



# LS RESEARCH, LLC

Wireless Product Development

W66 N220 Commerce Court • Cedarburg, WI 53012 USA • Phone: 262.375.4400 • Fax: 262.375.4248 • www.lsr.com

## ENGINEERING TEST REPORT # 313136 C

**LSR Job #: C-1724**

RF Exposure Compliance of:

TiWi-uB1

Test Date(s):

August 6, 2013

Prepared For:

LS Research, LLC.

Attn: Josh Bablitch

W66 N220 Commerce Court

Cedarburg, WI 53012

**This Test Report is issued under the Authority of:** Adam Alger, EMC Engineer

Signature:

Date: 8-20-13

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Prepared For: LS Research, LLC.	Name: TiWi-uB1
Report: TR 313136 C RFX	Model: TiWi-uB1
LSR: C-1724	Serial: Trace Antenna Unit (1CBA8C1B8B35); U.FL Unit (1CBA8C1B8C65)

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## LS Research, LLC in Review

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:

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TESTING CERT #1255.01

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope of Accreditation

A2LA Certificate Number: 1255.01

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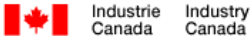


Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948

FCC Registration Number: 90756

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**Canada**

Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1

File Number: IC 3088-A

On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1

File Number: IC 3088

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U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility – Council Directive 2004/108/EC (formerly 89/336/EEC, Article 10.2).

Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.

Date of Validation: November 20, 2002

Notified Body Identification Number: 1243

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## 1.0 Conformance Summary

The EUT was found to MEET the 5mm minimum test separation distance threshold for SAR test exclusion per FCC §2.1091(mobile) and §2.1093(portable) using methods of FCC KDB 447498 D01 General RF Exposure Guidance v05r01 as a standalone device.

## 2.0 SAR Test Exclusion Threshold

SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm

1-g SAR test exclusion threshold equation:

$$\left[ \frac{\text{(max. power of channel, including tune-up tolerance, mW)}}{\text{(min. test separation distance, mm)}} \right] * \sqrt{f(\text{GHz})} \leq 3.0$$

10-g SAR test exclusion threshold equation:

$$\left[ \frac{\text{(max. power of channel, including tune-up tolerance, mW)}}{\text{(min. test separation distance, mm)}} \right] * \sqrt{f(\text{GHz})} \leq 7.5$$

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### 3.0 Client Information

<b>Manufacturer Name:</b>	LS Research, LLC.
<b>Address:</b>	W66 N220 Commerce Ct. Cedarburg, WI 53012
<b>Contact Person:</b>	Josh Bablitch

### 3.1 Equipment Under Test (EUT) Information

*The following information has been supplied by the applicant.*

<b>Product Name:</b>	TiWi-uB1
<b>Model Number:</b>	TiWi-uB1
<b>Serial Number:</b>	Trace Antenna Unit (1CBA8C1B8B35); U.FL Unit (1CBA8C1B8C65)
<b>FCC ID</b>	TFB-BT2
<b>IC Number</b>	5969A-BT2

### 3.2 Product Description

The TiWi-uB1 Module is a radio module that implements a Bluetooth Low Energy (BLE) transceiver.

This module uses a hybrid trace antenna and an off board U.FL option for +2 dBi peak gain Dipole antenna.

### 3.3 Additional Information

The channels used for test were 2402 MHz (low), 2440 MHz (mid), and 2480 MHz (high). The radio is programmed via a Chipcon AS (SOC\_BB 1.1) board with USB cable connected to computer running TiWi Bluetooth Eval Tool Version 4.0.0.0. Once programmed the module is removed from the programming board and powered with a DC bench supply.

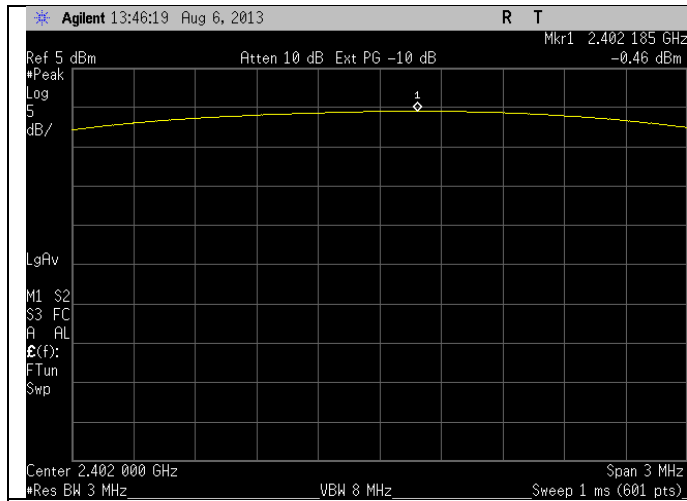
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## 4.0 RF Conducted Measurement Data

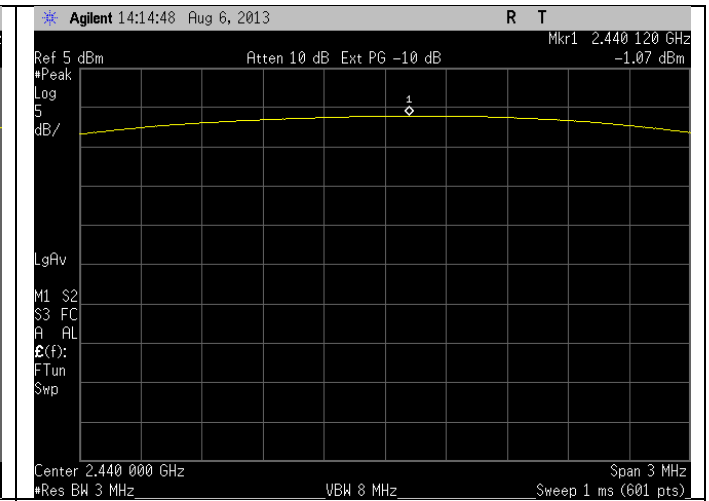
Table

Frequency (MHz)	Power (dBm)
2402	-0.46
2440	-1.07
2480	-1.83

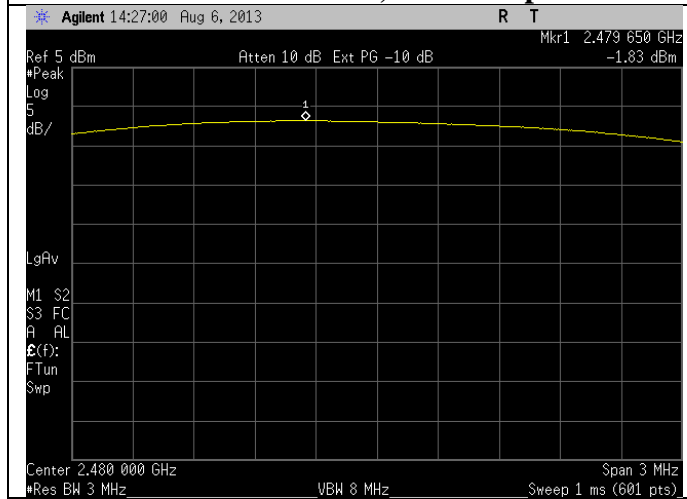
### Plots



**Low Channel – 2402 MHz, Peak Output Power**



**Mid Channel – 2440 MHz, Peak Output Power**



**High Channel – 2480 MHz, Peak Output Power**

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## 5.0 SAR Test Exclusion Calculation

**Note:** 100 % duty cycle

Description	Line #	Data	Unit	Additional Description
Transmit Packet on time:	1	100	(ms)	Worst case
Packet repetition time:	2	100	(ms)	Worst case
Duty factor:	3	1		Transmit Packet on time / Packet repetition time (1/2)
Maximum peak output power at antenna input terminal:	4	-0.46	(dBm)	Measured worst case
Antenna gain:	5	2	(dBi)	Antenna gain (supplied by applicant)
Maximum peak radiated power:	6	1.540	(dBm)	Antenna terminal measured power + antenna gain (4+5)
Maximum peak radiated power:	7	1.426	(mW)	dBm to mW conversion
Prediction distance:	8	5	(mm)	Minimum test separation distance
Prediction frequency:	9	2.402	(GHz)	Measured frequency
Square root of frequency (GHz):	10	1.549839		Calculation
Duty factor applied to maximum peak radiated power (mW):	11	1.425608	(mW)	duty factor * maximum peak radiated power (11*7)
Source based power (mW) / min test separation distance (mm):	12	0.285122		Calculation (11/8)
SAR exclusion calculation:	13	0.44		Calculation (12*10)
Threshold:	14	3		
Margin:	15	2.56		Calculation (14-13)

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## END OF REPORT

Date	Version	Comments	Person
8-19-13	V0	Initial Draft Release	Adam A
8-20-13	V1	Final Release	Adam A

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