

InterLab®

RF Exposure and Maximum ERP/EIRP Assessment

For

TOBY-L4006

FCC ID: XPY1EHQ37NN

IC: 8595A-1EHQ37NN

Assessment Reference: MDE_UBLOX_1717_MPEa Rev0

Test Laboratory:

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40880 Ratingen
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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 ISSED 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

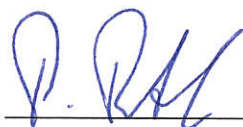
IC SRSP-510 Issue 5, February 2009

FCC 47 CFR §27.50(d)

RSS-139, Issue 2 / SRSP-513

Report version control			
Rev Version	Release date	Changes	Version validity
00	2018.02.08	Initial version	Valid

Responsible for
Accreditation Scope:



Responsible
for Report:



1 Administrative Data

1.1 Testing Laboratory

Company Name: 7Layers 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: 2017-08-02

1.2 Project Data

Responsible for assessment and report: Mr. Patrick Lomax

Date of Report: 2018-02-08

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

Equipment under Test	GSM/UMTS /LTE Voice/Data Module
Type Designation:	TOBY-L4006
Kind of Device:	GSM/UMTS/LTE Voice/Data Module
GSM MSC/UMTS/LTE CAT	33 / 8 / (4/6)
FCC ID:	FCC ID: XPY1EHQ37NN
IC Number:	IC: 8595A-1EHQ37NN

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: DE1015050am04)	GSM/UMTS/LTE Module	TOBY-L4106	355958080015191	294000	40.12
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 IC RSS-132, Issue 3	(GSM 850/FDD5 WCDMA/HSUPA/HSDPA/LTE)
FCC 47 CFR §24.232 IC RSS-133 Issue 6	(GSM 1900/FDD2 WCDMA/HSUPA/HSDPA/LTE)
FCC 47 CFR §27.50(d) RSS-139, Issue 2 / SRSP-513	(FDD4,7,12,13 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 ERIP 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 (%)	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	50.0%	836.2 - 848.8	32.59	1815.515663	848.80	11484	8.0
1900	GSM	50.0%	1850.2 - 1909.8	30.29	1069.054879	1909.80	2000	2.7
FDD 2	UMTS	100.0%	1850 - 1907.6	23.79	239.3315756	1907.60	2000	9.2
FDD 4	UMTS	100.0%	1710 - 1752.6	24.5	281.8382931	1740.00	1000	5.5
FDD 5	UMTS	100.0%	824 - 846.6	23.7	234.4228815	836.00	11484	16.9
eFDD 2	LTE	100.0%	1850-1910	23.52	224.9054606	1902.50	2000	9.5
eFDD 4	LTE	100.0%	1710-1755	23.24	210.862815	1732.50	1000	6.8
eFDD 5	LTE	100.0%	824 - 849	22.51	178.2378767	825.50	11484	18.1
eFDD 7	LTE	100.0%	2500-2570	23.3	213.796209	2567.50	1000	6.7
eFDD13	LTE	100.0%	777-787	22.13	163.3051948	784.50	4920	14.8
eFDD12	LTE	100.0%	698-716	22.73	187.4994508	711.00	4921	14.2

3.1.3 Conclusion

Band	Max gain to comply with FCC / ISSED EIRP Limits	Max gain to be used to comply with FCC MPE Limits	Max gain to be used to comply with ISSED MPE Limits	Maximum gain to be compliant with all limits
850	8.0	4.0	0.7	0.7
1900	2.7	9.5	6.1	2.7
FDD 2	9.2	12.5	9.1	9.1
FDD 4	5.5	12.5	8.8	5.5
FDD 5	16.9	9.0	5.7	5.7
eFDD 2	9.5	13.0	9.6	9.5
eFDD 4	6.8	13.0	9.3	6.8
eFDD 5	18.1	10.4	7.1	7.1
eFDD 7	6.7	13.0	10.5	6.7
eFDD13	14.8	10.2	7.0	7.0
eFDD12	14.2	10.2	7.1	7.1

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 ²)
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 ²)	Power density (mW/cm ²)
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 ²)	Maximum antenna gain to meet MPE Limit (dBi)	Separation distance (cm)
850	GSM	50%	848.8	33.5	2238.72	1119.44	0.2628	0.7	20
1900	GSM	50%	1909.8	30.5	1122.02	561.05	0.4575	6.1	20
FDD 2	UMTS	100%	1907.6	24.5	281.84	281.84	0.4571	9.1	20
FDD 4	UMTS	100%	1740.0	24.5	281.84	281.84	0.4293	8.8	20
FDD 5	UMTS	100%	836.0	25.5	354.81	354.81	0.2601	5.7	20
eFDD 2	LTE	100%	1902.5	24.0	251.19	251.19	0.4563	9.6	20
eFDD 4	LTE	100%	1732.5	24.0	251.19	251.19	0.4280	9.3	20
eFDD 5	LTE	100%	825.5	24.0	251.19	251.19	0.2579	7.1	20
eFDD 7	LTE	100%	2567.5	24.0	251.19	251.19	0.5600	10.5	20
eFDD13	LTE	100%	784.5	24.0	251.19	251.19	0.2491	7.0	20
eFDD12	LTE	100%	711.0	24.0	251.19	251.19	0.2329	7.1	21

* 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 ²)	Maximum antenna gain to meet MPE Limit (dBi)	Separation distance (cm)
850	GSM	50%	848.8	33.5	2238.72	1119.44	0.5659	4.0	20
1900	GSM	50%	1909.8	30.5	1122.02	561.05	1.0000	9.5	20
FDD 2	UMTS	100.0%	1907.6	24.5	281.84	281.84	1.0000	12.5	20
FDD 4	UMTS	100.0%	1740.0	24.5	281.84	281.84	1.0000	12.5	20
FDD 5	UMTS	100.0%	836.0	25.5	354.81	354.81	0.5573	9.0	20
eFDD 2	LTE	100.0%	1902.5	24	251.19	251.19	1.0000	13.0	20
eFDD 4	LTE	100.0%	1732.5	24	251.19	251.19	1.0000	13.0	20
eFDD 5	LTE	100.0%	825.5	24	251.19	251.19	0.5503	10.4	20
eFDD 7	LTE	100.0%	2567.5	24	251.19	251.19	1.0000	13.0	20
eFDD13	LTE	100.0%	777.0	24	251.19	251.19	0.5230	10.2	20
eFDD12	LTE	100.0%	711.0	24	251.19	251.19	0.4740	10.2	21

* 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 ISED 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 4	12.5	8.8	8.8
FDD 5	9.0	5.7	5.7
eFDD 2	13.0	9.6	9.6
eFDD 4	13.0	9.3	9.3
eFDD 5	10.4	7.1	7.1
eFDD 7	13.0	10.5	10.5
eFDD13	10.2	7.0	7.0
eFDD12	10.2	7.1	7.1

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 ≥ 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.
6. Where the maximum allowable gain permitted with respect to EIRP is lower than the maximum allowable gain for relative exposure, the lower gain respecting the EIRP limit shall be used to make the calculation.

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 (%)	Frequency (MHZ)	Maximum Conducted output power (dBm)	Max Conducted output power (mW)	FCC MPE Limit (mW/cm ²)	Power Density (mW/cm ²)	Separation distance (cm)	Verdict
850	GSM	50%	848.8	33.5	1119.44	0.5659	0.5343	20	Pass
1900	GSM	50%	1909.8	30.5	561.05	1.0000	0.2088	20	Pass
FDD 2	UMTS	100%	1907.6	24.5	281.84	1.0000	0.4686	20	Pass
FDD 4	UMTS	100%	1740.0	24.5	281.84	1.0000	0.1989	20	Pass
FDD 5	UMTS	100%	836.0	25.5	354.81	0.5573	0.5234	20	Pass
eFDD 2	LTE	100%	1902.5	24	251.19	1.0000	0.4444	20	Pass
eFDD 4	LTE	100%	1732.5	24	251.19	1.0000	0.2370	20	Pass
eFDD 5	LTE	100%	825.5	24	251.19	0.5503	0.5115	20	Pass
eFDD 7	LTE	100%	2567.5	24	251.19	1.0000	0.2337	20	Pass
eFDD13	LTE	100%	784.5	24	251.19	0.5230	0.4906	20	Pass
eFDD12	LTE	100%	711.0	24	251.19	0.4740	0.4475	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 (%)	Frequency (MHZ)	Maximum Conducted output power (dBm)	Max Conducted output power (mW)	FCC MPE Limit (mW/cm ²)	Power Density (mW/cm ²)	Separation distance (cm)	Verdict
850	GSM	50%	848.8	33.5	1119.44	0.2628	0.2333	20	Pass
1900	GSM	50%	1909.8	30.5	561.05	0.4575	0.2088	20	Pass
FDD 2	UMTS	100%	1907.6	24.5	281.84	0.4571	0.4072	20	Pass
FDD 4	UMTS	100%	1740.0	24.5	281.84	0.4293	0.1989	20	Pass
FDD 5	UMTS	100%	836.0	25.5	354.81	0.2601	0.2338	20	Pass
eFDD 2	LTE	100%	1902.5	24	251.19	0.4563	0.4072	20	Pass
eFDD 4	LTE	100%	1732.5	24	251.19	0.4280	0.2370	20	Pass
eFDD 5	LTE	100%	825.5	24	251.19	0.2579	0.2285	20	Pass
eFDD 7	LTE	100%	2567.5	24	251.19	0.5600	0.2337	20	Pass
eFDD13	LTE	100%	784.5	24	251.19	0.2491	0.2242	20	Pass
eFDD12	LTE	100%	711.0	24	251.19	0.2329	0.2093	20	Pass

MPE Values for the generic Bluetooth and WLAN radios operating alone. These values are used to calculate the

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 ²)	Maximum antenna gain dBi	Power density (mW/cm ²)	Separation distance (cm)	Verdict
Bluetooth	64%	8.91	3.72	1.0000	4.0	0.0019	20	Pass
WLAN	100%	79.43	79.43	1.0000	5.0	0.0500	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 ²)	Maximum antenna gain dBi	Power density (mW/cm ²)	Separation distance (cm)	Verdict
Bluetooth	64%	8.91	3.72	0.54	4.00	0.0019	20.00	Pass
WLAN	100%	79.43	79.43	0.54	5.00	0.0500	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

Relative exposure for Primary Transmitter for FCC							
OP-Mode	Mode	Output Power	Frequency (MHZ)	Seq	Slin (mW/cm ²)	<u>Seq</u> ----- <u>Slin</u>	Verdict
850	GSM	1119.4379	848.8	0.5343	0.5659	0.944299117	Pass
1900	GSM	561.0480	1909.8	0.2088	1.0000	0.20881443	Pass
FDD 2	UMTS	281.8383	1907.6	0.4686	1.0000	0.468554925	Pass
FDD 4	UMTS	281.8383	1740.0	0.1989	1.0000	0.198943847	Pass
FDD 5	UMTS	354.8134	836.0	0.5234	0.5573	0.939093159	Pass
eFDD 2	LTE	251.1886	1902.5	0.4444	1.0000	0.444386142	Pass
eFDD 4	LTE	251.1886	1732.5	0.2370	1.0000	0.236990268	Pass
eFDD 5	LTE	251.1886	825.5	0.5115	0.5503	0.929389746	Pass
eFDD 7	LTE	251.1886	2567.5	0.2337	1.0000	0.233738639	Pass
eFDD13	LTE	251.1886	784.5	0.4906	0.5230	0.93798075	Pass
eFDD12	LTE	251.1886	711.0	0.4475	0.4740	0.944072908	Pass

Relative exposure for Primary Transmitter for ISED							
OP-Mode	Mode	Output Power	Frequency (MHZ)	Seq	Slin (mW/cm ²)	<u>Seq</u> ----- <u>Slin</u>	Verdict
850	GSM	1119.4379	848.8	0.2333	0.2628	0.887447369	Pass
1900	GSM	561.0480	1909.8	0.2088	0.4575	0.456454912	Pass
FDD 2	UMTS	281.8383	1907.6	0.4072	0.4571	0.890717487	Pass
FDD 4	UMTS	281.8383	1740.0	0.1989	0.4293	0.463450822	Pass
FDD 5	UMTS	354.8134	836.0	0.2338	0.2601	0.898777987	Pass
eFDD 2	LTE	251.1886	1902.5	0.4072	0.4563	0.892348571	Pass
eFDD 4	LTE	251.1886	1732.5	0.2370	0.4280	0.553714273	Pass
eFDD 5	LTE	251.1886	825.5	0.2285	0.2579	0.885938849	Pass
eFDD 7	LTE	251.1886	2567.5	0.2337	0.5600	0.417383782	Pass
eFDD13	LTE	251.1886	784.5	0.2242	0.2491	0.900316678	Pass
eFDD12	LTE	251.1886	711.0	0.2093	0.2329	0.898836486	Pass

Relative exposure for Secondary transmitter for FCC					
OP-Mode	Transmitter	Output power	S_{eq} (mW/cm ²)	S_{lin} (mW/cm ²)	Seq ----- 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 ²)	S_{lin} (mW/cm ²)	Seq ----- 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

Simultaneous exposure of Primary and Secondary transmitter installed in generic host device for FCC						
Primary Band	Primary Mode	All Transmitters	Frequency (MHZ)	Maximum Seq / Slin	Maximum Spri/Slim_pri + Ssec / Slin_Sec	Compliance Maximum (Spri/Slim_pri) + (Ssec / Slin_Sec) < 1
850	GSM	Bluetooth	2441	0.0019	0.9961	Compliant
		Wlan	2412	0.0500		
		Toby-L4006	848.8	0.9443		
1900	GSM	Bluetooth	2441	0.0019	0.2606	Compliant
		Wlan	2412	0.0500		
		Toby-L4006	1909.8	0.2088		
FDD 2	UMTS	Bluetooth	2441	0.0019	0.5204	Compliant
		Wlan	2412	0.0500		
		Toby-L4006	1907.6	0.4686		
FDD 4	UMTS	Bluetooth	2441	0.0019	0.2508	Compliant
		Wlan	2412	0.0500		
		Toby-L4006	1740.0	0.1989		
FDD 5	UMTS	Bluetooth	2441	0.0019	0.9909	Compliant
		Wlan	2412	0.0500		
		Toby-L4006	836.0	0.9391		
eFDD 2	LTE	Bluetooth	2441	0.0019	0.4962	Compliant
		Wlan	2412	0.0500		
		Toby-L4006	1902.5	0.4444		
eFDD 4	LTE	Bluetooth	2441	0.0019	0.2888	Compliant
		Wlan	2412	0.0500		
		Toby-L4006	1732.5	0.2370		
eFDD 5	LTE	Bluetooth	2441	0.0019	0.9812	Compliant
		Wlan	2412	0.0500		
		Toby-L4006	825.5	0.9294		
eFDD 7	LTE	Bluetooth	2441	0.0019	0.2856	Compliant
		Wlan	2412	0.0500		
		Toby-L4006	2567.5	0.2337		
eFDD13	LTE	Bluetooth	2441	0.0019	0.9898	Compliant
		Wlan	2412	0.0500		
		Toby-L4006	784.5	0.9380		
eFDD12	LTE	Bluetooth	2441	0.0019	0.9959	Compliant
		Wlan	2412	0.0500		
		Toby-L4006	711.0	0.9441		

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

Simultaneous exposure of Primary and Secondary transmitter installed in generic host device for ISED						
Primary Band	Primary Mode	Transmitter	Frequency (MHZ)	Maximum Seq / SLin	Maximum Spri/Slim_pri + Ssec / Slin_Sec	Compliance Maximum (Spri/Slim_pri) + (Ssec / Slin_Sec) < 1
850	GSM	Bluetooth	2441	0.0034	0.9832	Compliant
		Wlan	2412	0.0924		
		Toby-L4006	848.8	0.8874		
1900	GSM	Bluetooth	2441	0.0034	0.5523	Compliant
		Wlan	2412	0.0924		
		Toby-L4006	1909.8	0.4565		
FDD 2	UMTS	Bluetooth	2441	0.0034	0.9865	Compliant
		Wlan	2412	0.0924		
		Toby-L4006	1907.6	0.8907		
FDD 4	UMTS	Bluetooth	2441	0.0034	0.5593	Compliant
		Wlan	2412	0.0924		
		Toby-L4006	1740	0.4635		
FDD 5	UMTS	Bluetooth	2441	0.0034	0.9946	Compliant
		Wlan	2412	0.0924		
		Toby-L4006	836	0.8988		
eFDD 2	LTE	Bluetooth	2441	0.0034	0.9882	Compliant
		Wlan	2412	0.0924		
		Toby-L4006	1902.5	0.8923		
eFDD 4	LTE	Bluetooth	2441	0.0034	0.6495	Compliant
		Wlan	2412	0.0924		
		Toby-L4006	1732.5	0.5537		
eFDD 5	LTE	Bluetooth	2441	0.0034	0.9817	Compliant
		Wlan	2412	0.0924		
		Toby-L4006	825.5	0.8859		
eFDD 7	LTE	Bluetooth	2441	0.0034	0.5132	Compliant
		Wlan	2412	0.0924		
		Toby-L4006	2567.5	0.4174		
eFDD13	LTE	Bluetooth	2441	0.0034	0.9961	Compliant
		Wlan	2412	0.0924		
		Toby-L4006	784.5	0.9003		
eFDD12	LTE	Bluetooth	2441	0.0034	0.9946	Compliant
		Wlan	2412	0.0924		
		Toby-L4006	711	0.8988		

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	dBi (For FCC)	dBi (For Industry Canada)
850	3.8	0.2
1900	2.7	2.7
FDD 2	9.2	8.6
FDD 4	6.8	6.8
FDD 5	5.5	5.5
eFDD 2	9.5	9.1
eFDD 4	6.8	6.8
eFDD 5	10.1	6.6
eFDD 7	6.7	6.7
eFDD13	9.9	6.5
eFDD12	9.5	6.2