

Test Report # 317246 RFx

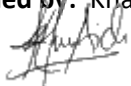
Equipment Under Test: Power Wave Communication Kit

Test Date(s): 8/1/17 to 8/16/17

Prepared for: Samir Farah


The Lincoln Electric Company
22801 St. Clair Ave
Cleveland, OH 44117

Report Issued by: Khairul Aidi Zainal, Laboratory Manager

Signature: 

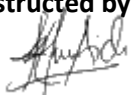
Date: 10/2/17

Report Reviewed by: Adam Alger, Quality Systems Engineer

Signature: 

Date: 10/02/2017

Report Constructed by: Khairul Aidi Zainal, Laboratory Manager

Signature: 

Date: 9/14/17

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Report: 317246 RFx		Model: G8814
Job: C-2771		Serial: 100002017212001,100002017212002, 100002017132023, 100002017123015

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Laird Technologies Test Services in Review

The Laird Technologies, Inc. laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:



A2LA – American Association for Laboratory Accreditation

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

A2LA Certificate Number: 1255.01

Scope of accreditation includes all test methods listed herein, unless otherwise noted.



Federal Communications Commission (FCC) – USA

Accredited recognition of two 3 meter Semi-Anechoic Chambers

Accredited Test Firm Registration Number: 953492



Innovation, Science and Economic Development Canada

ISED Site listing of two 3 meter Semi-Anechoic Chambers based on RSS-GEN – Issue 4

File Number: IC 3088A-2

File Number: IC 3088A-3

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1 TEST REPORT SUMMARY

During 8/1/2017 to 8/13/2017 the Equipment Under Test (EUT), **Power Wave Communication kit**, as provided by **The Lincoln Electric Company** was tested to the following requirements:

Requirement	Description	Specification	Method	Result
FCC Part 1.1307, 2.1091, 2.1093	RF Exposure and equipment authorization requirements	Reported	FCC KDB 447498	Reported
ISED Canada RSS-102	Exemption Limits for Routine Evaluation — SAR Evaluation	Reported	RSS-102 Section 2.5.2	Reported

Notice:

The results relate only to the item tested and described in this report. Any modifications made to the equipment under test after the specified test date(s) may invalidate the data herein.

If the resulting measurement margin is seen to be within the uncertainty value, as listed in this report, the possibility exists that this unit may not meet the required limit specification if subsequently tested.

2 CLIENT INFORMATION

Company Name	The Lincoln Electric Company
Contact Person	Samir Farah
Address	22801 St, Clair Avenue, Cleveland, OH. 44117

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Power Wave Communication Kit
Model Number	G8814
Serial Number	100002017212001, 100002017132023 (radiated) 100002017212002, 100002017123015 (Conducted)
FCC / IC ID	2AJY8-LEWB0000111/22017-LEWB0000111

2.2 Product Description

A connectivity gateway that will be used in conjunction with a welder.

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2.3 Modifications Incorporated for Compliance

N/A

2.4 Deviations and Exclusions from Test Specifications

N/A

2.5 Additional Information

The EUT could be programmed for specific test modes in two ways:

1. EUT was programmed into the appropriate test modes using a proprietary test tool, ArcLink Suite. The test tool was installed on a laptop and connection to the EUT was via an Ethernet cable. The revision of the test tool used during testing was 7.0.0.3395
2. Programming through a series of button pushes on the front of the EUT.

3 REFERENCES

Publication	Edition	Date
CFR 47 Part 1	-	2017
CFR 47 Part 2	-	2017
RSS-102	Issue 5	2015

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of $k = 2$.

References	Version / Date
CISPR 16-4-1	Ed. 2 (2009-02)
CISPR 16-4-2	Ed. 2 (2011-06)
CISPR 32	Ed. 1 (2012-01)
ANSI C63.23	2012
A2LA P103	February 4, 2016
A2LA P103c	August 10, 2015
ETSI TR 100-028	V1.3.1 (2001-03)

Measurement Type	Configuration	Uncertainty \pm
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

Parameter	ETSI U.C. \pm	U.C. \pm
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

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5 TEST DATA

5.1 Fundamental Measurements WLAN

Operator	Aidi
QA	Coty H.
Test Date	8/14/2017
Location	Conducted measurement area
Temp. / R.H.	72/75
Requirement	15.247 (b) (3)
Method	FCC KDB 558074 D01 DTS Meas Guidance V04, section 9.1.3

Test Parameters

Frequency	2412, 2437 and 2462 MHz
Settings	Wideband Power meter and sensor
Settings	Channel mode = Modulated, Measurement = Peak
Settings	Trigger source = internal A

Table

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A. 802.11b

1MBPS				
Channel	Frequency (MHz)	Peak Output power (dBm)	Limit (dBm)	Margin (dB)
1	2412.0	14.7	30.0	15.3
6	2437.0	15.9	30.0	14.1
11	2462.0	15.7	30.0	14.3

11MBPS				
Channel	Frequency (MHz)	Peak Output power (dBm)	Limit (dBm)	Margin (dB)
1	2412.0	14.8	30.0	15.2
6	2437.0	16.2	30.0	13.8
11	2462.0	15.6	30.0	14.4

B. 802.11g

6MBPS				
Channel	Frequency (MHz)	Peak Output power (dBm)	Limit (dBm)	Margin (dB)
1	2412.0	17.5	30.0	12.5
6	2437.0	18.2	30.0	11.8
11	2462.0	18.1	30.0	11.9

54MBPS				
Channel	Frequency (MHz)	Peak Output power (dBm)	Limit (dBm)	Margin (dB)
1	2412.0	16.8	30.0	13.2
6	2437.0	17.5	30.0	12.5
11	2462.0	17.2	30.0	12.8

C. 802.11n

MCS0				
Channel	Frequency (MHz)	Peak Output power (dBm)	Limit (dBm)	Margin (dB)
1	2412.0	18.0	30.0	12.0
6	2437.0	18.5	30.0	11.5
11	2462.0	18.3	30.0	11.7

MCS7				
Channel	Frequency (MHz)	Peak Output power (dBm)	Limit (dBm)	Margin (dB)
1	2412.0	15.5	30.0	14.5
6	2437.0	17.6	30.0	12.4
11	2462.0	17.1	30.0	12.9

5.2 Fundamental Measurements Bluetooth

Operator	Zach Wilson
QA	Aidi Zainal
Test Date	8/17/2017
Location	Radio Bench
Temp. / R.H.	70 / 82
Requirement	FCC 15.247 a.1, b.1
Method	ANSI C63.10 7.8.5

Test Parameters

Frequency	2402, 2440, 2480 MHz
RBW	2 MHz
VBW	6 MHz
Span	5 MHz
Modulations	GFSK, EDR2, EDR3
EUT Power	36 VDC from Power Supply @ 120VAC/60Hz

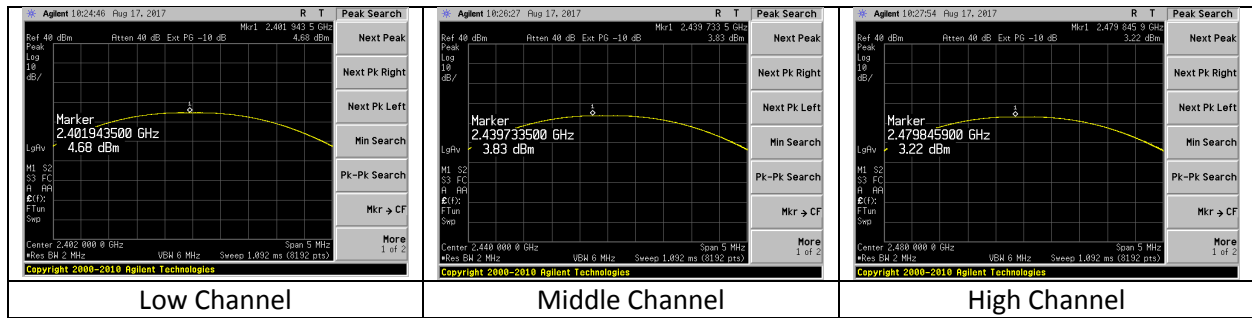
Data

Data Rate	Pout (dBm)		
	2402 MHz	2440 MHz	2480 MHz
1 Mbps	4.68	3.83	3.22
2 Mbps	4.80	4.11	3.53
3 Mbps	5.36	4.74	4.11

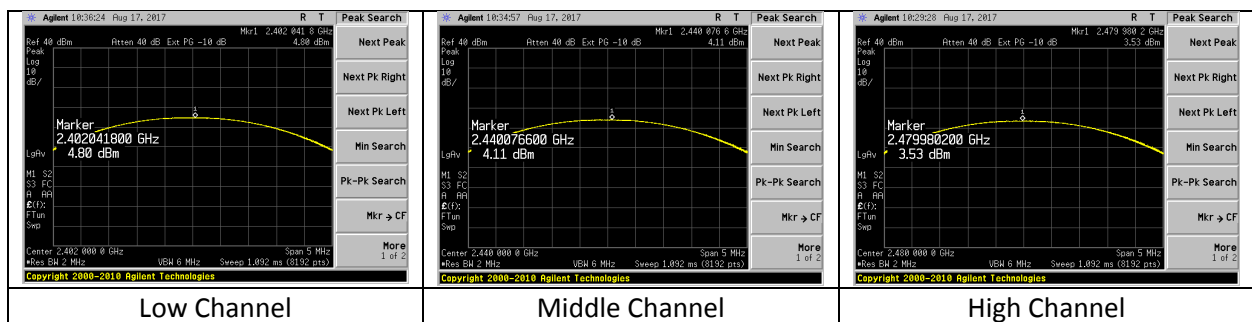
Worst case margin = 21.0 dBm-5.4 = 15.6dB

Plots

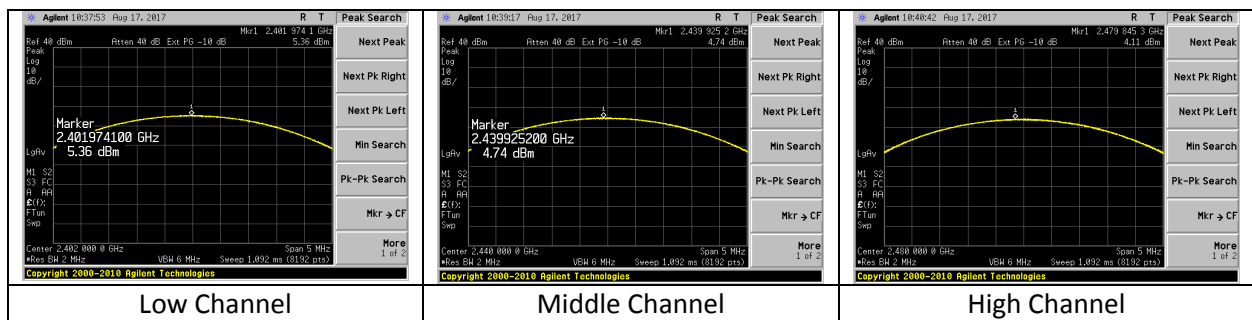
GFSK



EDR2



EDR3



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6 EXEMPTION CALCULATION

6.1 FCC

A. WLAN

Maximum conducted power (Peak) = 18.5 dBm

Tune-up tolerance = ± 2.0 dB

Maximum conducted power (Peak) + Tune-up tolerance = 20.5dBm

Frequency = 2437 MHz

Antenna gain = 0.8 dBi

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:	20.50 (dBm)
Maximum peak output power at antenna input terminal:	112.202 (mW)
Antenna gain(typical):	0.8 (dBi)
Maximum antenna gain:	1.202 (numeric)
Prediction distance:	20 (cm)
Prediction frequency:	2437 (MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1 (mW/cm ²)
Power density at prediction frequency:	0.026837 (mW/cm ²)
Maximum allowable antenna gain:	16.5 (dBi)
Margin of Compliance at 20 cm =	15.7 dB

B. Bluetooth

Maximum conducted power = 5.36 dBm

Tune-up tolerance = ± 2.0 dB

Maximum conducted power (Peak) + Tune-up tolerance = 7.4dBm

Frequency = 2480 MHz

Antenna gain = 1.3 dBi

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: 7.40 (dBm)

Maximum peak output power at antenna input terminal: 5.495 (mW)

Antenna gain(typical): 1.3 (dBi)

Maximum antenna gain: 1.349 (numeric)

Prediction distance: 20 (cm)

Prediction frequency: 2480 (MHz)

MPE limit for uncontrolled exposure at prediction frequency: 1 (mW/cm²)

Power density at prediction frequency: 0.001475 (mW/cm²)

Maximum allowable antenna gain: 29.6 (dBi)

Margin of Compliance at 20 cm = 28.3 dB

C. Simultaneous transmission

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in the host device is ≤ 1 , according to calculated/estimated, numerically modeled, or measured field strengths or power density.

WLAN MPE ratio = $0.0268 \text{ mW/cm}^2 / 1 \text{ mW/cm}^2 = 0.0268$

Bluetooth MPE ratio = $0.0015 \text{ mW/cm}^2 / 1 \text{ mW/cm}^2 = 0.0015$

Sum of MPE ratios = $0.0268 + 0.0015 = \underline{\underline{0.0283}}$

Conclusion.

The sum of the MPE ratio, 0.0283, is less than 1, therefore the EUT is exempt from RF exposure evaluation.

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6.2 Industry Canada

6.2.1 RSS 102 Compliance

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz⁶ and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

A. WLAN

Maximum conducted power (Peak) = 18.5 dBm

Tune-up tolerance = ± 2.0 dB

Maximum conducted power (Peak) + Tune-up tolerance = 20.5dBm

Frequency = 2437 MHz

Antenna gain = 0.8 dBi

EIRP = 20.5dBm + 0.8 dBi = 21.3dBm = 0.135W

Limit = $1.31 \times 10^{-2} f^{0.6834} = 1.31 \times 10^{-2} (2437)^{0.6834} = 2.7$ W

B. Bluetooth

Maximum conducted power = 5.36 dBm

Tune-up tolerance = ± 2.0 dB

Maximum conducted power (Peak) + Tune-up tolerance = 7.4dBm

Frequency = 2480 MHz

Antenna gain = 1.3 dBi

EIRP = 7.4dBm + 1.3 dBi = 8.7dBm = 0.007W

Limit = $1.31 \times 10^{-2} f^{0.6834} = 1.31 \times 10^{-2} (2480)^{0.6834} = 2.7$ W

Conclusion.

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The maximum EIRP of both the WLAN and Bluetooth radio is less than the limit, therefore the EUT is exempt from RF exposure evaluation.

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7 REVISION HISTORY

Version	Date	Notes	Person
0	9/14/17	Initial Draft	Aidi Zainal
1	10/2/17	Final	Aidi Zainal
1a	10/18/17	Modified per TCB responses	Aidi zainal

END OF REPORT