



LSRESEARCH, LLC

Wireless Product Development

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ENGINEERING TEST REPORT # 314128

LSR Job #: C-1951

RF Exposure Compliance of:
FZM BLUETOOTH MODULE

Test Date(s):
May 16, 17, 19, 20 and June 6, 2014

Prepared For:
NSN
Attn: Terry Schwenk
1501 W Shure Drive
Arlington Heights, IL 60004

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

Signature: Date: 7-7-14

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Prepared For: NSN	Name: FZM BLUETOOTH MODULE
Report: TR 314128 RFx	Model: FZM BLUETOOTH MODULE
LSR: C-1951	Serial: 000FBBD630FE

Table of Contents

i.	Title Page	1
ii.	Table of Contents	2
iii.	LS Research, LLC.....	3
1.0	Conformance Summary	4
2.0	SAR Test Exclusion Threshold.....	4
3.0	Equipment Under Test (EUT) Information.....	5
3.1	Product Description	5
3.2	Additional Information	5
4.0	RF Conducted Measurement Data	6
5.0	SAR Test Exclusion Calculation	7
6.0	Industry Canada Low Power Exemption	8
7.0	MPE Calculation.....	9

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LS Research, LLC in Review

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



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



Federal Communications Commission (FCC) – USA

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

FCC Registration Number: 90756



Industrie
Canada Industry
Canada

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



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 v05r2 as a standalone device.

2.0 SAR Test Exclusion Threshold

SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 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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LSR: C-1951	Serial: 000FBBD630FE

3.0 Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	FZM BLUETOOTH MODULE
Model Number:	FZM BLUETOOTH MODULE
Serial Number:	000FBBD630FE
FCC ID	VBNFZMBTM-01
IC Number	661W-FZMBTM01

3.1 Product Description

The FZM BLUETOOTH MODULE is a radio module that implements a dual mode Bluetooth (BT) and Bluetooth Low Energy (LE) transceiver. A Texas Instruments CC2564 (System on Integrated Circuit) has one transceiver that can operate in either BT or BLE mode.

3.2 Additional Information

Device programmed for continuous transmit or receive via a USB connection to a laptop computer running a HyperTerminal type program. HCI commands were keyed to program mode, channel, hopping, etc.

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LSR: C-1951	Serial: 000FBBD630FE

4.0 RF Conducted Measurement Data

Table

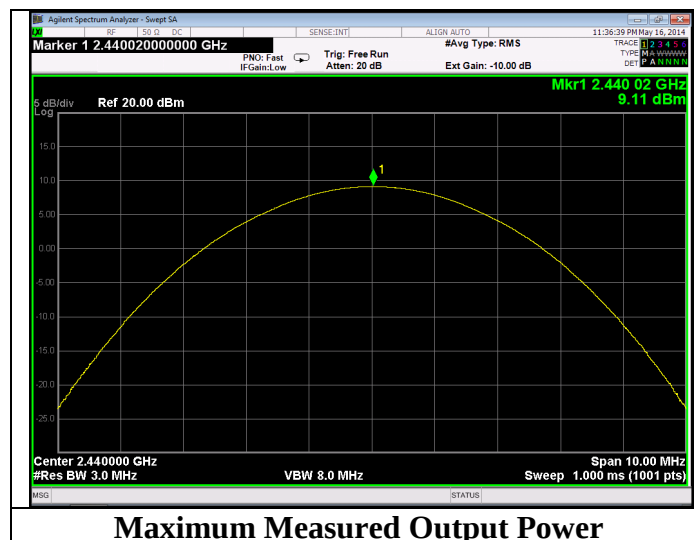
FHSS Device

Mode	Frequency (MHz)	Output Power (dBm)
BR	2402	8.22
	2440	8.24
	2480	7.62
EDR 2	2402	8.29
	2440	8.30
	2480	7.69
EDR 3	2402	9.08
	2440	9.11
	2480	8.51

DTS Device

Mode	Frequency (MHz)	PK Output Power (dBm)
BLE	2402	8.26
	2440	8.27
	2480	7.67

Plots



Prepared For: NSN

Report: TR 314128 RFx

LSR: C-1951

Name: FZM BLUETOOTH MODULE

Model: FZM BLUETOOTH MODULE

Serial: 000FBBD630FE

5.0 SAR Test Exclusion Calculation

Note: 100 % duty cycle used as worst case assessment

Description	Line #	Data	Unit	Additional Description
Transmit Packet on time:	1	100	(ms)	Worst case (supplied by applicant)
Packet repetition time:	2	100	(ms)	Worst case (supplied by applicant)
Duty factor:	3	1		Transmit Packet on time / Packet repetition time (1/2)
Maximum peak output power at antenna input terminal:	4	9.11	(dBm)	Measured worst case
Maximum peak radiated power:	5	8.147	(mW)	dBm to mW conversion
Prediction distance:	6	5	(mm)	Minimum test separation distance
Prediction frequency:	7	2.44	(GHz)	Measured frequency
Square root of frequency (GHz):	8	1.56205		Calculation
Duty factor applied to maximum peak radiated power (mW):	9	8.147043	(mW)	duty factor * maximum peak conducted power
Source based power (mW) / min test separation distance (mm):	10	1.629409		Calculation
SAR exclusion calculation:	11	2.55		Calculation
Threshold:	12	3		
Margin:	13	0.45		Calculation

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Report: TR 314128 RFx

Model: FZM BLUETOOTH MODULE

LSR: C-1951

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6.0 Industry Canada Low Power Exemption

RSS 102 Section 2.5 states that all transmitters that meet the output power requirements as stated in section 2.5.1 and 2.5.2 of RSS 102 are exempt from routine SAR and RF exposure evaluation.

Output Power Evaluation.

Evaluation Frequency = 2440MHz

Device Operation separation distance: **>20cm**

Maximum Effective Isotropic Radiated Power (dBm) = 9.11 dBm + 3.0 dBi = 12.11 dBm

Maximum Effective Isotropic Radiated Power (mW) = $\log^{-1}(\text{EIRP (dBm)}/10)$ = 0.016255 mW

Section 2.5.2 general public use limit at for devices operating more than 20cm:

Frequency	Limit
>1.5	5W

Conclusion:

Since the maximum effective radiated power (ERP) is less than the applicable section limit, the Product is exempt from SAR/RF Evaluation

7.0 MPE Calculation

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

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 center of radiation of the antenna

Maximum peak output power at antenna input terminal: 9.11 (dBm)
Duty Factor: 100.00 (%)
Maximum peak output power at antenna input terminal: 8.147 (mW)
Antenna gain(typical): 3 (dBi)
Maximum antenna gain: 1.995 (numeric)
Prediction distance: 20 (cm)
Prediction frequency: 2440 (MHz)
MPE limit for uncontrolled exposure at prediction frequency: 1 (mW/cm²)

Power density at prediction frequency: 0.003234 (mW/cm²)

Maximum allowable antenna gain: 27.9 (dBi)

Margin of Compliance at 20 cm = 24.9 dB

END OF REPORT

Date	Version	Comments	Person
7-7-14	V1	Final	Adam A

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