Washington Laboratories, Ltd

SAR Exclusion Report

For the

ReconRobotics Inc.

ReconRobotics Operator Control Unit 3 (OCU)

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SAR Exclusion Evaluation

For the
ReconRobotics Inc.
ReconRobotics Operator Control Unit 3 (OCU)

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Abstract

This report has been prepared on behalf of ReconRobotics Inc. ReconRobotics Operator Control Unit 3 (OCU) to document the findings of the SAR Exclusion Analysis on the ReconRobotics Inc. ReconRobotics Operator Control Unit 3 (OCU). The purpose of this evaluation is to determine if the EUT meets the SAR exclusion requirements.

The Evaluation was performed by Washington Laboratories, Ltd, 4840 Winchester Blvd. Suite 5 Frederick, MD 21703. Washington Laboratories, Ltd. has been accepted as an EMC Conformity Assessment Body (CAB) under the United States/European Union Memorandum of Agreement. Washington Laboratories, Ltd. is accredited by ACLASS under Testing Certificate AT-1448.

Revision History	Reason	Date
Rev 0	Initial Release	June 23, 2020

Table of Contents

List of Tables

1 Introduction

This report has been prepared on behalf of ReconRobotics Inc. ReconRobotics Operator Control Unit 3 (OCU) (EUT) Transmitter to show compliance with the RF exposure requirements as defined in FCC §1.1307.

Testing supporting this evaluation was performed at Washington Laboratories, Ltd, 4840 Winchester Blvd, Frederick, MD 21703. Washington Laboratories, Ltd. has been accepted as an EMC Conformity Assessment Body (CAB) under the United States/European Union Memorandum of Agreement. Washington Laboratories, Ltd. is accredited with ANAB. Testing Certificate AT-1448.

2 Device Description

The EUT is a remote-control device that is used to command a robotic unit. The remote control transmitter operates at 75 MHz. The device also has a 2.4GHz transmitter.

The EUT is defined to be a portable device for the purposes of this analysis.

3 Reference

KDB 447498: RF Exposure procedures and equipment authorization policies for mobile and portable devices. October 23, 2015

4 Device Summary

Table 1 below summarizes the performance used to evaluate the ReconRobotics Operator Control Unit 3 (OCU).

Table 1: Device Summary of the ReconRobotics Operator Control Unit 3 (OCU)

Model Evaluated:	ReconRobotics Operator Control Unit 3
Transmitter Category:	Portable
Exposure Category:	General Population
Power Output (dBm)	27dBm @ 75 MHz, 20 dBm @ 2442 MHz

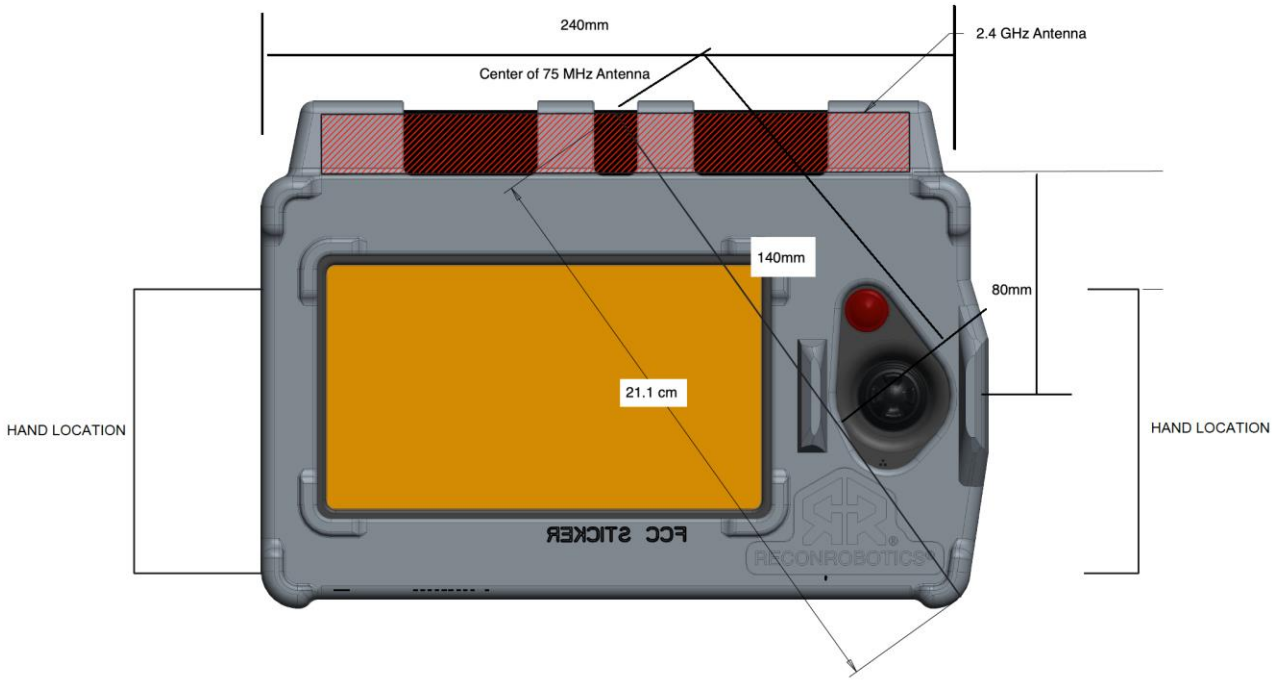
The device operation supports simultaneous transmission. This analysis has been performed to determine stand-alone SAR exclusion for each transmitter as well as SAR exclusion for simultaneous transmitter operation.

5 Device Construction

Dimensions and layout of the device are shown in the following figure. The EUT is a hand-held device with a "joystick" controller that the user manipulates with thumb.

For the purposes of this evaluation, test separation distance for both antennas are taken to be 80 mm.

Figure 1. OCU3 Device Construction



6 Radio Frequency Radiation Exposure Evaluation Summary

The evaluation of stand-alone and simultaneous transmission was performed per **447498 D01 General RF Exposure Guidance v06.** Calculations are provided in the attached Annex.

1) The 75 MHz transmitter and the 2442 MHz transmitter meet the stand-alone SAR exclusion.
2) The device meets the simultaneous transmission SAR limit.

Annex

KDB 447498 Evaluation

4.3.1

a) For 100 MHz to 6 GHz and *test separation distances* ≤ 50 mm, the 1-g and 10-g *SAR test exclusion thresholds* are determined by the following:

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR,30 where

f(GHz) is the RF channel transmit frequency in GHz

b) For 100 MHz to 6 GHz and *test separation distances* > 50 mm, the 1-g and 10-g *SAR test exclusion thresholds* are determined by the following (also illustrated in Appendix B):32

1) {[Power allowed at *numeric threshold* for 50 mm in step a)] + [(test separation distance – 50 mm)·(f(MHz)/150)]} mW, for 100 MHz to 1500 MHz

2) {[Power allowed at *numeric threshold* for 50 mm in step a)] + [(test separation distance – 50 mm)·10]} mW, for > 1500 MHz and ≤ 6 GHz

c) For frequencies below 100 MHz, the following may be considered for SAR test exclusion (also illustrated in Appendix C):33

1) For *test separation distances* > 50 mm and < 200 mm, the power threshold at the corresponding test separation distance at 100 MHz in step b) is multiplied by [1 + log(100/f(MHz))]

2) For *test separation distances* ≤ 50 mm, the power threshold determined by the equation in c) 1) for 50 mm and 100 MHz is multiplied by

Summary Calculations

Stand-Alone SAR Calculations

447498, 4.3.1:

@75 MHz	75	MHz
Test separation distance	80.0	mm
Frequency	100.0	MHz
Measured output power	27.0	dBm
Measured output power	501.2	mW

		1g SAR		10g SAR	
a) Power allowed in 4.3.1 a) @ 50mm & @ 100MHz		**474.3**	mW	**1185.9**	
	Margin:	**-26.8**		**684.7**	
b)	Power allowed @80 mm & 100 MHz	494.3	mW	1205.9	mW
c)	Power allowed at 80 mm & 75 MHz	556.1	mW	1356.5	mW
	Margin:	**54.9**	**mW**	**855.3**	**mW**

The 75 MHz antenna meets the stand-alone SAR exclusion

@2400 MHz	2442.0	MHz
Test separation distance	80.0	mm
Measured output power	20.0	dBm
Measured output power	100.0	mW

		1g SAR		10g SAR	
a) Power allowed in 4.3.1 a) @ 50 mm & @2442 MHz		**96.0**	mW	**240.0**	mW
	Margin:	**-4.0**	mW	**140.0**	mW
b)	Power allowed @ 80 mm @ 4442 MHz	126.0	mW	270.0	mW
	Margin:	30.0	mW	30.0	mW

The 2400 MHz antenna meets the stand-alone SAR exclusion

Simultaneous Transmission

Based on FCC KDB 447498

4.3.2
b) When an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:
1) [(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)]·[√f(GHz)/*x*] W/kg, for *test separation distances* ≤ 50 mm;

where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR.

2) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the *test separation distance* is > 50 mm.

Hence, 1 g SAR for simultaneous transmission for two antennas: 0.4 + 0.4 = 0.8 < 1.6 W/kg

And 10 g SAR for simultaneous transmission for two antennas: 1+1 = 2 < 4W/kg

The device meets the simultaneous transmission SAR exclusion