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ENGINEERING TEST REPORT # TR 315131 B

LSR Job #: C-2290

Compliance Testing of:

1DX0JB0AX

Test Date(s):

November 4, 5, 12, 13, 20 2015

Prepared For:

FCC:

Stanley Black and Decker

Attn: Kirwan Magdamo

701 E. Joppa Road

Towson, MD 21286

IC:

Stanley Black and Decker Canada

Attn: Mark Emmerson

6275 Millcreek Drive

Mississauga, Ontario L5N7K6

This Test Report issued:

Tom Smith, VP of Test Services

Signature:

Date: 12-23-15

Report by:

Adam Alger, Quality Manger – Test Services

Signature:

Date: 12-22-15

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Prepared For: Stanley Black and Decker	Name: 1DX0JB0AX
Report: TR 315131 B	Model: See section 1.1
LSR: C-2290	Serial: See Section 1.1

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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



Federal Communications Commission (FCC) – USA

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

FCC Registration Number: 90756



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 Client Information

FCC

Manufacturer Name:	Stanley Black and Decker
Address:	701 E. Joppa Road Towson, MD 21286
Contact Person:	Kirwan Magdamo

IC

Manufacturer Name:	Stanley Black and Decker Canada
Address:	6275 Millcreek Drive Mississauga, Ontario L5N7K6
Contact Person:	Mark Emmerson

1.1 Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	1DX0JB0AX
Model Number:	Module - Model: 1DX0JB0AX Battery Pack – Model: LBXR20BT
Serial Number:	None (engineering sample)
FCC ID:	YJ71DK0JB0AX
IC:	9082A-1DK0JB0AX

1.2 Product Information

Bluetooth Low Energy product utilizing PCB trace antenna with peak gain of 0 dBi as stated by the manufacturer.

1.3 Modifications Incorporated In the EUT for Compliance Purposes

None noted at time of test

1.4 Deviations & Exclusions from Test Specifications

None noted at time of test

1.5 Additional Information

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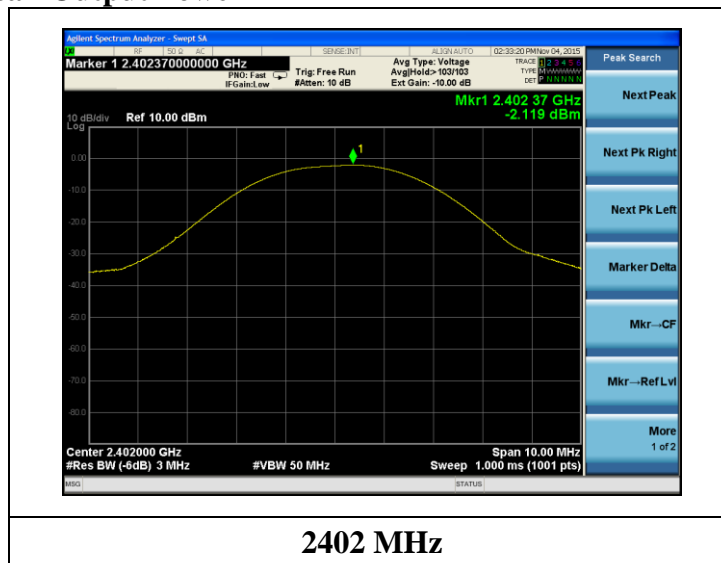
This EUT contains a TI CC2541 BLE radio module. It was programmed for continuous transmit via USB cable connected to a laptop computer running SmartRF Studio 7. Test channels; Low Channel (2402 MHz), Mid Channel (2440 MHz), and High Channel (2480 MHz).

2.0 RF Conducted Measurement Data

Table

Frequency (MHz)	6 dB DTS BW (kHz)	99% OBW (MHz)	20 dB OBW (MHz)	30 kHz PSD (dBm)	PSD Limit (dBm / 3 kHz)	PSD Margin (dB)	Max Output Power (dBm)	Max Output Power Limit (dBm)	Max Output Power Margin (dB)
2402	698	2.31	1.220	-6.22	8	14.22	-2.1	30	32.1
2440	722	2.294	1.236	-6.58	8	14.58	-2.5	30	32.5
2480	682	1.106	1.236	-6.81	8	14.81	-3.1	30	33.1

Plots – Maximum Peak Output Power



Date : November 4, 5, 20 2015 Type Test : Radiated And Conducted Emissions Job # : C-2290

Prepared By: Peter Feilen Customer : Stanley Black and Decker Quote #: 315131

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960150	Biconical Antenna	ETS	3110B	0003-3346	1/22/2015	1/22/2016	Active Calibration
2	EE 960088	8GHz MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	1/9/2015	1/9/2016	Active Calibration
3	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	1/19/2015	1/19/2016	Active Calibration
4	AA 960158	Double Ridge Horn Antenna	ETS Lindgren	3117	109300	7/9/2015	7/9/2016	Active Calibration
5	EE 960159	0.8 - 21GHz LNA	Mini-Circuits	ZVA-213X-S+	740411007	7/9/2015	7/9/2016	Active Calibration
6	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	5/6/2015	5/6/2016	Active Calibration
7	AA 960153	2.4GHz High Pass Filter	KwM	HPF-L-14186	7272-04	4/15/2015	4/15/2016	Active Calibration
8	EE 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro / EMC	w/LA622-4 / 3160-09	123001	8/19/2015	8/19/2016	Active Calibration
9	EE 960087	44GHz EXA Spectrum Analyzer	Agilent	N9010A	MY53400296	12/11/2014	12/11/2015	Active Calibration

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3.0 FCC 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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3.1 FCC SAR Test Exclusion Calculation

A. 2402 MHz

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 (Line # 1/2)
Maximum peak output power at antenna input terminal:	4	-2.10	(dBm)	Measured worst case
Tune up tolerance:	4.1	2.00	(dBm)	
Maximum peak power:	5	0.977	(mW)	dBm to mW conversion
Prediction distance:	6	5	(mm)	Minimum test separation distance
Prediction frequency:	7	2.402	(GHz)	Measured frequency
Square root of frequency (GHz):	8	1.549839		Calculation
Duty factor applied to maximum peak radiated power (mW):	9	0.977237	(mW)	duty factor * maximum peak power (Line # 11*3)
Source based power (mW) / min test separation distance (mm):	10	0.195447		Calculation (Line # 5/6)
SAR exclusion calculation:	11	0.30		Calculation (Line # 10*8)
Threshold:	12	3		
Margin:	13	2.70		Calculation (Line # 12-11)

B. 2480 MHz

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 (Line # 1/2)
Maximum peak output power at antenna input terminal:	4	-3.10	(dBm)	Measured worst case
Tune up tolerance:	4.1	2.00	(dBm)	
Maximum peak power:	5	0.776	(mW)	dBm to mW conversion
Prediction distance:	6	5	(mm)	Minimum test separation distance
Prediction frequency:	7	2.48	(GHz)	Measured frequency
Square root of frequency (GHz):	8	1.574802		Calculation
Duty factor applied to maximum peak radiated power (mW):	9	0.776247	(mW)	duty factor * maximum peak power (Line # 11*3)
Source based power (mW) / min test separation distance (mm):	10	0.155249		Calculation (Line # 5/6)
SAR exclusion calculation:	11	0.24		Calculation (Line # 10*8)
Threshold:	12	3		
Margin:	13	2.76		Calculation (Line # 12-11)

Note: 100% duty factor

3.2 FCC 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 v05r02 as a standalone device.

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4.0 Industry Canada Low Power Exemption

RSS 102 Issue 5 Section 2.5 states that all transmitters that meet the exemption limits as stated in section 2.5.1 are exempt from routine SAR and RF exposure evaluation.

Output Power Evaluation.

Device Operation separation distance: 5mm

Evaluation Frequency = 2402 MHz

Maximum Effective Isotropic Radiated Power (dBm) = -2.1 dBm + 0 dBi + 2.0dB (tolerance) = -0.1 dBm
 Maximum Effective Isotropic Radiated Power (mW) = $\log^{-1}(\text{EIRP (dBm)}/10)$ = **0.977 mW**

Interpolate to obtain limit of frequency 2402 MHz at separation of $\leq 5\text{mm}$: **4.3 mW**

Evaluation Frequency = 2480 MHz

Maximum Effective Isotropic Radiated Power (dBm) = -3.1 dBm + 0 dBi + 2.0dB (tolerance) = -1.1 dBm
 Maximum Effective Isotropic Radiated Power (mW) = $\log^{-1}(\text{EIRP (dBm)}/10)$ = **0.776 mW**

Interpolate to obtain limit of frequency 2480 MHz at separation of $\leq 5\text{mm}$: **3.8 mW**

Section 2.5.1 Table 1 general public use limit at for devices operating less than 20cm:

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤ 5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤ 300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

4.1 IC Conformance Summary

The EUT was found to MEET the 5mm minimum test separation distance threshold for SAR test exclusion per IC RSS-102 Issue 5.

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END OF REPORT

Date	Version	Comments	Person
12-23-15	V1	Final	Adam A
1-12-16	V1a	TCB response	Aidi Z

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