cm ²)	S_{seq} ----- S_{lin}	Verdict
FDD 2	UMTS	316.2278	1907.6	0.5738	1.0000	0.57376032	Pass
FDD 5	UMTS	354.8134	836.0	0.3081	0.5573	0.55286041	Pass

Relative exposure for Secondary transmitter				
Transmitter	EIRP	S_{seq} (mW/cm ²)	S_{lin} (mW/cm ²)	S_{seq} ----- S_{lin}
Bluetooth	76.43	0.0152	1.0000	0.015205278
WLAN	2000.00	0.3979	1.0000	0.397887694
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 with Bluetooth and WLAN					
OP-Mode	Transmitter	Frequency (MHZ)	Maximum S_{eq} / S_{Lin}	Maximum $S_{pri} / S_{lim_pri} + S_{sec} / S_{lin_Sec}$	Compliance Maximum $(S_{pri} / S_{lim_pri} + S_{sec} / S_{lin_Sec}) < 1$
2	Bluetooth	2441	0.01521	0.5681	Compliant
	SARA-U280	850	0.55286		
3	Bluetooth	2441	0.01521	0.5890	Compliant
	SARA-U280	1900	0.57376		
4	WLAN	2437	0.39789	0.9507	Compliant
	SARA-U280	850	0.55286		
5	WLAN	2437	0.39789	0.9716	Compliant
	SARA-U280	1900	0.57376		
6	Bluetooth	2441	0.01521	0.9660	Compliant
	WLAN	2437	0.39789		
	SARA-U280	850	0.55286		
7	Bluetooth	2441	0.01521	0.9869	Compliant
	WLAN	2437	0.39789		
	SARA-U280	1900	0.57376		

3.3.4 Conclusion

FCC Part 15, Subpart C	Op. Mode	Result
	op-mode 2	Compliant
	op-mode 3	Compliant
	op-mode 4	Compliant
	op-mode 5	Compliant
	op-mode 6	Compliant

Frequency Band	Maximum gain for co-location compliance
FDD 5	7.9 dBi
FDD 2	10.6 dBi

Maximum gain for SARA U280 for use in a generic host in a co-located environment with a Bluetooth radio operating at 100mW and WLAN transmitter operating at 2000mW.