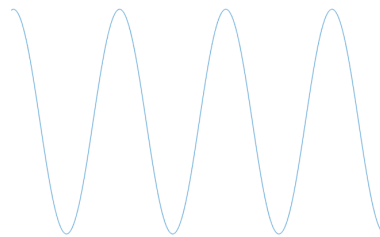


Test Plan

Robin Mannberg, Martin Andersson, Emma Beskow, Ella Grundin,
Joel Nilsson, Gabriel Suihko and Jianxin Qu

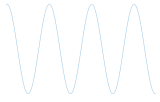
October 18, 2021

Version 1.0



Status

Reviewed	The project group	2021-10-18
Approved	Danyo Danev	2021-10-18



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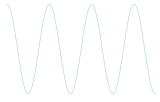
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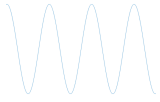
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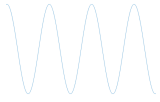
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DOCUMENT HISTORY

Version	Date	Changes made	Sign	Reviewer
1.0	2021-10-18	Fixed comments from supervisors.	The project group	Supervisors
0.1	2021-10-14	First draft.	The project group	Supervisors



1 INTRODUCTION

The objective of the system implemented in this project is to detect activities in an indoor environment. The system consists of several ADALM Pluto Software-Defined Radio (Pluto SDR) devices that send and receive signals, and are connected to a host computer. The system operates by first estimating the channel between transmitter and receiver in different environments, and then analysing the channel state information (CSI). Several machine learning (ML) algorithms that have been trained to recognise different types of events are used for classification of the CSI. The system has been split into three subsystems: a hardware subsystem, a software subsystem and a user interface subsystem.

This document will outline the series of tests that will be performed to determine and ensure that the final product lives up to the requirements detailed in the Requirement Specification [1]. Observe that only tests regarding priority 1 requirements will be considered here.

2 SYSTEM TESTS

All tests will be performed by at least two project group members and the testing site will be the lab environment. The Test Manager is responsible for the performance of all tests and that all requirements are fulfilled, or that other actions are taken if it turns out that the system is not able to reach the requirements. A test is defined according to Table 1. The first column contains a number that uniquely identifies the test, the second column consists of a short description of the test, and the last column will state the week during which the requirement is planned to be achieved.

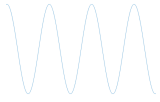
Table 1: Definition of a test.

Test number	Description	Target week
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Tests will be performed for each subsystem, as well as general tests that make sure that the subsystems work together. This includes the main tests that will ensure that the project requirements are fulfilled. In addition to what is presented here, smaller tests will be performed continuously as the system is implemented. The actual performance requirements (for example detection rates) of each test will not be stated in this document, but can be found in [1].

2.1 Hardware Subsystem

The hardware subsystem tests will ensure the functionality of the Pluto SDR devices and that the transmitted/received data can be used to estimate channels. The tests to be performed are listed in Table 2.

**Table 2:** Tests for the hardware subsystem.

Test number	Description	Target week
1	Test if the channel in a single-input single-output (SISO) scenario can be estimated.	44
2	Test if the hardware subsystem can handle different carrier frequencies.	45
3	Test if Binary Phase Shift Keying (BPSK) symbols can be used to evaluate a channel estimate.	46
4	Test if the channels in a multiple antenna scenario can be estimated.	47

2.2 Software Subsystem

The aim of the tests for the software subsystem is to make sure that the implemented classification algorithms work as expected. For the product to fulfill the performance requirements stated in [1], only the best classifier has to reach the desired accuracy. The different algorithms to be tested are k-means clustering, support vector machines and hidden Markov models. The tests to be performed are listed in Table 3.

Table 3: Tests for the software subsystem.

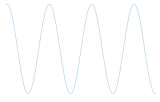
Test number	Description	Target week
5	Test if the system can identify a static environment.	44
6	Test if the system can discriminate between a static environment and an aluminium foiled balloon.	45
7	Test if the system can discriminate between a static environment and a walking person.	46
8	Test if the system can discriminate between a static environment and a jumping person.	46
9	Test if the system can discriminate between a static environment and a dancing person.	46

2.3 User Interface Subsystem

The tests for the graphical user interface (GUI) are split into two parts, the first part of the test will take place earlier than the second part and will test the individual parts of the GUI. The second part will be performed towards the end of the project and will ensure that the whole system can be controlled at once by the GUI. These are listed in Table 4.

Table 4: Tests for the GUI subsystem.

Test number	Description	Target week
10	Test if the GUI can control the individual subsystems.	44
11	Test if the GUI can control the entire system.	48

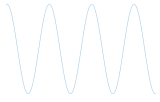


2.4 General Test

After having tested the different subsystems individually, several large-scale tests where the whole product's integrated systems are tested will be run, see Table 5. The difference between Test 10 and Test 11 is that the latter also includes that all parts of the system actually work, and not only that they can be controlled by the GUI.

Table 5: Final test.

Test number	Description	Target week
12	Test if the whole system works and that it fulfills all priority 1 requirements in [1].	49



REFERENCES

- [1] M. Andersson, E. Beskow, E. Grundin, R. Mannberg, J. Nilsson, G. Suihko, and J. Qu, “Detection of static and dynamic indoor environments: Requirement specification, 2021.”