

Test Report # 317134 B

Equipment Under Test: RG191-M2

Test Date(s): 5/12/17 – 6/23

Prepared for: Laird Technologies, Inc.
Attn: Josh Bablitch
W66N220 Commerce Ct.
Cedarburg, WI 53012

Report Issued by: Adam Alger, Quality Systems Engineer

Signature:



Date: 6/30/17

Report Reviewed by: Adam Alger, Quality Systems Engineer

Signature: 

Date: 6/23/17

Report Constructed by: Shane Dock, EMC Engineer

Signature:



Date: 6/23/17

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Job: C-2722		Serial: 00027

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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 **6/22/17** the Equipment Under Test (EUT), **RG191-M2**, as provided by **Laird Technologies, Inc.** 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	Radiofrequency Radiation Exposure Evaluation: Portable	Reported	RSS-102 Section 2.5.1	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	Laird Technologies, Inc.
Contact Person	Josh Bablitch
Address	W66N220 Commerce Ct. Cedarburg, WI 53012

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	RG191-M2
Model Number	RG191-M2
Serial Number	00027
FCC / IC ID	SQG-1001 / 3147A-1001

2.2 Product Description

The Laird Sentrius M2.COM Card is an easy to integrate LoRa-enabled concentrator card for use in a LoRaWAN network.

The antenna used is an LSR 900 MHz Dipole Antenna with a gain of 2 dBi.

2.3 Modifications Incorporated for Compliance

Cable implemented to separate module from host board units.

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Additional Information

EUT programmed via serial connection (PuTTY v 0.69 used for testing). Module is provided with 5V dc power from the host board. For AC Mains Emissions and Frequency Stability Test, this 5V was supplied to the unit directly from an auxiliary DC source.

2.6 Additional Information

Unit tested at spreading factors of 7 and 12. Unit has a modulation bandwidth of 500kHz. High Power Setting is a PA Gain of 3 and a Mixer Gain of 13. Low Power Setting is PA Gain 0 and Mixer Gain 13.

Low – 923.3 MHz

Mid – 925.7 MHz

High – 927.5 MHz

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3 REFERENCES

Publication	Edition	Date
CFR 47 Part 15	-	2017
ANSI C63.10	-	2013
RSS-247	2	2017
RSS GEN	4	2014
RSS-102	5	2015
CFR 47 Part 1 and 2	-	2017
FCC KDB 447498	6	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 Fundamental Emission

Operator	Shane Dock
QA	Kim Bay
Test Date	5/12/17, 6/9/17
Location	Conducted RF Area
Temp. / R.H.	73/40
Requirement	FCC: 15.247 (b)(3) IC: RSS-247 5.4 (4)
Method	KDB 558074 Section 9.2.2.3

Limits: (Measured as Average)

Maximum Conducted Output Power (dBm)	Maximum Conducted Output Power (watts)
30	1

Test Parameters

Frequency	923.3 – 927.5 MHz
Settings	Low, Mid, and High Channels Checked on SF 7 and SF 12
Settings	Unit measured at full power and minimum power. Duty cycle of 100%.

Table

Max Power (dBm)

	Low	Mid	High
SF 7	27.5	27.2	27.2
SF 12	27.7	27.4	27.3

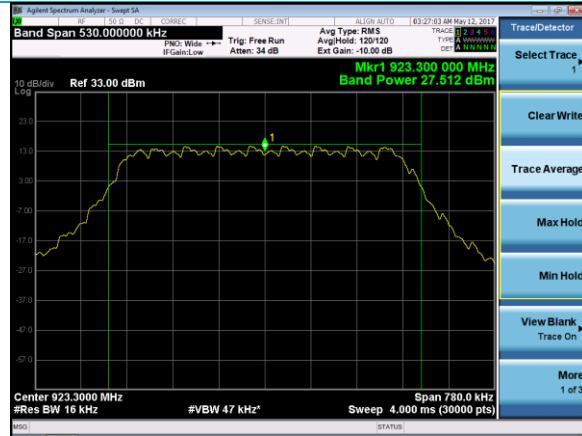
Min Power (dBm)

	Low	Mid	High
SF 7	1.5	0.8	0.8
SF 12	1.3	-0.1	-0.0

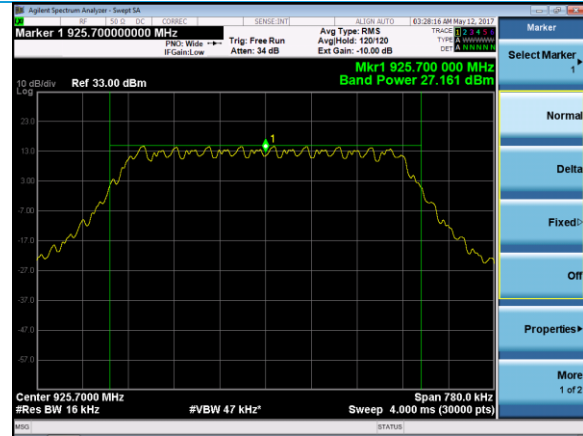
Worst Case Margin = Limit - Closest Measurement = 30.0 dBm – 27.7 dBm = 2.3 dB

Plots

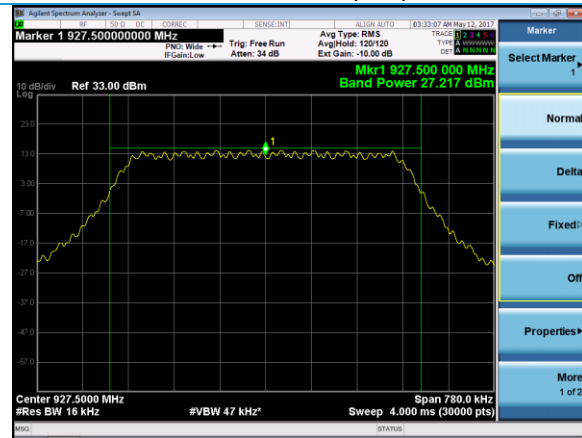
Maximum Power



Low Channel (SF7)



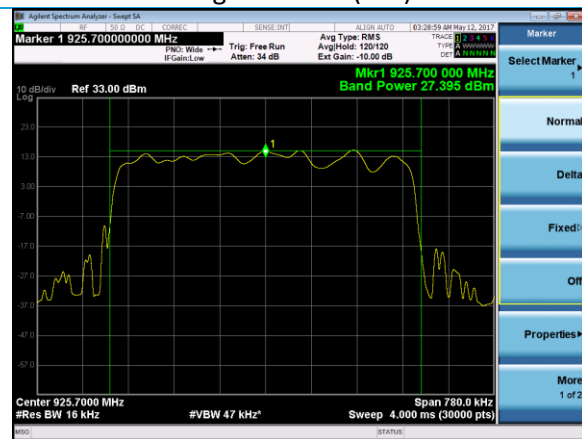
Mid Channel (SF7)



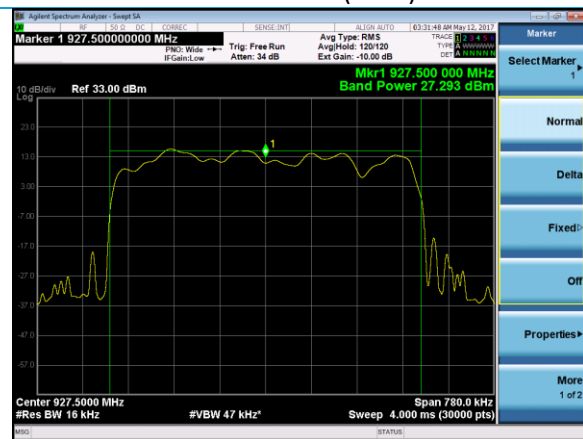
High Channel (SF7)



Low Channel (SF12)

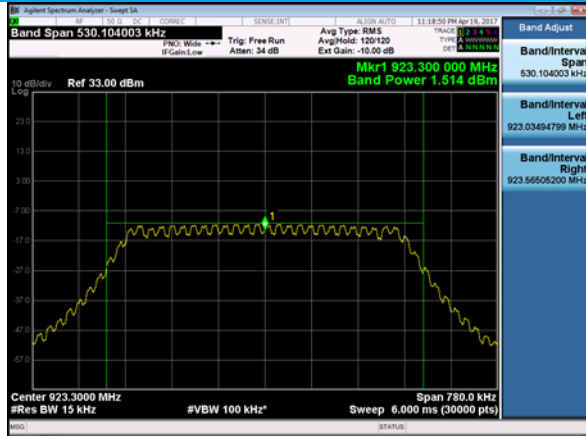


Mid Channel (SF 12)

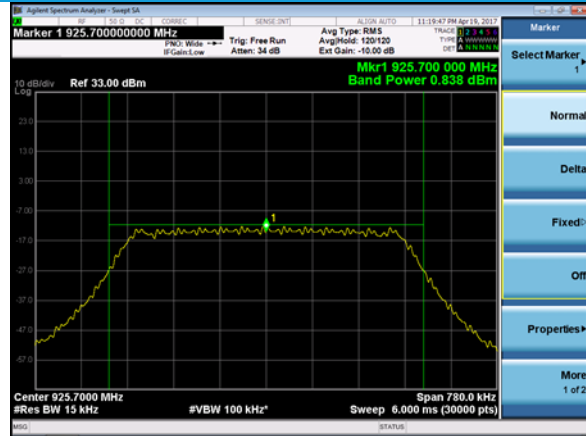


High Channel SF (12)

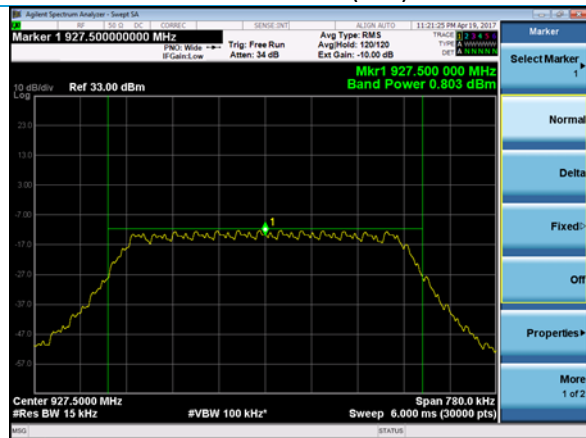
Minimum Power



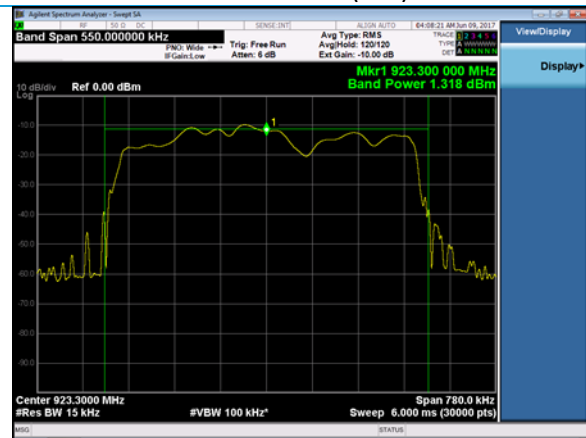
Low Channel (SF7)



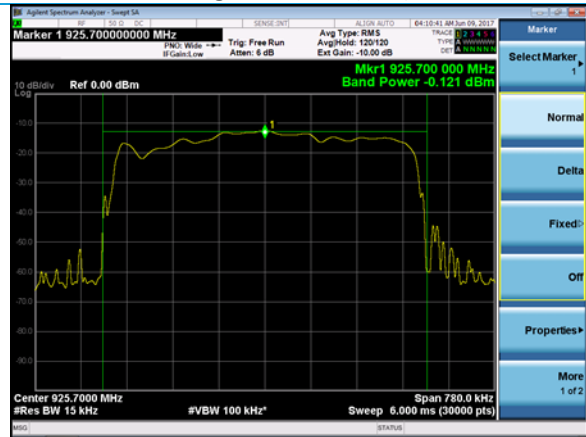
Mid Channel (SF7)



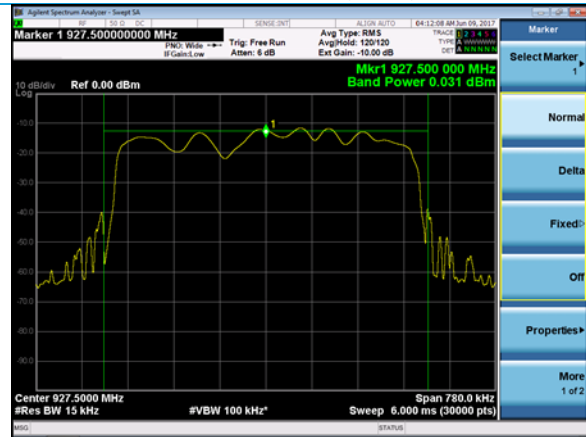
High Channel (SF7)



Low Channel (SF12)



Mid Channel (SF 12)



High Channel SF (12)

6 EXCLUSION CALCULATION

6.1 FCC

Frequency = 925 MHz

Output Power = 27.7 dBm + .9 dB (Tune-up Tolerance) = 28.6 dBm
= 724.4 mW

For 100 MHz to 1500 MHz at test separation distance greater than 50 mm the 1-g SAR test exclusion threshold:

$\{[\text{Power allowed at numeric threshold for 50 mm}] + [(\text{test separation distance} - 50 \text{ mm}) * (f(\text{MHz})/150)]\}$

Interpolating for 50 mm numeric threshold at 925 MHz = 156.5 mW

Threshold at 925 MHz with distance of 140 mm = 711.5 mW

Threshold at 925 MHz with distance of 150 mm = 773.2 mW

Interpolating for EUT output power of 724.4 mW = **142 mm minimum separation distance for SAR test exclusion (1-gram)**

6.2 ISED Canada

Limit = $1.31 \times (10^{-2}) \times f(\text{MHz})^{.6834} = 1.31 \times (10^{-2}) \times (923.3)^{.6834} = 1.39 \text{ W}$

Power = Output Power + Tune-up Tolerance + Antenna Gain = 27.7 dBm + .9 dB + 2dBi = 30.6 dBm
= 1.15 W

Since the unit operates lower than the limit specified in RSS 102 issue 5 Section 2.5.2, the EUT is excluded from routine evaluation at 20 cm.

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7 REVISION HISTORY

Version	Date	Notes	Person
V0	6/19/17	First Draft	Shane Dock
V1	6/22/17	Update	Shane Dock
V2	6/23/17	Final Version	Shane Dock
V3	6/30/17	Updated Calculations from TCB comment	Adam Alger

END OF REPORT