



LSRESEARCH, LLC

Wireless Product Development

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ENGINEERING TEST REPORT # 314006

LSR Job #: C-1883

RF Exposure Compliance of:

Proximity Locator

Test Date(s):

March 18, 19, 20, 24, 25, 26 2014

Prepared For:

Matrix

Attn: Tony Amos

3299 Tower Drive

Newburgh, IN 47630

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

Signature:

Date: 06-04-2014

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Prepared For: Matrix

Report: TR 314066

LSR: C-1883

Name: Proximity Locator

Model: 10000615

Serial: Radiated (001A57-000D7D) RF Conducted (001A57-000D8B)

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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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3.0 Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	Proximity Locator
Model Number:	10000615
Serial Number:	Radiated (001A57-000D7D); RF Conducted (001A57-000D8B)
FCC ID	USK-10000615
IC Number	11898A-10000615

3.1 Product Description

The locator is a portable device worn by a coal miner in an underground and topside environment. It is use to detect an individual's proximity to operating coal extraction equipment.

If an operator gets too close to the equipment, it will either shut the equipment down or put it into a safe mode of operation via a controller that is mounted on the equipment.

Device utilizes a PCB mounted antenna. Taoglass PN SWLP.2450.12.4.B.02 with a +2 dBi typ. Peak gain per antenna manufacturer data sheet.

3.2 Additional Information

EUT programmed for continuous transmit modulation or receive mode via serial port connection to a modified cradle with USB. Hyper-terminal (or similar) used to type commands into EUT.

EUT fitted with a temporary connector for RF conducted measurements (serial # 002A57-000D8B).

Radiated sample serial # 001A57-000D7D

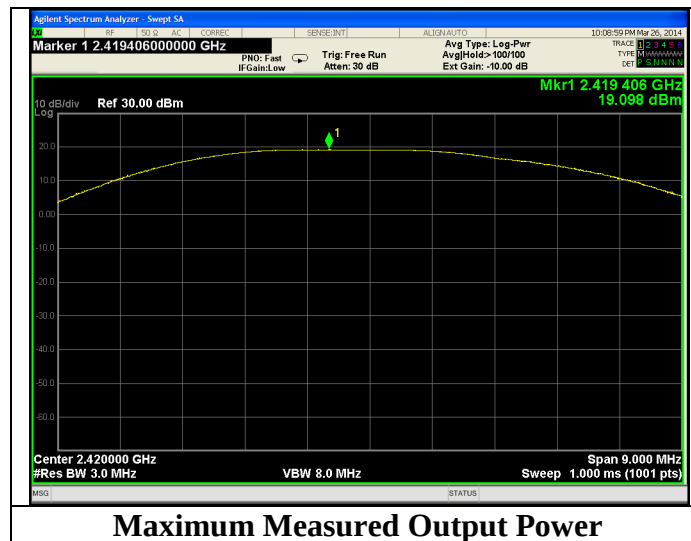
Power supply with EUT cradle: V-INFINITY P/N: EPSA150160U-PSP-SZ, Model: 3A-242WU15

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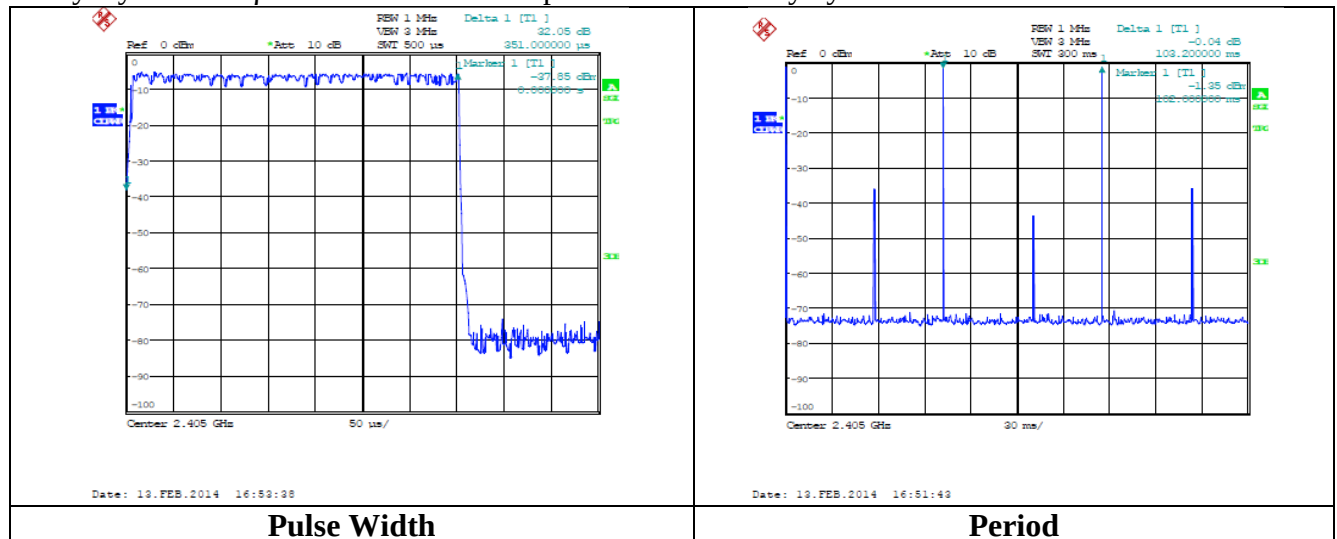
4.0 RF Conducted Measurement Data Table

Frequency (MHz)	Channel	Power Level	Output Power (dBm)
2405	0	14	15.02
2410	1	13	17.65
2415	2	12	18.56
2420	3	11	19.09
2440	7	11	18.51
2465	12	11	18.02
2470	13	12	16.43
2475	14	14	10.59

Plots



Duty Cycle Plots (This information has been supplied by the client)
Duty Cycle = 351μs On-time in 100 ms period = 0.35% duty cycle



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5.0 SAR Test Exclusion Calculation

Description	Line #	Data	Unit	Additional Description
Transmit Packet on time:	1	0.351	(ms)	Worst case (supplied by applicant)
Packet repetition time:	2	100	(ms)	Worst case (supplied by applicant)
Duty factor:	3	0.00351		Transmit Packet on time / Packet repetition time (1/2)
Maximum peak output power at antenna input terminal:	4	19.09	(dBm)	Measured worst case
Maximum peak radiated power:	5	81.096	(mW)	dBm to mW conversion
Prediction distance:	6	5	(mm)	Minimum test separation distance
Prediction frequency:	7	2.42	(GHz)	Measured frequency
Square root of frequency (GHz):	8	1.555635		Calculation
Duty factor applied to maximum peak radiated power (mW):	9	0.284647	(mW)	duty factor * maximum peak conducted power
Source based power (mW) / min test separation distance (mm):	10	0.056929		Calculation
SAR exclusion calculation:	11	0.09		Calculation
Threshold:	12	3		
Margin:	13	2.91		Calculation

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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 = 2420MHz

Device Operation separation distance: $\leq 20\text{cm}$

Maximum Effective Isotropic Radiated Power (dBm) = 19.09 dBm + 2.0 dBi = 21.090 dBm

Maximum Effective Isotropic Radiated Power (mW) = $\log^{-1}(\text{EIRP (dBm)}/10)$ = 128.529 mW

Duty Factor 0.35% * Maximum EIRP = 0.451 mW

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

Frequency	Limit
2.2 to 3 GHz	20 mW

Conclusion:

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

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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:	19.09 (dBm)
Duty Factor:	0.35 (%)
Maximum peak output power at antenna input terminal:	0.451 (mW)
Antenna gain(typical):	2 (dBi)
Maximum antenna gain:	1.585 (numeric)
Prediction distance:	0.5 (cm)
Prediction frequency:	2420 (MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1 (mW/cm ²)
Power density at prediction frequency:	0.227524 (mW/cm ²)
Maximum allowable antenna gain:	8.4 (dBi)
Margin of Compliance at 0.5 cm =	6.4 dB

END OF REPORT

Date	Version	Comments	Person
6-2-14	V2	Final	Adam A

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