

**InterLab<sup>®</sup>**

## RF Exposure and Maximum ERP/EIRP Assessment

For

**TOBY-R200**

**FCC ID XPY1EHM44NN**

**IC: 8595A-1EHM44NN**

**Assessment Reference:** MDE\_UBLOX\_1626\_MPEa Rev0

**Test Laboratory:**

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40880 Ratingen  
Germany

**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 UMTS/LTE 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

IC SRSP-503 Issue 7, September 2008

FCC 47 CFR §24.232

IC SRSP-510 Issue 5, February 2009

FCC 47 CFR §27.50(d)

RSS-139, Issue 2 / SRSP-513

| Report version control |              |                 |                     |
|------------------------|--------------|-----------------|---------------------|
| Rev<br>Version         | Release date | Changes         | Version<br>validity |
| 000                    | 2017.01.03   | Initial version | Valid               |
|                        |              |                 |                     |
|                        |              |                 |                     |
|                        |              |                 |                     |

Responsible for  
Accreditation Scope:



Responsible  
for Report:



## 1 Administrative Data

### 1.1 Testing Laboratory

Company Name: 7 Layers GmbH

Address: Borsigstr. 11  
40880 Ratingen  
Germany

This facility has been fully described in a report submitted to the FCC and ISED and accepted under the registration number 96716 and ISED 3699A-1.

The test facility is also accredited by the following accreditation organisation:  
Laboratory accreditation no.: DAKKS D-PL-12140-01-00

Responsible for Accreditation Scope: Dipl.-Ing. Bernhard Retka  
Dipl.-Ing. Robert Machulec  
Dipl.-Ing. Andreas Petz  
Dipl.-Ing. Marco Kullik

Report Template Version: 2016-08-30

### 1.2 Project Data

Responsible for assessment and report: Mr. Patrick Lomax

Date of Report: 2017-01-03

### 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

|                             |                                 |
|-----------------------------|---------------------------------|
| <b>Equipment under Test</b> | GSM/UMTS /LTE Voice/Data Module |
| <b>Type Designation:</b>    | TOBY-R200                       |
| <b>Kind of Device:</b>      | GSM/UMTS/LTE Voice/Data Module  |
| <b>GSM MSC/UMTS/LTE CAT</b> | 33 / 8 / 1                      |
| <b>FCC ID:</b>              | XPY1EHM44NN                     |
| <b>IC Number:</b>           | 8595A-1EHM44NN                  |

#### General product description:

The EUT is Cellular radio module supporting GSM/WCDMA/HSDPA/HSUPA/LTE

### 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 |
|---|----------------------|------------------|-----------------|-----------|-----------|
| EUT A (Code: DE1015040aT06)   | GSM/UMTS/LTE Module  | TOBY-R200        | 352848080028158 | 283A00    | 30.26     |
| Remark: EUT A is equipped with a temporary antenna connector. The Module is not sold with a predefined antenna. |                      |                  |                 |           |           |

**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 |
|-------------------|-----------------------|------------------|------------------|-----------|-------------|--------|
| AE 1              | AC/DC converter       | UUX324-1215      | -                | -         | E09-0291981 | -      |
| AE 2              | Evaluation test board | EVB-WL3          | NO_EVK_CS_191A00 | -         | -           | -      |

## 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<br>IC RSS-132, Issue 3           | (GSM 850/FDD5 WCDMA/HSUPA/HSDPA/LTE)  |
| FCC 47 CFR §24.232<br>IC RSS-133 Issue 6            | (GSM 1900/FDD2 WCDMA/HSUPA/HSDPA/LTE) |
| FCC 47 CFR §27.50(d)<br>RSS-139, Issue 2 / SRSP-513 | (FDD4,12 LTE)                         |

##### 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 all other limits, refer to the values stipulated in the corresponding tables.

##### 3.1.2 Test Protocol

| Band   | Mode | Duty Cycle correction | Frequency (MHZ) | Maximum Conducted output power (dBm) | Maximum Conducted output power (mW) | Freq of highest power MHz | FCC EIRP limit (mW) | Maximum antenna gain to meet EIRP Limit (dBi) |
|--------|------|-----------------------|-----------------|--------------------------------------|-------------------------------------|---------------------------|---------------------|---|
| 850    | GSM  | -3.01 dBm             | 836.2 - 848.8   | 32.78                                | 1896.7059                           | 848.80                    | 11484               | 7.8   |
| 1900   | GSM  | -3.01 dBm             | 1850.2 - 1909.8 | 30.8                                 | 1202.2644                           | 1909.80                   | 2000                | 2.2   |
| FDD 2  | UMTS | 0                     | 1850 - 1907.6   | 24.68                                | 293.76497                           | 1907.60                   | 2000                | 8.3   |
| FDD 5  | UMTS | 0                     | 824 - 846.6     | 24.32                                | 270.39584                           | 836.00                    | 11484               | 16.3  |
| eFDD 2 | LTE  | 0                     | 1850-1910       | 21.86                                | 153.4617                            | 1902.50                   | 2000                | 11.2  |
| eFDD 4 | LTE  | 0                     | 1710-1755       | 22.24                                | 167.49429                           | 1732.50                   | 1000                | 7.8   |
| eFDD 5 | LTE  | 0                     | 824 - 849       | 23.21                                | 209.41125                           | 825.50                    | 11484               | 17.4  |
| eFDD12 | LTE  | 0                     | 698-716         | 22                                   | 158.48932                           | 711.00                    | 4921                | 14.9  |

### 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    | 7.8  | 4.0   | 0.7  | 0.7  |
| 1900   | 2.2  | 9.5   | 6.1  | 2.2  |
| FDD 2  | 8.3  | 12.5  | 9.1  | 8.3  |
| FDD 5  | 16.3   | 10.0  | 6.7  | 6.7  |
| eFDD 2 | 11.2   | 13.0  | 9.6  | 9.6  |
| eFDD 4 | 7.8  | 13.0  | 9.3  | 7.8  |
| eFDD 5 | 17.4   | 10.4  | 7.1  | 7.1  |
| eFDD12 | 14.9   | 9.8   | 6.7  | 6.7  |

The above table lists the gains which conform to both the EIRP limits and the MPE limits for both ISSED and FCC. Gain expressed in dBi.



### 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 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/cm <sup>2</sup> ) |
|-----------------------|-------------------------------------|
| 300 – 1,500           | f/1500                              |
| 1,500 – 100,000       | 1.0                                 |

Limits specified per RSS-102, Issue 5.

| Frequency range (MHz) | Power density (W/m <sup>2</sup> ) | Power density (mW/cm <sup>2</sup> ) |
|-----------------------|-----------------------------------|-------------------------------------|
| 300 – 6000            | $0.02619 f^{0.6834}$              | $mW/cm^2 = W/m^2 * 0.1$             |

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/cm <sup>2</sup> ) | Maximum antenna gain to meet MPE Limit (dBi) | Separation distance (cm) |
|--------|------|------------|-----------------|--------------------------------------|-------------------------------------|--|---------------------------------|--|--------------------------|
| 850    | GSM  | -3.01 dBm  | 848.8           | 33.5                                 | 2238.72                             | 1119.44                                | 0.2628                          | <b>0.7</b>                                   | 20                       |
| 1900   | GSM  | -3.01 dBm  | 1909.8          | 30.5                                 | 1122.02                             | 561.05                                 | 0.4575                          | <b>6.1</b>                                   | 20                       |
| FDD 2  | UMTS | 0          | 1907.6          | 24.5                                 | 281.84                              | 281.84                                 | 0.4571                          | <b>9.1</b>                                   | 20                       |
| FDD 5  | UMTS | 0          | 836.0           | 24.5                                 | 281.84                              | 281.84                                 | 0.2601                          | <b>6.7</b>                                   | 20                       |
| eFDD 2 | LTE  | 0          | 1902.5          | 24.0                                 | 251.19                              | 251.19                                 | 0.4563                          | <b>9.6</b>                                   | 20                       |
| eFDD 4 | LTE  | 0          | 1732.5          | 24.0                                 | 251.19                              | 251.19                                 | 0.4280                          | <b>9.3</b>                                   | 20                       |
| eFDD 5 | LTE  | 0          | 825.5           | 24.0                                 | 251.19                              | 251.19                                 | 0.2579                          | <b>7.1</b>                                   | 20                       |
| eFDD12 | LTE  | 0          | 711.0           | 24.0                                 | 251.19                              | 251.19                                 | 0.2329                          | <b>6.7</b>                                   | 20                       |

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

#### 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/cm <sup>2</sup> ) | Maximum antenna gain to meet MPE Limit (dBi) | Separation distance (cm) |
|--------|------|------------|-----------------|--------------------------------------|-------------------------------------|--|---------------------------------|--|--------------------------|
| 850    | GSM  | -3.01 dBm  | 848.8           | 33.5                                 | 2238.72                             | 1119.44                                | 0.5659                          | <b>4.0</b>                                   | 20                       |
| 1900   | GSM  | -3.01 dBm  | 1909.8          | 30.5                                 | 1122.02                             | 561.05                                 | 1.0000                          | <b>9.5</b>                                   | 20                       |
| FDD 2  | UMTS | 0          | 1907.6          | 24.5                                 | 281.84                              | 281.84                                 | 1.0000                          | <b>12.5</b>                                  | 20                       |
| FDD 5  | UMTS | 0          | 836.0           | 24.5                                 | 281.84                              | 281.84                                 | 0.5573                          | <b>10.0</b>                                  | 20                       |
| eFDD 2 | LTE  | 0          | 1902.5          | 24                                   | 251.19                              | 251.19                                 | 1.0000                          | <b>13.0</b>                                  | 20                       |
| eFDD 4 | LTE  | 0          | 1732.5          | 24                                   | 251.19                              | 251.19                                 | 1.0000                          | <b>13.0</b>                                  | 20                       |
| eFDD 5 | LTE  | 0          | 825.5           | 24                                   | 251.19                              | 251.19                                 | 0.5503                          | <b>10.4</b>                                  | 20                       |
| eFDD12 | LTE  | 0          | 711.0           | 24                                   | 251.19                              | 251.19                                 | 0.4740                          | <b>9.8</b>                                   | 20                       |

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

### 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 limits |
|--------|-----------------------------|---|--|
| 850    | 4.0                         | 0.7                                     | 0.7  |
| 1900   | 9.5                         | 6.1                                     | 6.1  |
| FDD 2  | 12.5                        | 9.1                                     | 9.1  |
| FDD 5  | 10.0                        | 6.7                                     | 6.7  |
| eFDD 2 | 13.0                        | 9.6                                     | 9.6  |
| eFDD 4 | 13.0                        | 9.3                                     | 9.3  |
| eFDD 5 | 10.4                        | 7.1                                     | 7.1  |
| eFDD12 | 9.8                         | 6.7                                     | 6.7  |

Gain expressed in dBi

### 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 5 – March 2015              |

#### 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. Primary transmitter does not support power reduction for multiple time slots on the uplink.
2. Antenna separation from module to human body is  $\geq 20$ cm.
3. Separation distance between co-located transmitting antennas is 0cm.
4. Hypothetical Bluetooth radio is assumed to have an output power of 9.5dBm and an antenna gain of 4dBi.
5. Hypothetical WLAN radio is assumed to have an output power of 19dBm and an antenna gain of 5dBi.

#### 3.3.3 Test Protocol

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

#### OP mode-1 – FOR FCC ONLY

| Band   | Mode | Duty Cycle Correction | Frequency (MHZ) | Maximum Conducted output power (dBm) | Equivalent conducted output power (mW) | FCC MPE Limit (mW/cm <sup>2</sup> ) | Power Density (mW/cm <sup>2</sup> ) | Separation distance (cm) | Verdict |
|--------|------|-----------------------|-----------------|--------------------------------------|--|-------------------------------------|-------------------------------------|--------------------------|---------|
| 850    | GSM  | -3.01 dBm             | 848.8           | 33.5                                 | 1119.44                                | 0.5659                              | 0.5342                              | 20                       | Pass    |
| 1900   | GSM  | -3.01 dBm             | 1909.8          | 30.5                                 | 561.05                                 | 1.0000                              | 0.1852                              | 20                       | Pass    |
| FDD 2  | UMTS | 0                     | 1907.6          | 24.5                                 | 281.84                                 | 1.0000                              | 0.1773                              | 20                       | Pass    |
| FDD 5  | UMTS | 0                     | 836.0           | 24.5                                 | 281.84                                 | 0.5573                              | 0.0889                              | 20                       | Pass    |
| eFDD 2 | LTE  | 0                     | 1902.5          | 24                                   | 251.19                                 | 1.0000                              | 0.6588                              | 20                       | Pass    |
| eFDD 4 | LTE  | 0                     | 1732.5          | 24                                   | 251.19                                 | 1.0000                              | 0.3011                              | 20                       | Pass    |
| eFDD 5 | LTE  | 0                     | 825.5           | 24                                   | 251.19                                 | 0.5503                              | 0.5114                              | 20                       | Pass    |
| eFDD12 | LTE  | 0                     | 711.0           | 24                                   | 251.19                                 | 0.4740                              | 0.4454                              | 20                       | Pass    |

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

**OP mode-1 – FOR Industry Canada ONLY**

| Band   | Mode | Duty Cycle Correction | Frequency (MHZ) | Maximum Conducted output power (dBm) | Equivalent conducted output power (mW) | IC MPE Limit (mW/cm <sup>2</sup> ) | Power Density (mW/cm <sup>2</sup> ) | Separation distance (cm) | Verdict |
|--------|------|-----------------------|-----------------|--------------------------------------|--|------------------------------------|-------------------------------------|--------------------------|---------|
| 850    | GSM  | -3.01 dBm             | 848.8           | 33.5                                 | 1119.44                                | 0.2628                             | <b>0.2359</b>                       | 20                       | PASS    |
| 1900   | GSM  | -3.01 dBm             | 1909.8          | 30.5                                 | 561.05                                 | 0.4575                             | <b>0.1852</b>                       | 20                       | PASS    |
| FDD 2  | UMTS | 0                     | 1907.6          | 24.5                                 | 281.84                                 | 0.4571                             | <b>0.2810</b>                       | 20                       | PASS    |
| FDD 5  | UMTS | 0                     | 836.0           | 24.5                                 | 281.84                                 | 0.2601                             | <b>0.1119</b>                       | 20                       | PASS    |
| eFDD 2 | LTE  | 0                     | 1902.5          | 24                                   | 251.19                                 | 0.4563                             | <b>0.4062</b>                       | 20                       | PASS    |
| eFDD 4 | LTE  | 0                     | 1732.5          | 24                                   | 251.19                                 | 0.4280                             | <b>0.3011</b>                       | 20                       | PASS    |
| eFDD 5 | LTE  | 0                     | 825.5           | 24                                   | 251.19                                 | 0.2579                             | <b>0.2311</b>                       | 20                       | PASS    |
| eFDD12 | LTE  | 0                     | 711.0           | 24                                   | 251.19                                 | 0.2329                             | <b>0.2083</b>                       | 20                       | PASS    |

MPE Values for the generic Bluetooth and WLAN radios operating alone. These values are used to calculate the relative exposure for simultaneous transmission with the primary transmitter.

| MPE Calculation for Single Transmitter installed in Generic host for FCC |            |          |                     |                                 |                          |                                     |                          |         |
|--|------------|----------|---------------------|---------------------------------|--------------------------|-------------------------------------|--------------------------|---------|
| Radio type   | Duty Cycle | ERP (mW) | ERP 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  | 64%        | 8.91     | 3.72                | 1.0000                          | 4.0                      | <b>0.0019</b>                       | 20                       | Pass    |
| WLAN   | 100%       | 79.43    | 79.43               | 1.0000                          | 5.0                      | <b>0.0500</b>                       | 20                       | Pass    |

| MPE Calculation for Single Transmitter installed in Generic host for Industry Canada |            |          |                     |                                 |                          |                                     |                          |         |
|--|------------|----------|---------------------|---------------------------------|--------------------------|-------------------------------------|--------------------------|---------|
| Radio type   | Duty Cycle | ERP (mW) | ERP 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  | 64%        | 8.91     | 3.72                | 0.54                            | 4.00                     | <b>0.0019</b>                       | 20.00                    | Pass    |
| WLAN   | 100%       | 79.43    | 79.43               | 0.54                            | 5.00                     | <b>0.0500</b>                       | 20.00                    | Pass    |

Below are the relative exposure values for the primary, secondary and combined primary + secondary transmitters for both FCC and Industry Canada limits.

### Relative exposure for Primary Transmitter for FCC

| OP-Mode | Mode | Output Power | Frequency (MHZ) | $S_{eq}$ (mW/cm <sup>2</sup> ) | $S_{lin}$ (mW/cm <sup>2</sup> ) | $\frac{S_{eq}}{S_{lin}}$ (mW/cm <sup>2</sup> ) | Verdict |
|---------|------|--------------|-----------------|--------------------------------|---------------------------------|--|---------|
| 850     | GSM  | 1119.4379    | 848.8           | 0.5342                         | 0.5659                          | 0.9440965                                      | Pass    |
| 1900    | GSM  | 561.0480     | 1909.8          | 0.1852                         | 1.0000                          | 0.1852382                                      | Pass    |
| FDD 2   | UMTS | 281.8383     | 1907.6          | 0.1773                         | 1.0000                          | 0.1773089                                      | Pass    |
| FDD 5   | UMTS | 281.8383     | 836.0           | 0.0889                         | 0.5573                          | 0.1594467                                      | Pass    |
| eFDD 2  | LTE  | 251.1886     | 1902.5          | 0.6588                         | 1.0000                          | 0.658765                                       | Pass    |
| eFDD 4  | LTE  | 251.1886     | 1732.5          | 0.3011                         | 1.0000                          | 0.3011137                                      | Pass    |
| eFDD 5  | LTE  | 251.1886     | 825.5           | 0.5114                         | 0.5503                          | 0.9291904                                      | Pass    |
| eFDD12  | LTE  | 251.1886     | 711.0           | 0.4454                         | 0.4740                          | 0.9396198                                      | Pass    |

### Relative exposure for Primary Transmitter for ISED

| OP-Mode | Mode | Output Power | Frequency (MHZ) | $S_{eq}$ (mW/cm <sup>2</sup> ) | $S_{lin}$ (mW/cm <sup>2</sup> ) | $\frac{S_{eq}}{S_{lin}}$ (mW/cm <sup>2</sup> ) | Verdict |
|---------|------|--------------|-----------------|--------------------------------|---------------------------------|--|---------|
| 850     | GSM  | 1119.4379    | 848.8           | 0.2359                         | 0.2628                          | 0.8975309                                      | Pass    |
| 1900    | GSM  | 561.0480     | 1909.8          | 0.1852                         | 0.4575                          | 0.4049188                                      | Pass    |
| FDD 2   | UMTS | 281.8383     | 1907.6          | 0.2810                         | 0.4571                          | 0.6147662                                      | Pass    |
| FDD 5   | UMTS | 281.8383     | 836.0           | 0.1119                         | 0.2601                          | 0.4300899                                      | Pass    |
| eFDD 2  | LTE  | 251.1886     | 1902.5          | 0.4062                         | 0.4563                          | 0.8902347                                      | Pass    |
| eFDD 4  | LTE  | 251.1886     | 1732.5          | 0.3011                         | 0.4280                          | 0.703535                                       | Pass    |
| eFDD 5  | LTE  | 251.1886     | 825.5           | 0.2311                         | 0.2579                          | 0.8960053                                      | Pass    |
| eFDD12  | LTE  | 251.1886     | 711.0           | 0.2083                         | 0.2329                          | 0.8945968                                      | Pass    |

| Relative exposure for Secondary transmitter for FCC |             |              |                                |                                 |                          |
|---|-------------|--------------|--------------------------------|---------------------------------|--------------------------|
| OP-Mode   | Transmitter | Output power | $S_{eq}$ (mW/cm <sup>2</sup> ) | $S_{lin}$ (mW/cm <sup>2</sup> ) | $\frac{S_{eq}}{S_{Lin}}$ |
| 2   | Bluetooth   | 3.72         | 0.0019                         | 1.0000                          | 0.001856652              |
| 3   | WLAN        | 79.43        | 0.0500                         | 1.0000                          | 0.049972435              |
| 4   | Bluetooth   | 3.72         | 0.0019                         | 1.0000                          | 0.001856652              |
|   | WLAN        | 79.43        | 0.0500                         | 1.0000                          | 0.049972435              |

| Relative exposure for Secondary transmitter for Industry Canada |             |              |                                |                                 |                          |
|---|-------------|--------------|--------------------------------|---------------------------------|--------------------------|
| OP-Mode   | Transmitter | Output power | $S_{eq}$ (mW/cm <sup>2</sup> ) | $S_{lin}$ (mW/cm <sup>2</sup> ) | $\frac{S_{eq}}{S_{Lin}}$ |
| 2   | Bluetooth   | 3.72         | 0.0019                         | 0.5410                          | 0.003431873              |
| 3   | WLAN        | 79.43        | 0.0500                         | 0.5410                          | 0.092370053              |
| 4   | Bluetooth   | 3.72         | 0.0019                         | 0.5410                          | 0.003431873              |
|   | WLAN        | 79.43        | 0.0500                         | 0.5410                          | 0.092370053              |

**Simultaneous exposure of Primary and Secondary transmitter installed in generic host device for FCC**

| Primary Band | Primary Mode | All Transmitters | 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 Maximum $(S_{pri} / S_{lim\_pri}) + (S_{sec} / S_{lin\_sec}) < 1$ |
|--------------|--------------|------------------|-----------------|--|---|--|
| 850          | GSM          | Bluetooth        | 2441            | 0.0019   | 0.9959  | Compliant  |
|              |              | Wlan             | 2412            | 0.0500   |   |  |
|              |              | Toby             | 848.8           | 0.9441   |   |  |
| 1900         | GSM          | Bluetooth        | 2441            | 0.0019   | 0.2371  | Compliant  |
|              |              | Wlan             | 2412            | 0.0500   |   |  |
|              |              | Toby             | 1909.8          | 0.1852   |   |  |
| FDD 2        | UMTS         | Bluetooth        | 2441            | 0.0019   | 0.2291  | Compliant  |
|              |              | Wlan             | 2412            | 0.0500   |   |  |
|              |              | Toby             | 1907.6          | 0.1773   |   |  |
| FDD 5        | UMTS         | Bluetooth        | 2441            | 0.0019   | 0.2113  | Compliant  |
|              |              | Wlan             | 2412            | 0.0500   |   |  |
|              |              | Toby             | 836.0           | 0.1594   |   |  |
| eFDD 2       | LTE          | Bluetooth        | 2441            | 0.0019   | 0.7106  | Compliant  |
|              |              | Wlan             | 2412            | 0.0500   |   |  |
|              |              | Toby             | 1902.5          | 0.6588   |   |  |
| eFDD 4       | LTE          | Bluetooth        | 2441            | 0.0019   | 0.3529  | Compliant  |
|              |              | Wlan             | 2412            | 0.0500   |   |  |
|              |              | Toby             | 1732.5          | 0.3011   |   |  |
| eFDD 5       | LTE          | Bluetooth        | 2441            | 0.0019   | 0.9810  | Compliant  |
|              |              | Wlan             | 2412            | 0.0500   |   |  |
|              |              | Toby             | 825.5           | 0.9292   |   |  |
| eFDD12       | LTE          | Bluetooth        | 2441            | 0.0019   | 0.9914  | Compliant  |
|              |              | Wlan             | 2412            | 0.0500   |   |  |
|              |              | Toby             | 711.0           | 0.9396   |   |  |

**Simultaneous exposure of Primary and Secondary transmitter installed in generic host device for ISED**

| Primary Band | Primary 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 Maximum $(S_{pri} / S_{lim\_pri}) + (S_{sec} / S_{lin\_Sec}) < 1$ |
|--------------|--------------|-------------|-----------------|--|---|--|
| 850          | GSM          | Bluetooth   | 2441            | <b>0.0034</b>                                    | 0.9933  | Compliant  |
|              |              | Wlan        | 2412            | <b>0.0924</b>                                    |   |  |
|              |              | Toby        | 848.8           | <b>0.8975</b>                                    |   |  |
| 1900         | GSM          | Bluetooth   | 2441            | <b>0.0034</b>                                    | 0.5007  | Compliant  |
|              |              | Wlan        | 2412            | <b>0.0924</b>                                    |   |  |
|              |              | Toby        | 1909.8          | <b>0.4049</b>                                    |   |  |
| FDD 2        | UMTS         | Bluetooth   | 2441            | <b>0.0034</b>                                    | 0.7106  | Compliant  |
|              |              | Wlan        | 2412            | <b>0.0924</b>                                    |   |  |
|              |              | Toby        | 1907.6          | <b>0.6148</b>                                    |   |  |
| FDD 5        | UMTS         | Bluetooth   | 2441            | <b>0.0034</b>                                    | 0.5259  | Compliant  |
|              |              | Wlan        | 2412            | <b>0.0924</b>                                    |   |  |
|              |              | Toby        | 836             | <b>0.4301</b>                                    |   |  |
| eFDD 2       | LTE          | Bluetooth   | 2441            | <b>0.0034</b>                                    | 0.9860  | Compliant  |
|              |              | Wlan        | 2412            | <b>0.0924</b>                                    |   |  |
|              |              | Toby        | 1902.5          | <b>0.8902</b>                                    |   |  |
| eFDD 4       | LTE          | Bluetooth   | 2441            | <b>0.0034</b>                                    | 0.7993  | Compliant  |
|              |              | Wlan        | 2412            | <b>0.0924</b>                                    |   |  |
|              |              | Toby        | 1732.5          | <b>0.7035</b>                                    |   |  |
| eFDD 5       | LTE          | Bluetooth   | 2441            | <b>0.0034</b>                                    | 0.9918  | Compliant  |
|              |              | Wlan        | 2412            | <b>0.0924</b>                                    |   |  |
|              |              | Toby        | 825.5           | <b>0.8960</b>                                    |   |  |
| eFDD12       | LTE          | Bluetooth   | 2441            | <b>0.0034</b>                                    | 0.9904  | Compliant  |
|              |              | Wlan        | 2412            | <b>0.0924</b>                                    |   |  |
|              |              | Toby        | 711             | <b>0.8946</b>                                    |   |  |

**When operating the primary transmitter simultaneously with a generic Bluetooth and WLAN radio, the following antenna gains can be used with the module TOBY-R200 while still complying with the exposure limits.**

| Band   | dB <sub>i</sub> (For FCC) | dB <sub>i</sub> (For Industry Canada) |
|--------|---------------------------|---------------------------------------|
| 850    | 3.8                       | 0.25                                  |
| 1900   | 2.2                       | 2.2                                   |
| FDD 2  | 5                         | 7                                     |
| FDD 5  | 2                         | 2                                     |
| eFDD 2 | 11.2                      | 9.1                                   |
| eFDD 4 | 7.8                       | 7.8                                   |
| eFDD 5 | 10.1                      | 6.65                                  |
| eFDD12 | 9.5                       | 6.2                                   |