T-11 Suspicious Package Training Aid –Test Plan

Contributing Members

Jeremiah Franke

Devin Lorenzen

Edward Sayers

Seth Ward

Table of Contents

[1.0 Introduction 3](#_Toc404539520)

[1.1 This Document 3](#_Toc404539521)

[1.2 Conduct of System Tests 3](#_Toc404539522)

[1.3 Recording of Results, Witnessing and Authorities 3](#_Toc404539523)

[2.0 Reference Document 3](#_Toc404539524)

[2.1 Design Documentation 3](#_Toc404539525)

[2.2 Other 3](#_Toc404539526)

[3.0 SPTA Overview 3](#_Toc404539527)

[3.1 Operational Description 3](#_Toc404539528)

[3.2 Definition of Terminology 4](#_Toc404539529)

[3.3 Computational Methods 4](#_Toc404539530)

[4.0 Pretest Preparation 4](#_Toc404539531)

[4.1 Test Equipment 4](#_Toc404539532)

[4.2 Test Setup and Calibration 4](#_Toc404539533)

[5.0 System Tests 5](#_Toc404539534)

[5.1 Functional Checks 5](#_Toc404539535)

[5.1.1 Power Switch and Voltage Regulator 5](#_Toc404539536)

[5.1.2 Power Supply and Current levels 5](#_Toc404539537)

[5.2 Vibration Sensor 5](#_Toc404539538)

[5.3 RF Power Measurement 5](#_Toc404539539)

[5.4 Microcontroller 5](#_Toc404539540)

[5.5 Audio and Visual 5](#_Toc404539541)

[5.5.1 RF Failure LED 5](#_Toc404539542)

[5.5.2 Vibration Failure LED 5](#_Toc404539543)

[5.5.3 Buzzer 5](#_Toc404539544)

[5.6 Usability Testing 5](#_Toc404539545)

[6.0 Appendix: Test Record Sheets 5](#_Toc404539546)

# Introduction

The SPTA (Suspicious Package Training Aid) is intended to be used by security personnel for training simulations in the event of locating an abandoned or otherwise suspicious package in the workplace. This device will give an audio indication to indicate if the simulation has failed. It will also give a visual indication of the point of failure in the simulation.

## This Document

The purpose of this document is to detail the test plan for the SPTA circuit board. The tests on this device will be broken up into sections and will test the input and output, the individual components (RF, power, MCU, and audio visual indicators), and the usability of the device.

## Conduct of System Tests

Testing of this device will be divided up between the contributors to this project after the first initial test. Initial testing will be done as a group and focus on key modules such as the power systems of the device. Later tests will be run concurrently by individual contributors. All tests will be reviewed by individual contributors and retested as needed. Integration and usability testing will be done as a group. Lastly, usability testing will be done with individuals unfamiliar with the device.

## Recording of Results, Witnessing and Authorities

Results of the testing will be recorded by the contributing members of the project. All tests conducted will be reviewed by contributing members as a group. Results of the testing will be recorded and uploaded to the project GitHub website.

# Reference Document

This section details the level 1 block diagram of the device.

## Design Documentation



# SPTA Overview

## Operational Description

The SPTA is intended to be used in training simulations for security personnel in the event of an unattended or suspicious package. Once the device has been turned on the simulation will be begin after an arbitrary time delay. Simulation mode will be indicated visually by a labeled LED. The simulation ends if the device has been physically agitated or if a radio device with a frequency range of 410 MHz – 470MHz has been used within a 20 foot radius. Any event that ends the simulation will result in an audio indication from the buzzer and a visual indication specific to the event that was triggered.

# Pretest Preparation

Testing of the SPTA will be confined to the DC voltage, the spectrum of the incoming RF signal, and the

usability of the device.

## Test Equipment

The equipment needed for testing the SPTA is as follows:

* Spectrum Analyzer
* Volt/Ohm meter
* XPR-6550 – RF radio
* Atmel AVR Dragon Board

## Test Setup and Calibration

Equipment used in the testing of the SPTA device will need to be calibrated to their default setup. For all testing purposes the RF radio will need to be set to channel 13 to avoid interference with currently active channels.

# System Tests

## Functional Checks

The functional checks of the system have been limited to the power supply, current levels, power switch, and the voltage regulator.

### Power Switch and Voltage Regulator

The power switch needs to be tested with the power supply using a voltmeter. The voltage regulator needs to be tested to see that it is outputting 5 volts with 9 volts being applied to it. The steps for testing the voltage regulator is detailed in test case 2 in the appendix.

### Power Supply Voltage and Current levels

The testing of the power supply voltage and the current levels will be done with a volt/ohm meter to make sure that all voltages and currents are within an acceptable threshold level.

## Vibration Sensor

Testing of the vibration sensor requires only a volt/ohm meter.

## Vibration Sensor Test

To test the vibration sensor the voltage and ground probes of a volt/ohm meter needs to be applied to the ends of the vibration sensor.

## RF Power Measurement

Testing of the RF Power requires a function generator.

## RF Module Test

To test the RF Power module a sinusoidal signal needs to be applied to the SMA connector by a function generator. The process for this test is described in Unit Test 3.

## Microcontroller

The Microcontroller of the device needs to be tested using an AVR Dragon board.

## Microcontroller Pinout Test

This device needs the inputs and the outputs of the microcontroller to be tested with a volt/ohm meter.

## Audio and Visual

There are two visual indicators and one audio indicator on this device. All three of these indicators will be tested with a volt/ohm meter.

### RF Failure LED

This actuator will be triggered on the event of an RF signal within the specified bandwidth being used within a 25 foot radius of the device. It can be tested with a volt/ohm meter or with the usability test in test case 1.

### Vibration Failure LED

This actuator will be triggered if the device is agitated. It can be tested with a volt/ohm meter or with the usability test in test case 1.

### Buzzer

This actuator will be triggered in the event of an RF signal or if the device has been agitated. It can be tested with a volt/ohm meter or with the usability test in test case 1.

## Usability Testing

Usability testing will be done by the contributing members of the group and by someone not affiliated with the project.

### SPTA User Test

The user test will be performed by a person or persons not affiliated with the SPTA project. This test is outlined in test case 1 in the appendix.

# Appendix: Test Record Sheets

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Writer: Jeremiah Franke | | | | | | | | | | | | |
| Test Case Name: | | | | | SPTA User Test | | | | | Test ID#: | | USR-1 |
| Description: | | | | | A user test for functionality of the completed suspicious package training device. | | | | | Type: | | ☒ Black Box  ☐ White Box |
| Tester Information: | | | | | | | | | | | | |
| Name of Tester: | | |  | | | | | Date: | | |  | |
| Hardware Ver: | | | 1.0 | | | | | Time: | | |  | |
| Setup: | | | | | | | | Have device located in training environment. Have 9v battery and Oregon Zoo handheld radio. | | | | |
| Step | Action | Expected Result | | Pass | | Fail | N/A | | Comments | | | |
| 1 | Open battery compartment and install 9v battery. Close compartment. | Power LED off.  Active LED off. | |  | |  |  | |  | | | |
| 2 | Press power button to turn on device. | Power LED on.  Active LED off. | |  | |  |  | |  | | | |
| 3 | Wait for 30 seconds for activation. | Power LED on.  Active LED on. | |  | |  |  | |  | | | |
| 4 | Move training device. | Buzzer activated.  Failure LED is on. | |  | |  |  | |  | | | |
| 5 | Press reset switch. | Power LED on.  Buzzer off.  Failure LED off.  Active LED on. | |  | |  |  | |  | | | |
| 6 | Press talk button on Oregon Zoo radio. | Buzzer activated.  Failure LED is on. | |  | |  |  | |  | | | |
| 7 | Press power button to turn off device. | Power LED off.  Active LED off.  Buzzer off.  Failure LED off. | |  | |  |  | |  | | | |
| Overall test results: | | | |  | |  |  | |  | | | |

Test Case 1: User Test

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Writer: Jeremiah Franke | | | | | | | | | | | | |
| Test Case Name: | | | | | Voltage Regulator Output Test | | | | | Test ID#: | | VRO-1 |
| Description: | | | | | Test that the output of the voltage regulator is approximately 5v when supplied with a 9v input. | | | | | Type: | | ☒ Black Box  ☐ White Box |
| Tester Information: | | | | | | | | | | | | |
| Name of Tester: | | |  | | | | | Date: | | |  | |
| Hardware Ver: | | | 1.0 | | | | | Time: | | |  | |
| Setup: | | | | | | | | Make sure that there is a capacitor hooked up to the input of the regulator. Prior to the test, check that the battery is outputting approximately 9v. Have a voltmeter available. | | | | |
| Step | Action | Expected Result | | Pass | | Fail | N/A | | Comments | | | |
| 1 | Hook 9v battery positive terminal to capacitor input. Test the output of the capacitor. | Approximately 9v output measured at the capacitor. No less than 7v. | |  | |  |  | |  | | | |
| 2 | Remove 9v from input of capacitor.  Hook output of capacitor to input of voltage regulator. | No voltage at the output of voltage regulator. | |  | |  |  | |  | | | |
| 3 | Hook 9v output to input terminal of capacitor. | Approximately 5v output measured at the output of the voltage regulator. No less than 4v. | |  | |  |  | |  | | | |
| Overall test results: | | | |  | |  |  | |  | | | |

Test Case 2: Unit Test Voltage Regulator

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Writer: Jeremiah Franke | | | | | | | | | | | | |
| Test Case Name: | | | | | RF module Test | | | | | Test ID#: | | RFM-1 |
| Description: | | | | | Test that the output of the RF chip is approximately 2v when supplied with a 410 to 510Mhz radio signal. | | | | | Type: | | ☒ Black Box  ☐ White Box |
| Tester Information: | | | | | | | | | | | | |
| Name of Tester: | | |  | | | | | Date: | | |  | |
| Hardware Ver: | | | 1.0 | | | | | Time: | | |  | |
| Setup: | | | | | | | | Have a spectrum analyzer. Make sure to have power going to the RF chip. Have a capacitor between the power source and RF chip. Have a voltmeter for measuring output of the RF chip. Ground the RF chip and power source. | | | | |
| Step | Action | Expected Result | | Pass | | Fail | N/A | | Comments | | | |
| 1 | Hook 5v output to capacitor. | No smoke. | |  | |  |  | |  | | | |
| 2 | Hook output lead from capacitor to power input of RF chip. | No smoke. | |  | |  |  | |  | | | |
| 3 | Set frequency to 410Mhz. | 410Mhz on spectrum analyzer output screen | |  | |  |  | |  | | | |
| 4 | Hook 410Mhz output from frequency to frequency input on RF chip. | Approximately 2v on output of volt meter. | |  | |  |  | |  | | | |
| 5 | Change frequency to 420Mhz. | Approximately 2v on output of volt meter. | |  | |  |  | |  | | | |
| 6 | Change frequency to 440Mhz. | Approximately 2v on output of volt meter. | |  | |  |  | |  | | | |
| 7 | Change frequency to 460Mhz. | Approximately 2v on output of volt meter. | |  | |  |  | |  | | | |
| 8 | Change frequency to 480Mhz. | Approximately 2v on output of volt meter. | |  | |  |  | |  | | | |
| 9 | Change frequency to 500Mhz. | Approximately 2v on output of volt meter. | |  | |  |  | |  | | | |
| 10 | Change frequency to 510Mhz. | Approximately 2v on output of volt meter. | |  | |  |  | |  | | | |
| Overall test results: | | | |  | |  |  | |  | | | |

Test Case 3: Unit test RF Module

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Writer: Jeremiah Franke | | | | | | | | | | | | |
| Test Case Name: | | | | | RF CPU Integration Test | | | | | Test ID#: | | RFCPU-I-1 |
| Description: | | | | | Test that the output of the ATMEGA 328 when integrated with the LT5538 RF chip on its ADC is a high signal only when the RF chip is supplied with a 410 to 510Mhz radio signal. | | | | | Type: | | ☒ Black Box  ☐ White Box |
| Tester Information: | | | | | | | | | | | | |
| Name of Tester: | | |  | | | | | Date: | | |  | |
| Hardware Ver: | | | 1.0 | | | | | Time: | | |  | |
| Setup: | | | | | | | | Have a spectrum analyzer. Make sure to have power going to the RF chip and ATMEGA 328. Have a capacitor between the power source and RF chip and ATMEGA. Have a voltmeter for measuring output of the ATMEGA. Ground the RF chip, ATMEGA, and power source as appropriate. Wire the RF chip to the ADC input port of the ATMEGA 328. | | | | |
| Step | Action | Expected Result | | Pass | | Fail | N/A | | Comments | | | |
| 1 | Compile RFTest.c in /working direcory | No warning generated by IDE. | |  | |  |  | |  | | | |
| 2 | Download compiled file. | File downloaded successfully. | |  | |  |  | |  | | | |
| 3 | Run the downloaded file. | No smoke. | |  | |  |  | |  | | | |
| 4 | Hook 410Mhz output from spectrum analyzer to frequency input on RF chip. | High signal greater than .8v is read from output pin 7 of the ATMEGA. | |  | |  |  | |  | | | |
| 5 | Change frequency to 420Mhz. | High signal greater than .8v is read from output pin 7 of the ATMEGA. | |  | |  |  | |  | | | |
| 6 | Change frequency to 440Mhz. | High signal greater than .8v is read from output pin 7 of the ATMEGA. | |  | |  |  | |  | | | |
| 7 | Change frequency to 460Mhz. | High signal greater than .8v is read from output pin 7 of the ATMEGA. | |  | |  |  | |  | | | |
| 8 | Change frequency to 480Mhz. | High signal greater than .8v is read from output pin 7 of the ATMEGA. | |  | |  |  | |  | | | |
| 9 | Change frequency to 500Mhz. | High signal greater than .8v is read from output pin 7 of the ATMEGA. | |  | |  |  | |  | | | |
| 10 | Change frequency to 510Mhz. | High signal greater than .8v is read from output pin 7 of the ATMEGA. | |  | |  |  | |  | | | |
| 11 | Change frequency to 530Mhz. | Low signal less than .8v is read from output pin 7 of the ATMEGA. | |  | |  |  | |  | | | |
| 12 | Change frequency to 390Mhz. | Low signal less than .8v is read from output pin 7 of the ATMEGA. | |  | |  |  | |  | | | |
| Overall test results: | | | |  | |  |  | |  | | | |

Test Case 4: Integration Test RF and MCU