


Test Report # 317161 B

Equipment Under Test: IRIS

Test Date(s): August 18-22 and September 12, 2017

Prepared for: Husqvarna
Attn: Matt Albinger
8825 Statesville Road
Charlotte, NC 28269

Report Issued by: Adam Alger, Quality Systems Engineer

Signature: 


Date: 12/20/2017

Report Reviewed by: Khairul Aidi Zainal, Laboratory Manager

Signature: 

Date: 12/20/2017

Report Constructed by: Adam Alger, Quality Systems Engineer

Signature: 

Date: 12/20/2017

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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

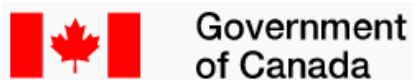
Scope of accreditation includes all test methods listed herein, unless otherwise noted.



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

Company: Husqvarna	Page 3 of 12	Name: IRIS
Report: TR 317161 B		Model: 590568001
Job: C-2772		Serial: Engineering Sample

1 TEST REPORT SUMMARY

During **August to September 2017** the Equipment Under Test (EUT), **IRIS**, as provided by **Husqvarna** was tested to the following requirements:

Requirement	Description	Specification	Method	Compliant
15.247 (b)(3)	Maximum Conducted Output Power	30 dBm	ANSI C63.10	Yes
1.1310 2.1091	Radiofrequency radiation exposure limits / Radiofrequency radiation exposure evaluation: mobile devices	SAR Exclusion Threshold	KDB 447498	Yes
RSS-102	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)	SAR Exclusion Threshold	Section 2.5.1	Yes

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	Husqvarna
Contact Person	Matthew Albinger
Address	8825 Statesville Road Charlotte, NC 28269

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	IRIS
Model Number	590568001
Serial Number	Engineering Sample
FCC / IC ID	2ANTT-IRIS01 / 23218-IRIS01

2.2 Product Description

Bluetooth low energy product with integral antenna

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

Channels low (2402 MHz), middle (2440 MHz) and high (2480 MHz) with transmit selectable modulated or un-modulated programmed via hex files loaded by a computer connected to a programming board plugged into EUT for programming then removed for testing. Cypress PSoC Programmer 3.26.0.2791 loaded custom hex files for each channel and mode.

3 REFERENCES

Publication	Edition	Date
CFR 47 Part 15.247	-	2017
RSS-247	2	2017
CFR 47 Part 15.209	-	2017
ANSI C63.10	-	2013
RSS-GEN	4	2014
FCC KDB 447498 D01 v06	-	2015
RSS-102	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

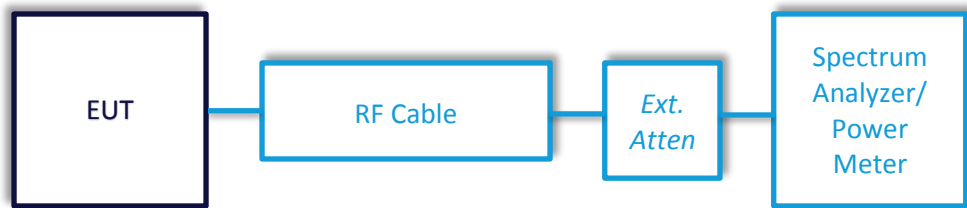
Parameter	ETSI U.C. \pm	U.C. \pm
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %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

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	<p>The direct measurement of emissions at the antenna port of the EUT is achieved by use of a RF connection to a spectrum analyzer or power meter.</p> <p>The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.</p>
Example Calculations	<p>Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm)</p> <p>Margin (dB) = Limit (dBm) – Corrected Reading (dBm)</p>

Block Diagram



5.1.1 Antenna Port Conducted Emissions

Operator	Adam Alger
QA	Zach Wilson
Test Date	8/19/2017
Location	Radio bench
Temp. / R.H.	68/60
Requirement	FCC 15.247 / RSS-247
Method	ANSI C63.10

Limits:

Type	Limit
Output Power	30 dBm

Test Parameters

Frequency	30-25000 MHz
RBW	100 kHz (spurious, PSD, DTS BW); RBW > DTS BW = 3 MHz (output power)
Detector	Peak Max Hold
EUT	12 VDC from bench supply (5.5-16.5 VDC for frequency stability)
EUT Channels	Low (2402 MHz), Mid (2440 MHz), High (2480 MHz)
Example Calculation	Spurious Limit = 100 kHz reference (PSD Plot) – 20 dB

Instrumentation



Date : 18-Aug-2017

Test : Antenna Port Conducted Emissions

Job : C-2772

PE : Adam Alger

Customer : Husqvarna

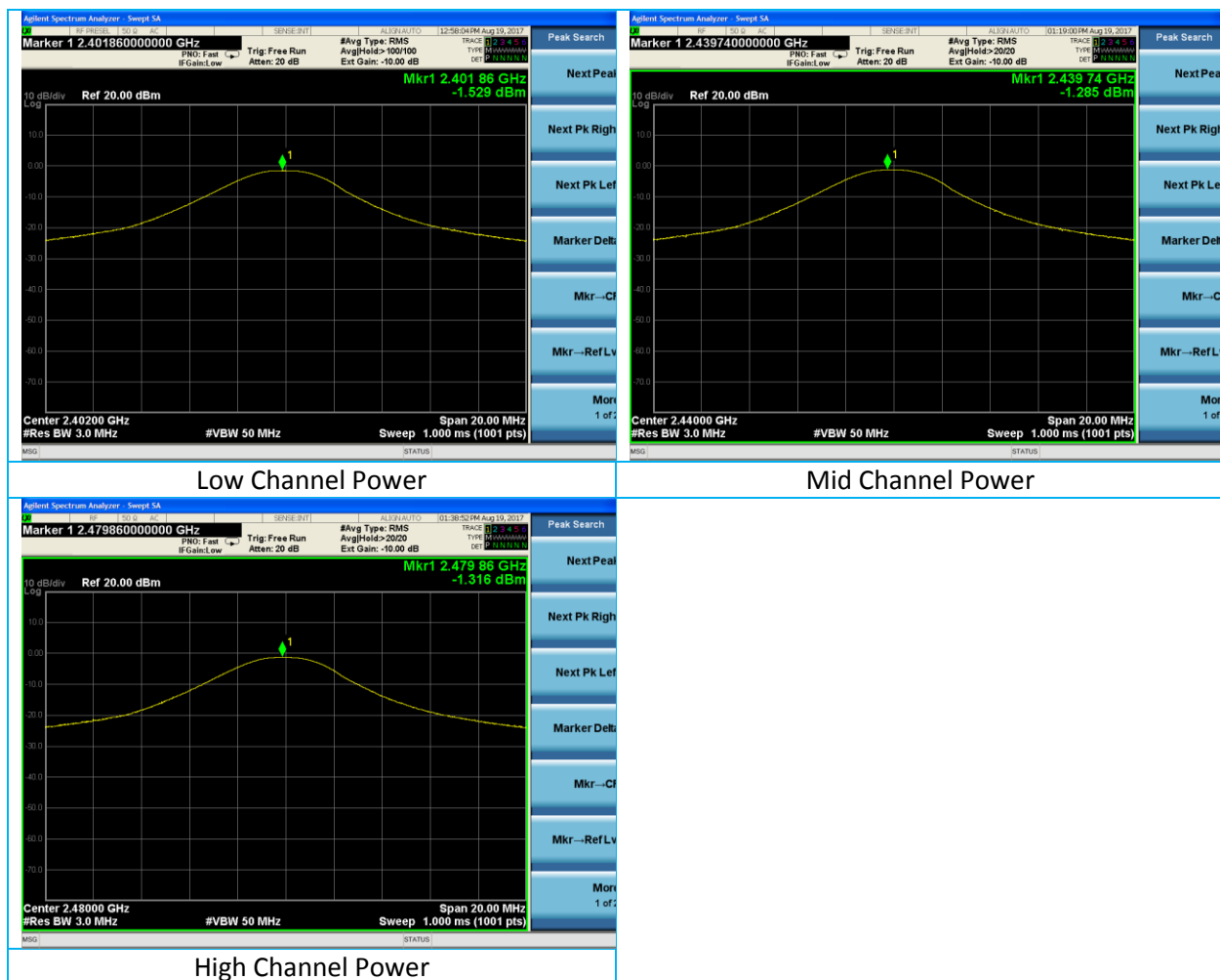
Quote : 317161

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	EMI Receiver	Agilent	N9038A	MY51210148	5/12/2017	5/12/2018	Active Calibration
2	EE 960081	DC Power Supply	Tenma	72-7700	1001514	11/14/2016	11/14/2017	Active Verification

Table

Frequency (MHz)	99 % BW (MHz)	DTS BW (MHz)	PSD 100 kHz (dBm)	PSD 3 kHz limit (dBm)	PSD Margin (dB)	Output Power (dBm)	Output Power Limit (dBm)	Output Power Margin (dBm)
2402	1.06	0.718	-2.05	8.00	10.1	-1.53	30.00	31.5
2440	1.06	0.714	-1.86	8.00	9.9	-1.29	30.00	31.3
2480	1.06	0.709	-1.87	8.00	9.9	-1.32	30.00	31.3

Plots



6 RF EXPOSURE EVALUATION

Frequency: 2440 MHz

Conducted Output Power: -1.29 dBm

Tune-up Tolerance: 1.5 dB

Peak Antenna Gain: 3.3 dBi

Maximum Output Power (dBm): conducted output power (dBm) + tune-up (dB) = 0.21

Maximum Output Power (mW): 1.05

Maximum EIRP (dBm): output power (dBm) + tune-up (dB) + antenna gain (dBi) = 3.51

Maximum EIRP (mW): 2.24

FCC KDB 447498 Section 4.3 Standalone SAR test exclusion calculation

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	0.21	(dBm)	Measured worst case
Maximum peak power:	5	1.050	(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	1.049542	(mW)	duty factor * maximum peak power (Line # 11*3)
Source based power (mW) / min test separation distance (mm):	10	0.209908		Calculation (Line # 5/6)
SAR exclusion calculation:	11	0.33		Calculation (Line # 10*8)
Threshold:	12	3		
Margin:	13	2.67		Calculation (Line # 12-11)

FCC Compliance Statement

With a separation distance of 5mm the EUT meets the standalone SAR test exclusion threshold. The device can be used in standalone portable or mobile configurations.

RSS-102 Compliance Statement

At a minimum separation distance of 5mm the EUT at 2.24 mW EIRP is exempt from SAR evaluation as seen in Table 1 of RSS-102 Issue 5.

7 REVISION HISTORY

Version	Date	Notes	Person
V1	12/20/2017	Final Version	Adam Alger

END OF REPORT