



*a Laird Business*



TESTING CERT #1255.01

W66 N220 Commerce Court • Cedarburg, WI 53012

Phone: 262.375.4400 • Fax: 262.375.4248

[www.lsr.com](http://www.lsr.com)

**TEST REPORT #: 316280**  
**LSR Job #: C-2557**

Compliance Testing of:  
VS1000

Prepared For:  
Vulture Systems, LLC  
Attn: Gregg Haensgen  
1764 Koshkonong Rd  
Stoughton, WI 53589

This Test Report is issued under the Authority of:  
John Johnston, EMC Engineer

Signature:

Date: 10/20/16

This Test Report may not be reproduced, except in full, without written approval of LS Research, LLC.

## TABLE OF CONTENTS

EXHIBIT 1	INTRODUCTION .....	3
1.1	Client Information .....	3
1.2	Equipment Under Test (EUT) Information.....	3
1.3	Product Description .....	3
1.4	Compliance Statement .....	3
EXHIBIT 2	SAR Minimum Separation Distance .....	4
2.1	LoRa Transmitter .....	4
2.1.1	1-g Head/Body Minimum Separation Distance.....	5
EXHIBIT 3	RSS 102 Compliance.....	6
3.1	LoRa Transmitter .....	6
3.1.1	1-g SAR Exemption: .....	7

Prepared For: Vulture Systems, LLC	Model #: VS1000	Report #: 316280
EUT: VS1000	Serial #: 001	LSR Job #: C-2557

## EXHIBIT 1 INTRODUCTION

### 1.1 Client Information

Manufacturer Name:	Vulture Systems LLC
Address:	1764 Koshkonong Rd Stoughton, WI 53589
Contact Name:	Gregg Haensgen

### 1.2 Equipment Under Test (EUT) Information

Product Name:	VS1000
Model Number:	VS1000
Serial Number:	001

### 1.3 Product Description

The VS1000, referred to herein as an “equipment under test,” or “EUT,” is a handheld transceiver designed to monitor for Vulture Systems base units (i.e., VS2000) in a VultureNet system. The VS1000 is powered by two AAA batteries in series that present a 3.0 V nominal voltage to the board. The VS1000 includes a Semtech SX1272 LoRa radio configured to transmit at a fixed 922 MHz and exhibits a 500 kHz channel bandwidth.

### 1.4 Compliance Statement

The VS1000 was evaluated against the SAR test exclusion threshold listed in FCC KDB 447498 D01 General RF Exposure Guidance v06 Section 4.3 (1) and RSS 102 issue 5. As such, the VS1000 is found to be compliant as a portable device without SAR testing.

Prepared For: Vulture Systems, LLC	Model #: VS1000	Report #: 316280
EUT: VS1000	Serial #: 001	LSR Job #: C-2557

## EXHIBIT 2 SAR Minimum Separation Distance

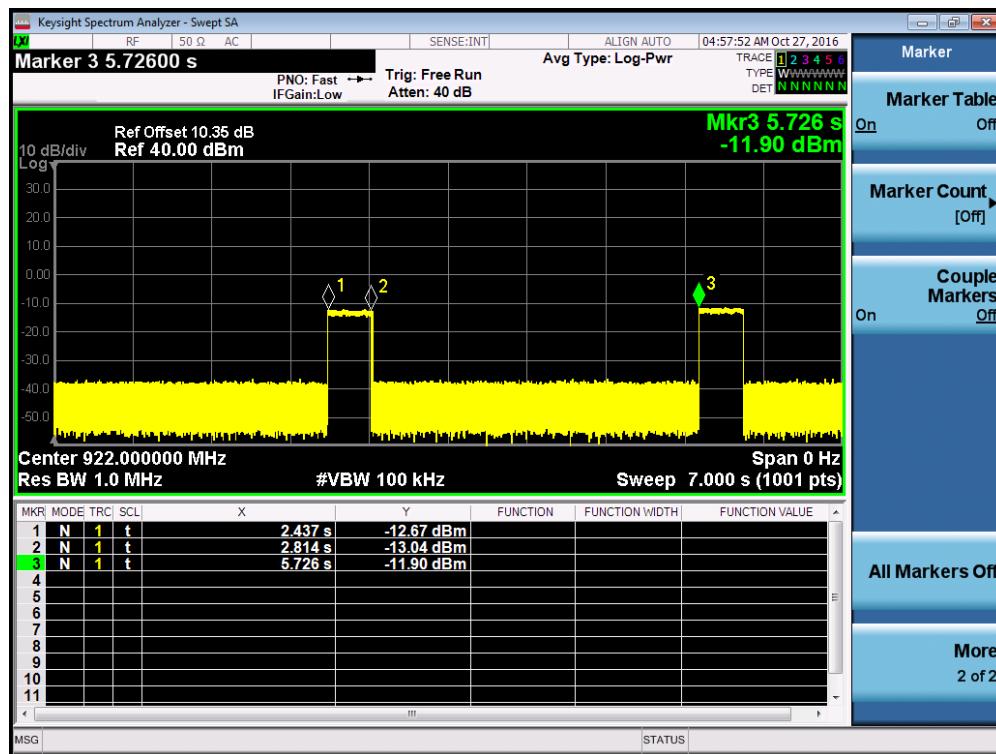
### 2.1 LoRa Transmitter

The EUT was evaluated against the SAR test exclusion threshold listed in FCC KDB 447498 D01 General RF Exposure Guidance v06 Section 4.3 (1).

Transmitter output power:

Channel Frequency (MHz)	Max Avg Conducted Output Power (dBm)
922	16.29

Transmitter Source based duty cycle (From manufacturer):



The only time the VS1000 transmits is when a user presses a button to poll a sensor (i.e., a VS2000). When the user presses a button, the VS1000 sends a packet exhibiting a duration of 377 ms. Once this packet is sent, the VS1000 disables the transmitter and enables the receiver for 2.912 seconds. During normal operation, the VS1000 cannot transmit at a faster rate. As such, although the user may attempt to press the same or a different button, the VS1000 will not transmit for a minimum of 2.912 seconds following a previous transmission.

Prepared For: Vulture Systems, LLC	Model #: VS1000	Report #: 316280
EUT: VS1000	Serial #: 001	LSR Job #: C-2557

Based on the explanation provided above, the following correction factor is calculated:

$$\text{Correction factor} = 10 \cdot \log [0.377 / (0.377 + 2.912)] = -9.41 \text{ dB}$$

Frequency = **922 MHz**

Source Based corrected Output Power = 16.29 dBm - 9.41 dB = **6.88 dBm**

Tune-up Tolerance = **1 dB**

$P_{\text{out}}$  including tune-up tolerance = 6.88 dBm + 1.0 dB = 7.88 dBm = **6.14 mW**

### **2.1.1 1-g Head/Body Minimum Separation Distance**

$d$  (Separation Distance)  $\leq$  5mm; use 5 mm in calculation per KDB 447498

$$(6.14 \text{ mW} / 5 \text{ mm}) * \sqrt{0.922 \text{ GHz}} = \underline{\underline{1.2 < 3}}$$

**The EUT meets the power requirement and thus, SAR testing is exempt.**

Prepared For: Vulture Systems, LLC	Model #: VS1000	Report #: 316280
EUT: VS1000	Serial #: 001	LSR Job #: C-2557

## EXHIBIT 3 RSS 102 Compliance

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

Note: Table 1 from RSS 102. The exemption limits represented in this table apply to 1-gram tissue, head and body, evaluation (uncontrolled). For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5

### 3.1 LoRa Transmitter

Frequency = **922 MHz**

Source Based corrected Output Power = 16.29 dBm – 9.41 dB = **6.88 dBm**

Tune-up Tolerance = **1 dB**

Antenna gain = **2.0 dBi**

$P_{out}$  including tune-up tolerance =  $6.88 \text{ dBm} + 1.0 \text{ dB} + 2.0 \text{ dBi} = 9.88 \text{ dBm} = \text{9.73 mW}$

Prepared For: Vulture Systems, LLC	Model #: VS1000	Report #: 316280
EUT: VS1000	Serial #: 001	LSR Job #: C-2557

### **3.1.1 1-g SAR Exemption:**

Interpolating between 835 MHz and 1900 MHz for 922 MHz at a separation distance of **less than 5 mm** yields the exemption limit of **16.20 mW**.

When evaluated against RSS 102 issue 5 section 2.5, table 1:

**9.73 mW < 16.20 mW**

**The EUT meets the power requirement and thus, SAR testing is exempt.**

Prepared For: Vulture Systems, LLC	Model #: VS1000	Report #: 316280
EUT: VS1000	Serial #: 001	LSR Job #: C-2557