

Test Report # TR 318032 RFX

Equipment Under Test: Vehicle Tag V2

Test and Evaluation Date(s): 12 July and 29 October 2018


Prepared for: Arity 875, LLC
Attn: Emad Isaac
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Chicago, IL 60654

Report Issued by: Laura Zehnder, EMC Engineer

Signature: 

Date: 29 October 2018

Report Reviewed by: Adam Alger, Quality Manager

Signature: 

Date: 29 October 2018

Report Constructed by: Laura Zehnder, EMC Engineer

Signature: 

Date: 29 October 2018

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Company: Arity	Page 1 of 11	Name: Vehicle Tag V2
Report: TR 318032 RFX		Model: ARTST2001
Job: C-2977		Serial: D28

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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



**Government
of Canada**

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

On **29 October 2018** the Equipment Under Test (EUT), **Vehicle Tag V2**, as provided by **Arity** was evaluated to the following requirements:

Requirements	Description	Evaluation Guidance	Evaluation Result
FCC 2.1092	Radio frequency radiation exposure evaluation: mobile devices	KDB 447498	Below SAR test exclusion threshold

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	Arity 875, LLC
Contact Person	Emad Isaac
Address	222 W. Merchandise Mart Plaza Chicago, IL 60654

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Vehicle Tag v2
Model Number	ARTST2001
Serial Number	D28 and 21
FCC ID	2AQQAARTST2001

2.2 Product Description

The Arity model ARTST2001 is a battery-powered driving behavior and device presence tracking device that is designed to be fixed inside the passenger area of a vehicle and when enabled, relay information to a mobile phone application over Bluetooth. The ARTST2001 uses a low power accelerometer and real-time clock to capture significant movement events and send the events immediately or at next opportunity to the mobile application.

Antenna is a folded monopole with a peak gain of 2.9 dBi and an efficiency of 73.28%.

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Additional Information

EUT was programmed using LightBlue explorer for Android version 2.6.4.

Channels tested: BLE channels 0 (2402 MHz), 18 (2438 MHz), 39 (2480 MHz)

EUT nominal operating voltage: 1.5 VDC.

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3 REFERENCES

Publication	Edition	Date
FCC CFR Title 47 Part 2	-	2018
FCC OET KDB 447498	06	Oct 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 %

5 TEST DATA

5.1.1 Conducted Output Power

Operator	Jeysson Gonzalez
QA	Aidi Zainal
Test Date	7/12/2018
Location	Bench
Temp. / R.H.	22.1 deg C/56% RH
Requirement	FCC 15.247
Method	ANSI C63.10

Test Parameters

Requirement	FCC 15.247(b)(3) and (4)
Method	ANSI C63.10 Section 11.9.1.1
Settings	RBW = 3 MHz VBW= 50 MHz

Instrumentation



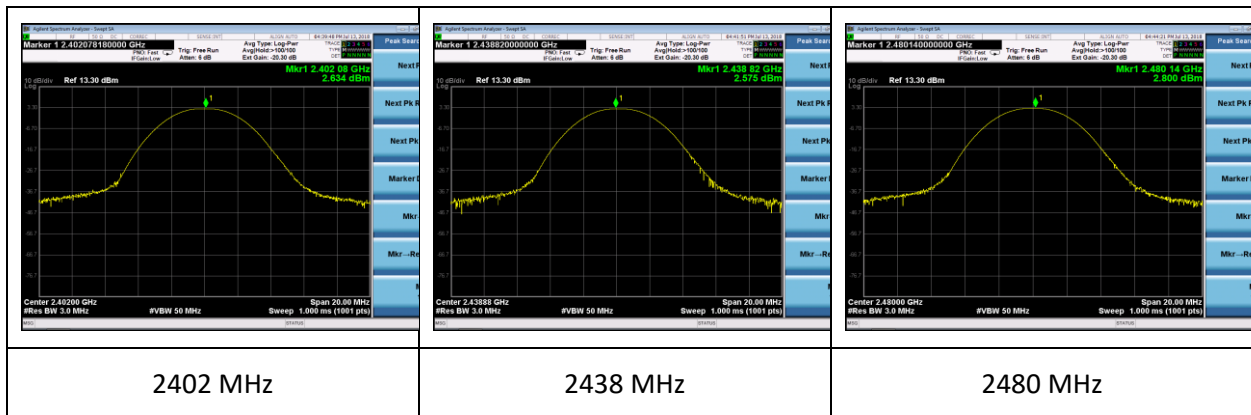
Date: 9-May-2018 Test: Final - Conducted RF Job: C-2977
 PE: Jeysson Gonzalez Customer: Arity Quote: 318032

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	AA 960047	Gage - Temp/Humidity	Lufft	5064.34	80206-01	5/19/2018	5/19/2019	Active Calibration
2	EE 960054	Meter - Multi	HP	971A	JP40011152	1/3/2018	1/3/2019	Active Calibration
3	EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/25/2018	4/25/2019	Active Calibration
4	AA 960160	Cable	Micro-Coax	UFC142A-0-0720-2002	218652-001	11/15/2017	11/15/2018	Active Verification

Table

Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
2402	3.1	30.0	26.9
2438	3.1	30.0	26.9
2480	3.3	30.0	26.7

Plots



6 MPE CALCULATIONS

Per FCC 1.1310, the limit for Maximum Permissible Exposure of devices operating in the frequency range 1500-100000 MHz is 1.0 mW/cm².

Prediction of MPE limit at a given distance

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

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:	3.30 (dBm)
Tune-up tolerance:	2.00 (dB)
Maximum peak output power at antenna input terminal:	3.3884415613920300000000 (mW)
Antenna gain(typical):	2.9 (dBi)
Maximum antenna gain:	2.900 (numeric)
Prediction distance:	20 (cm)
Prediction frequency:	2480 (MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1.00 (mW/cm ²)
Power density at prediction frequency:	0.00195 (mW/cm ²)

7 REVISION HISTORY

Version	Date	Notes	Reference Personnel
0.0	29 October 2018	Initial Release for Review	Laura Zehnder
0.1	14 March 2019	Revise to MPE Calculation	Laura Zehnder

END OF REPORT