

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:**

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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 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

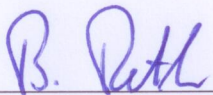
IC SRSP-510 Issue 5, February 2009

Note:

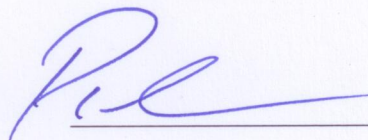
None

| 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<br>40880 Ratingen<br>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.: DAKS D-PL-12140-01-01

|                                      |                                                                                    |
|--------------------------------------|------------------------------------------------------------------------------------|
| Responsible for Accreditation Scope: | Dipl.-Ing. Bernhard Retka<br>Dipl.-Ing. Robert Machulec<br>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<br>34010 Sgonico (Trieste)<br>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:<br>DE1015001<br>AA02 | SARA U260            | U260             | 352252060028<br>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 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       | 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/cm <sup>2</sup> ) |
|-----------------------|-------------------------------------|
| 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 <sup>2</sup> ) | Maximum antenna gain to meet MPE Limit (dBi) | Separation distance (cm) |
| 850                                                                        | GSM / GPRS | 50%        | 848.8           | 34                                    | 2511.89                             | 1256.03                                | 0.5659                          | <b>3.5</b>                                   | 20                       |
| 1900                                                                       | GSM / GPRS | 50%        | 1850.2          | 31                                    | 1258.93                             | 629.51                                 | 1.0000                          | <b>9.0</b>                                   | 20                       |
| FDD 5                                                                      | W-CDMA     | 100%       | 846.6           | 31                                    | 1258.93                             | 251.19                                 | 0.5644                          | <b>10.5</b>                                  | 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                          | <b>13.0</b>                                  | 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 **     | <b>3.5 dBi</b>          |
|                                         | 1900 MHz       | 9.0 **     | <b>2.0 dBi</b>          |

\*\* 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.

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

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  $\geq 20$ 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

| 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/cm <sup>2</sup> ) | Max antenna gain (dBi) | MPE Value using Max gain (mW/cm <sup>2</sup> ) | Separation distance (cm) | Verdict |
| 850                                                                                                                             | GSM / GPRS | 50%        | 848.8           | 34                                    | 2511.89                             | 1256.03                                | 0.5659                          | 1.0                    | <b>0.3146</b>                                  | 20                       | Pass    |
| 1900                                                                                                                            | GSM / GPRS | 50%        | 1850.2          | 31                                    | 1258.93                             | 629.51                                 | 1.0000                          | 2.0                    | <b>0.1985</b>                                  | 20                       | Pass    |
| FDD 5                                                                                                                           | W-CDMA     | 100%       | 846.6           | 31                                    | 1258.93                             | 251.19                                 | 0.5644                          | 1.0                    | <b>0.0792</b>                                  | 20                       | Pass    |
|                                                                                                                                 | HSDPA      | 100%       | 846.6           | 24                                    | 251.19                              | 251.19                                 | 0.5644                          | 1.0                    | <b>0.0792</b>                                  | 20                       | Pass    |
|                                                                                                                                 | HSUPA      | 100%       | 836.6           | 24                                    | 251.19                              | 251.19                                 | 0.5577                          | 1.0                    | <b>0.0792</b>                                  | 20                       | Pass    |
| FDD 2                                                                                                                           | W-CDMA     | 100%       | 1852.4          | 24                                    | 251.19                              | 251.19                                 | 1.0000                          | 2.0                    | <b>0.0792</b>                                  | 20                       | Pass    |
|                                                                                                                                 | HSDPA      | 100%       | 1907.6          | 24                                    | 251.19                              | 251.19                                 | 1.0000                          | 2.0                    | <b>0.0792</b>                                  | 20                       | Pass    |
|                                                                                                                                 | HSDPA      | 100%       | 1880.0          | 24                                    | 251.19                              | 251.19                                 | 1.0000                          | 2.0                    | <b>0.0792</b>                                  | 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 <sup>2</sup> ) | Maximum antenna gain (dBi) | Power density (mW/cm <sup>2</sup> ) | Separation distance (cm) | Verdict |
| Bluetooth                                                        | 25%        | 100.00    | 76.43                | 1.0000                          | 0.0                        | <b>0.0152</b>                       | 20                       | Pass    |
| WLAN                                                             | 100%       | 2000.00   | 2000.00              | 1.0000                          | 0.0                        | <b>0.3979</b>                       | 20                       | Pass    |

#### OP mode-1

| Relative exposure for SARA U260 Module |            |                  |                 |                                |                                 |                                                |         |
|----------------------------------------|------------|------------------|-----------------|--------------------------------|---------------------------------|------------------------------------------------|---------|
| OP-Mode                                | Mode       | EIRP             | Frequency (MHZ) | $S_{eq}$ (mW/cm <sup>2</sup> ) | $S_{lin}$ (mW/cm <sup>2</sup> ) | $S_{eq}$ ----- $S_{Lin}$ (mW/cm <sup>2</sup> ) | Verdict |
| GSM 850                                | GSM / GPRS | <b>1581.2480</b> | 848.8           | <b>0.3146</b>                  | 0.5659                          | 0.55592525                                     | Pass    |
| GSM 1900                               | GSM / GPRS | <b>792.5013</b>  | 1850.2          | <b>0.1985</b>                  | 1.0000                          | 0.19848629                                     | Pass    |
| FDD 5                                  | W-CDMA     | <b>316.2278</b>  | 846.6           | <b>0.0629</b>                  | 0.5644                          | 0.11146628                                     | Pass    |
|                                        | HSDPA      | <b>316.2278</b>  | 846.6           | <b>0.0629</b>                  | 0.5644                          | 0.11146628                                     | Pass    |
|                                        | HSUPA      | <b>316.2278</b>  | 836.6           | <b>0.0629</b>                  | 0.5577                          | 0.11279865                                     | Pass    |
| FDD 2                                  | W-CDMA     | <b>316.2278</b>  | 1852.4          | <b>0.0792</b>                  | 1.0000                          | 0.07920097                                     | Pass    |
|                                        | HSDPA      | <b>316.2278</b>  | 1907.6          | <b>0.0792</b>                  | 1.0000                          | 0.07920097                                     | Pass    |
|                                        | HSDPA      | <b>316.2278</b>  | 1880.0          | <b>0.0792</b>                  | 1.0000                          | 0.07920097                                     | Pass    |

| Relative exposure for Secondary transmitter |             |         |                                |                                 |                          |
|---------------------------------------------|-------------|---------|--------------------------------|---------------------------------|--------------------------|
| OP-Mode                                     | Transmitter | EIRP    | $S_{eq}$ (mW/cm <sup>2</sup> ) | $S_{lin}$ (mW/cm <sup>2</sup> ) | $S_{eq}$ ----- $S_{Lin}$ |
| 2                                           | Bluetooth   | 76.43   | <b>0.0152</b>                  | 1.0000                          | 0.015205278              |
| 3                                           | WLAN        | 2000.00 | <b>0.3979</b>                  | 1.0000                          | 0.397887694              |
| 4                                           | Bluetooth   | 76.43   | <b>0.0152</b>                  | 1.0000                          | 0.015205278              |
|                                             | WLAN        | 2000.00 | <b>0.3979</b>                  | 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/cm <sup>2</sup> ) | Maximum $(S_{pri}/S_{lim\_pri}) + (S_{sec} / S_{lin\_Sec})$ (mW/cm <sup>2</sup> ) | Compliance<br>Maximum $(S_{pri}/S_{lim\_pri}) + (S_{sec}/S_{lin\_Sec}) < 1$ |
| 2                                                                                           | Bluetooth   | 2441            | <b>0.0152</b>                                    | 0.5711                                                                            | Compliant                                                                   |
|                                                                                             | SARA U260   | 850             | <b>0.5559</b>                                    |                                                                                   |                                                                             |
| 2                                                                                           | Bluetooth   | 2441            | <b>0.0152</b>                                    | 0.2137                                                                            | Compliant                                                                   |
|                                                                                             | SARA U260   | 1900            | <b>0.1985</b>                                    |                                                                                   |                                                                             |
| 3                                                                                           | WLAN        | 2437            | <b>0.3979</b>                                    | 0.9538                                                                            | Compliant                                                                   |
|                                                                                             | SARA U260   | 850             | <b>0.5559</b>                                    |                                                                                   |                                                                             |
| 3                                                                                           | WLAN        | 2437            | <b>0.3979</b>                                    | 0.5964                                                                            | Compliant                                                                   |
|                                                                                             | SARA U260   | 1900            | <b>0.1985</b>                                    |                                                                                   |                                                                             |
| 4                                                                                           | Bluetooth   | 2441            | <b>0.0152</b>                                    | 0.9690                                                                            | Compliant                                                                   |
|                                                                                             | WLAN        | 2437            | <b>0.3979</b>                                    |                                                                                   |                                                                             |
|                                                                                             | SARA U260   | 850             | <b>0.5559</b>                                    |                                                                                   |                                                                             |
| 4                                                                                           | Bluetooth   | 2441            | <b>0.0152</b>                                    | 0.6116                                                                            | Compliant                                                                   |
|                                                                                             | WLAN        | 2437            | <b>0.3979</b>                                    |                                                                                   |                                                                             |
|                                                                                             | SARA U260   | 1900            | <b>0.1985</b>                                    |                                                                                   |                                                                             |

### 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.