


Test Report # 317244 C

Equipment Under Test: NRU1C

Test Date(s): September 21, 2017


Prepared for: **Geophysical Technology, Inc.**
Attn: Andrew Sedlmayr
800 Mulberry Lane
Bellaire, Texas 77401 USA

Report Issued by: Adam Alger, Quality Systems Engineer

Signature: 


Date: 10/10/2017

Report Reviewed by: Ryan Urness, Director of Test Services

Signature: 

Date: 10/9/17

Report Constructed by: Adam Alger, Quality Systems Engineer

Signature: 

Date: 10/04/2017

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Report: TR 317244 A		Model: NRU-1C
Job: C-2809		Serial: 21000019

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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

During **September 2017** the Equipment Under Test (EUT), **NRU1C**, as provided by **Geophysical Technology, Inc.** 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	1 mW/cm ² / 20 cm	KDB 447498	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	Geophysical Technology, Inc.
Contact Person	Andrew Sedlmayr
Address	800 Mulberry Lane Bellaire Texas 77401 USA

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	NRU1C
Model Number	NRU-1C
Serial Number	210000019
FCC ID	2AM2Z-NRU1C9G2Y1

2.2 Product Description

The NRU-1C is deployed in the field to record seismic data. It contains Bluetooth Low Energy and Ultra-Wide Band communication.

2.3 Modifications Incorporated for Compliance

Ferrite added to charger on AC and DC sides.

DC Ferrite two passes: Laird 28A5776-0A2

AC Ferrite one pass: Laird 28A0807-0A2

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Additional Information

EUT powered by internal battery 4.2 VDC maximum

Channels low (2402 MHz), mid (2440 MHz), and high (2480 MHz) programmed via BLE link to Android tablet running special test codes developed by manufacturer version NuSite Version 1.0.22.6 Android Version 7.0 (API 24).

EUT can transmit BLE stand-alone and when in charging base.

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3 REFERENCES

Publication	Date
CFR Title 47 Chapter I Subchapter A Part 1,2,15	2017
ANSI C63.10	2013
FCC KDB 447498 D01 v06	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

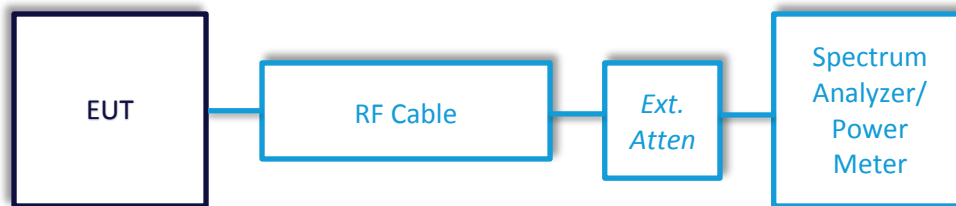
Parameter	ETSI U.C. \pm	U.C. \pm
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
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	Khairul Aidi Zainal
Test Date	09/21/2017
Location	Radio bench
Temp. / R.H.	68/65
Requirement	FCC 15.247
Method	ANSI C63.10 Section 11

Test Parameters

Frequency	30-25000 MHz
RBW	RBW > DTS BW = 3 MHz (output power)
Detector	Peak Max Hold
EUT	Battery 4.2 VDC
EUT Channels	Low (2402 MHz), Mid (2440 MHz), High (2480 MHz)

Instrumentation



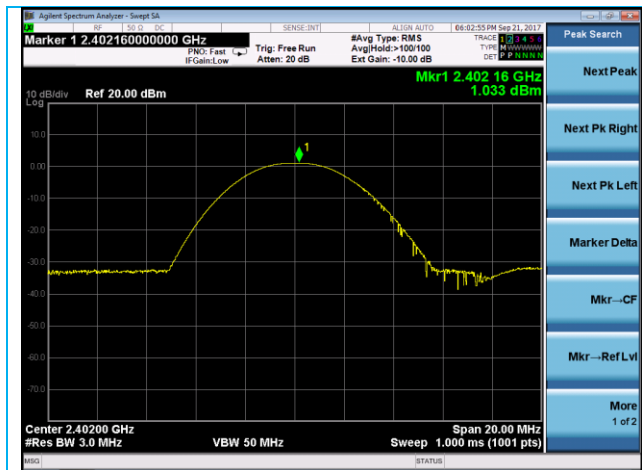
Date : 21-Sep-2017 Test : Antenna Port Conducted Emissions Job : C-2809
 PE : Adam Alger Customer : GTI Quote : 317244

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960087	Spectrum Analyzer	Agilent	N9010A	MY53400296	12/22/2016	12/22/2017	Active Calibration

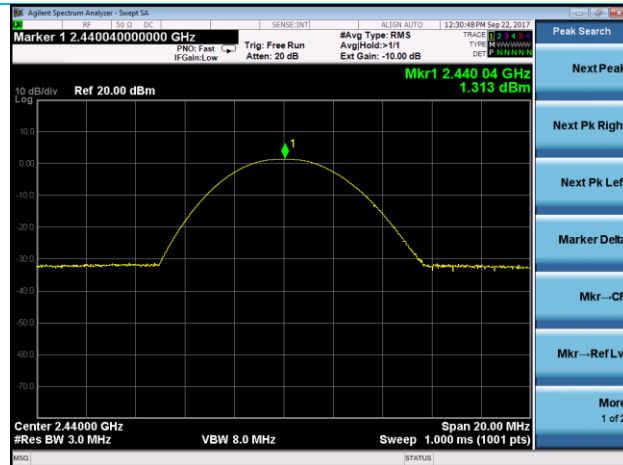
Table – BW, Power, PSD

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	1.00	0.667	1.03	8.00	7.0	1.03	30.00	29.0
2440	1.03	0.681	1.21	8.00	6.8	1.31	30.00	28.7
2480	1.01	0.67	1.20	8.00	6.8	1.24	30.00	28.8

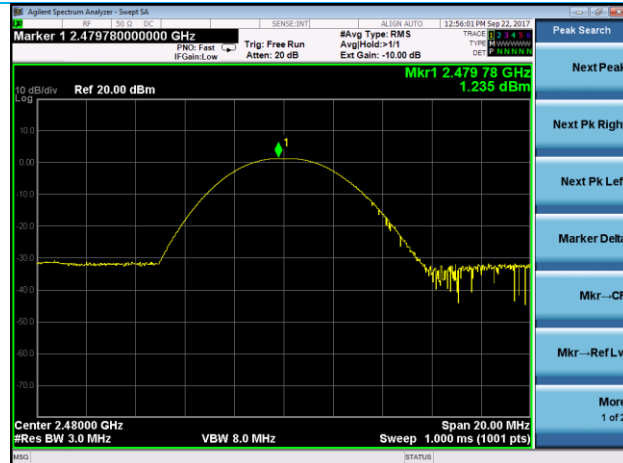
Plots – Output Power



Low Channel Power



Mid Channel Power



High Channel Power

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6 RF EXPOSURE EVALUATION

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:	<u>1.31</u> (dBm)
Tune-up tolerance:	<u>2.70</u> (dB)
Maximum peak output power at antenna input terminal:	<u>2.518</u> (mW)
Antenna gain(typical):	<u>2.1</u> (dBi)
Maximum antenna gain:	<u>1.622</u> (numeric)
Prediction distance:	<u>20</u> (cm)
Prediction frequency:	<u>2440</u> (MHz)
MPE limit for uncontrolled exposure at prediction frequency:	<u>1.00</u> (mW/cm ²)
Power density at prediction frequency:	0.00081 (mW/cm ²)

7 REVISION HISTORY

Version	Date	Notes	Person
V1	10/10/2017	Final Release	Adam Alger

END OF REPORT