RF Exposure Evaluation Report

FOR:

u-blox AG

Model Name: LISA-U200
Marketing Name: LISA-U200
Description: GSM/WCDMA/HSPA Data and Voice Module

FCC ID: XPYLISAU200

IC ID: 8595A-LISAU200

References:

1. FCC OET Bulletin 65 Supplement
2. FCC CFR Part 1 (1.1307 &1.1310), Part 2 (2.1091)
3. RSS-102- Radio Frequency Exposure Compliance of Radiocommunication Apparatus Issue 4 March 2010, Ch, 2.5 and Ch. 4

1 Administrative Data

1.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Test Lab Manager:	Sajay Jose
Test Engineer:	David Lang

1.2 Identification of the Client

Applicant's Name:	u-blox AG
Street Address:	Zuercherstrasse 68
City/Zip Code	8800 Thalwil
Country	SWITZERLAND
Contact Person:	Giulio Comar
Phone No.	+39 040 2529400
e-mail:	giulio.comar@u-blox.com

1.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Client.
Manufacturers Address:	
City/Zip Code	
Country	

2 Equipment under Test (EUT)

2.1 Specification of the Equipment under Test

Marketing Name:	LISA-U200
Model No:	LISA-U200
HW Revision:	146AB0
SW Revision:	22.40*
FCC-ID:	XPYLISAU200
IC-ID:	8595A-LISAU200
EUT S/N tested:	127
Product Description:	GSM/WCDMA/HSPA Data and Voice Module
Frequency Range / number of channels:	GSM/GPRS/EGPRS 850/900/1800/1900 UMTS FDD Bands 800/850/900/1900/2100
Antenna Type:	EUT will not be sold with antenna. A λ/4 antenna was used for test purpose.
Co-located Transmitters/ Antennas?	☐ Yes ■ No
Power supply:	3.8V DC
Rated Operating temperature range:	-20°C to + 65°C
Prototype / Production unit:	Prototype
Device Category:	☐ Fixed Installation ☐ Mobile ■ Portable
Exposure Category:	☐ Occupational/ Controlled ■ General Population/ Uncontrolled

*Note: All testing was performed using EUT#1 with FW Ver. 22.30. Per manufacturer SW change declaration, FW Ver. 22.40 does not have any impact on the performance characteristics reported in this test report.

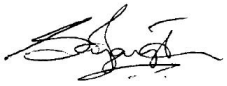
3 Assessment

This report serves as the Technical Information regarding RF Exposure evaluation of the below identified device in FDD IV operation according to the rules as stipulated in

- FCC OET Bulletin 65 Supplement
- FCC CFR Part 1 (1.1307 &1.1310), Part 2 (2.1091)
- RSS-102- Radio Frequency Exposure Compliance of Radiocommunication Apparatus Issue 4 March 2010, Ch, 2.5 and Ch. 4

The following device meets the conditions for exemption from routine evaluation in FDD Band IV operation.

Company	Description	Model #
u-blox AG	GSM/WCDMA/HSPA Data and Voice Module	LISA-U200

Date	Section	Name	Signature
2012-07-20	Compliance	Sajay Jose (Test Lab Manager)	

4 RF Exposure Evaluation Requirements

4.1 FCC:

Calculations can be made to predict RF field strength and power density levels around typical RF sources using the general equations (3) and (4) on page 19 of the following FCC document:
"OET Bulletin 65, Edition 97-01 - Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields".

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure:

Frequency Range (MHz)	Power density (mW/cm^2)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100.000	1.0	30

Using the equation from page 19 of OET Bulletin 65, Edition 97-01:

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

where: S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW)
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Note:
1. This device is to be used only for fixed and mobile applications.
2. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Additionally, according to § 2.1091:
The limit for <1.5 GHz mobile operations where no routine evaluation is required is: 1.5W ERP
The limit for >1.5 GHz mobile operations where no routine evaluation is required is: 3W ERP

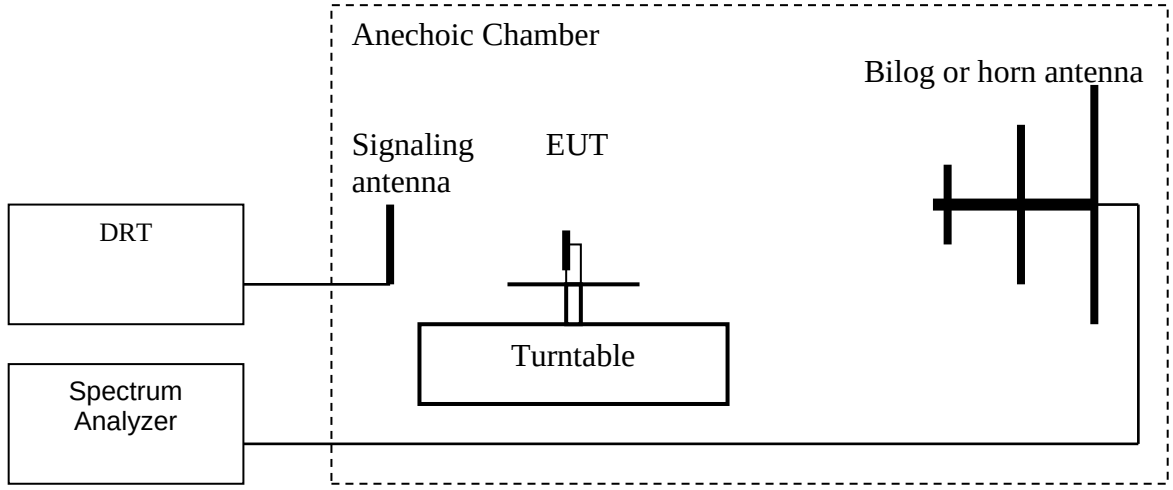
4.2 IC:

RSS-102 Section 2.5.2
RF exposure evaluation is required if the separation distance between the user and the device's radiating element is greater than 20 cm, except when the device operates as follows:
- below 1.5 GHz and the maximum EIRP of the device is equal to or less than 2.5 W;
- at or above 1.5 GHz and the maximum EIRP of the device is equal to or less than 5 W.

RSS-102 4.2: RF Field strength limits for devices used by the General Public (Uncontrolled Environment):
Power density
300MHz- 1500 MHz= f/150 W/m^2
1500 MHz- 1500000 MHz= 10 W/m^2

5 Measurement procedure:

5.1 Radiated power measurement- ERP/EIRP-

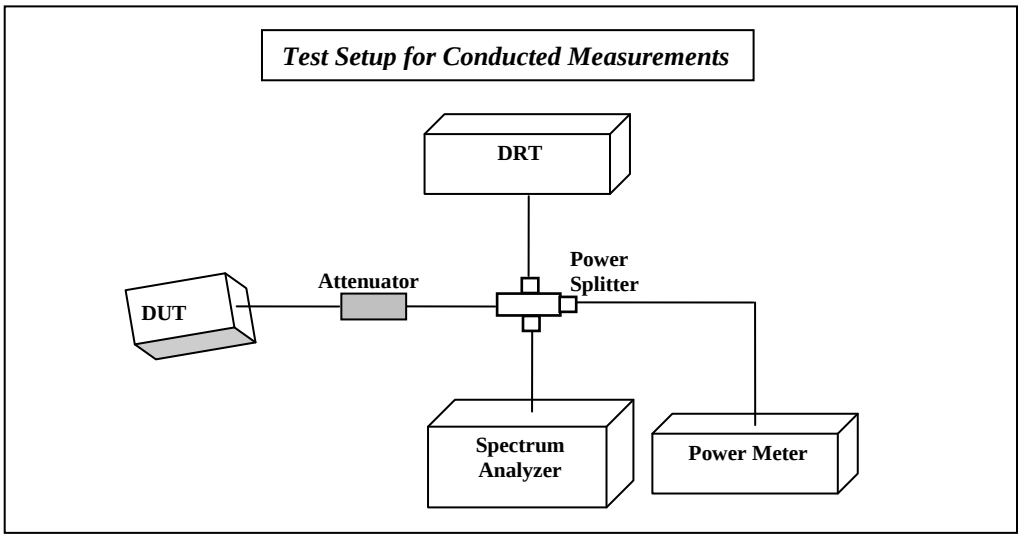


1. Connect the equipment as shown in the above diagram with the EUT's antenna in center of the turn table.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to the channel frequency. Set the analyzer to measure peak hold with the required settings.
4. Rotate the EUT 360°. Record the peak level in dBm (**LVL**).
5. Replace the EUT with a vertically polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS)**. **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the ERP using the following equation:
   ERP (dBm) = **LVL** (dBm) + **LOSS** (dB)
8. Determine the EIRP using the following equation:
   EIRP (dBm) = **ERP** (dBm) + 2.14 (dB)
9. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

Measurement uncertainty: +/-3.0 dB

(**Note:** Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4, 7 and 8 above are performed with test software.)

5.2 Radiated power Calculation- ERP/EIRP-



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to connect the EUT at the required channel (OR) alternatively use the EUT to set to transmit at a specific mode.
3. Measure conducted power using the power meter or the Spectrum Analyzer.
4. ERP/EIRP is calculated by adding the antenna gain to the measured conducted power.
   EIRP= Measured conducted power+ Antenna Gain (dBi)
   (Antenna gain based on measurement or data from the antenna manufacturer.)
   ERP= EIRP- 2.14

5.3 Measurement Equipment information:

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
Radio Communication Tester	CMU 200	Rohde & Schwarz	101821	May 2011	2 Years
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2011	2 Years
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	May 2011	2 Years
Loop Antenna	6512	EMCO	00049838	Aug 2011	3 years
Biconilog Antenna	3141	EMCO	0005-1186	Apr 2012	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035114	Mar 2012	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035111	Apr 2012	3 years
Horn Antenna (18-40GHz)	3116	ETS	00070497	Aug 2011	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
Power Smart Sensor	R&S	NRP-Z81	100161	May 2011	2 Years

5.4 Measurement Summary:

Band of operation	**Peak Radiated Power-EIRP**		**Limits (IC)** (where no routine evaluation is required)	**Peak Radiated Power ERP**		**Limits (FCC)** (where no routine evaluation is required)
MHz	dBm	mW	W	dBm	mW	W
UMTS FDDIV 1710-1755MHz	18.5	70.8	5	20.6	114.8	3

Since the Peak ERP <3W (FCC) and Peak EIRP <5W (IC), this device is exempt from Routine evaluation.

Compliance with MPE limits can be guaranteed as the calculation below shows:

1700 MHz frequency band

Maximum output power considerations:

Mode	Maximum conducted output power (dBm)	Maximum conducted output power (mW)	Duty cycle	Equivalent conducted output power (Maximum conducted output power x duty cycle) (mW)
UMTS FDD	22.7	186.21	100%	186.21

P	Maximum power input to the antenna:	186.21	mW
R	Distance:	20	cm
S	MPE limit for uncontrolled exposure:	1	mW/cm^2
G_1	Antenna gain (dBi) to comply with MPE limits:	**14.30**	**dBi**
EIRP power limit according to §2.1091:		3	W EIRP
G_2	Antenna gain (dBi) to comply with ERP limits: (EIRP = Equivalent conducted output power x Antenna gain)	**14.22**	**dBi**
EIRP power limit according to §27.50:		1	W EIRP
G_3	Antenna gain (dBi) to comply with EIRP limits: (EIRP = Maximum conducted output power x Antenna gain)	**7.30**	**dBi**
$G_{1900\ MHz\ band}$	Min (G_1, G_2, G_3)	**7.30**	**dBi**

Therefore the maximum antenna gain for mobile operation to comply with MPE and ERP limits shall not exceed **7.30 dBi**.