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1.0 Introduction

1.1 Purpose

Describe the requirements for the Test fixture components utilized as a baseline for execution of Amber hardware and software testing.

EEG Bioamplifier component
EEG Headset component

1.2 Testing Components Summary Overview

1.2.1 Bioamplifier Test fixture

Utilized for testing of the Bioamplifier.

Fig 1.

1.2.2 Headset Test Fixture (Sensor Test Fixtures)

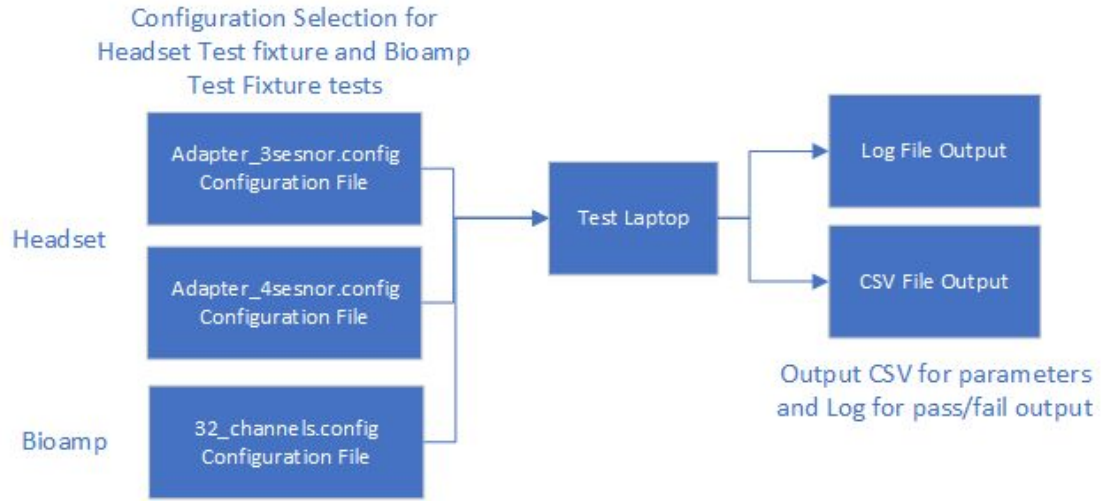
Utilized for testing of the sensor strip and adapter.

Fig 2.

1.2.3 Hardware Testing - Linux Laptop w/ Software Test Tool

Includes the Linux Laptop and Software Test Tool for initiating the Headset Test fixture Test, Bioamp Test Fixture Test and reading the DUT results.

Fig 3.



1.2.4 Barcode Scanner

Includes the Barcode scanner utilized for reading the unique DUT barcode and initiating the channel test sequence.

Fig 4.

1.3 Scope

This document shall include:

1) Test Fixture components overview
2) Test Fixture components requirements
3) Test Fixture components specifications
4) Log

1.4 References

The following documents form part of this document. In the event of conflict, this document supersedes:

Document Number	Title
990-03848-00	Bioamp Test Fixture Validation Test Plan
xxx-xxxxx-xx	Headset Test Fixture Validation Test Plan
xxx-xxxxx-xx	Headset Test Procedure
REF-0318-00	Bioamp Functional Test Procedure
xxx-xxxxx-xx	Headset FAI report
G5218 690-14180-01_01	Bioamp FAI Report

1.5 Definitions and Abbreviations

Acronym/Term	Definition

EEG	Electroencephalography
Session	One or more contiguous tasks for a single user/participant
SDLC	Software Development Life Cycle
SOP	Standard Operating Procedure
Task	Individual stimulus test

2.0 Requirements

2.1 Bioamp Test Fixture

2.1.1 The Bioamp test fixture shall verify that all 32 channels of the bioamplifier are functional.
2.1.2 The Bioamp test fixture shall verify that the Bias and Reference signals of the bioamplifier are functional.
2.1.3 The Bioamp test fixture shall verify that the output (data port) of the bioamplifier is functional.
2.1.4 The Bioamp test fixture shall verify that the bioamplifier can reproduce output amplitudes for all 32 channels within specification tolerances outlined.
2.1.5 The Bioamp test fixture shall verify that the bioamplifier can reproduce output frequencies for all 32 channels within specification tolerances outlined.
2.1.6 The Bioamp test fixture shall verify that the bioamplifier connector is electrically compatible to 32 channels of input including 2 additional channels of Bias and Reference signals.
2.1.7 The Bioamp test fixture shall verify that the adapter connector and bioamp assembly will allow the insertion and removal of the adapter.
2.1.8 The Bioamp test fixture shall be utilized with version compatible software installed on a Test Laptop.
2.1.9 The Bioamp test fixture shall require the use of a test computer to provide visual indication of pass or fail of DUT utilizing the Test Tool software - terminal window display.
2.1.10 The Bioamp test fixture shall report pass or fail for each channel tested for the bioamplifier.
2.1.11 The bioamp test fixture shall test with a 32 channel configuration file stored on the Hardware Testing - Linux Laptop.

2.2 Headset Test Fixture (Sensor Test Fixtures)

2.2.1 The Headset test fixture shall verify that 3 channel active sensor strip sensors (DUT) are located in the correct EEG montage within specification outlined - Fz, Pz, Cz, & Oz (if available).
2.2.2 The Headset test fixture shall verify that 4 channel active sensor strip sensors (DUT) are located in the correct EEG montage within specification outlined.
2.2.3 The Headset test fixture shall verify that all (3 or 4) sensor connectors on the headset (DUT) are functional.
2.2.4 The Headset test fixture shall verify that the Bias and Reference connectors on the headset (DUT) are functional.
2.2.5 The Headset test fixture shall be used with a Golden Bioamp (a Bioamp that has previously passed 32 channel test validation and is labeled the ‘Golden’ Bioamp).
2.2.6 The Headset test fixture shall be used with the Hardware Testing - Linux Laptop with the Software Test Tool.
2.2.7 The Headset test fixture shall provide pass or fail response for sensors being tested and fall within predetermined specification thresholds.
2.2.8 The Headset test fixture shall provide visual indicators for appropriate placement of the sensors strip, bias sensor w/ clip and reference sensor w/ clip.
2.2.9 The Headset test fixture shall be a portable device that connects to a Headset DUT..
2.2.10 The Headset test fixture shall test with a 3 channel configuration file stored on the Hardware Testing - Linux Laptop.
2.2.11 The Headset test fixture shall test with a 4 channel configuration file stored on the Hardware Testing - Linux Laptop.
2.2.12 The Headset test fixture shall provide an on/off switch to enable and disable the Headset test fixture.

2.3 Hardware Testing - Linux Laptop w/ Software Test Tool

2.3.1 The Software Test Tool shall allow automatic loading of / selection of a configuration file if only one configuration file is available.
2.3.2 The Software Test Tool shall not require access restrictions for execution.
2.3.3 The Software Test Tool shall display the DUT firmware version.
2.3.4 The Software Test Tool shall enter the DUT external label - serial number via barcode scanner or through manual keyboard entry.
2.3.5 The Software Test Tool shall automatically select the Port connected to the DUT if a single device is connected to the system.

2.3.6 The Software Test Tool shall allow selection of a configuration file as follows.
- 2.3.6.1 adapter_3sensor.config for 3 sensor test
- 2.3.6.2 adapter_4sensor.config for 4 sensor test
- 2.3.6.3 32_channel.config for 32 channel bioamp test

2.3.7 The Software Test Tool shall output a CSV file of data used for validation.
2.3.8 The Software Test Tool shall output a LOG file of test parameters including the barcode, test results, Software Test Tool version, and the DUT settings (e.g. Firmware version).
2.3.9 The Software Test Tool shall allow modifying configuration of the test parameters (frequency and peak-to-peak amplitude) for signal validation.
2.3.10 The Software Test Tool shall set the threshold for Amplitude test passing if within 90%-110% of expected value.
2.3.11 The Software Test Tool shall set the threshold for Frequency test passing if within 70%-110% of expected value.
2.3.12 The Software Test Tool shall validate a periodic square or sine signal with known peak-to-peak amplitude and frequency output by bioamp for up to 32 channels simultaneously.
2.3.13 The Software Test Tool shall record all Software Test Tool execution issues encountered unrelated to the data or DUT being tested in the LOG file.
2.3.14 The Hardware Test Laptop shall support a wired and bluetooth via USB fob connection barcode scanner (via a USB port).
2.3.15 The Hardware Test Laptop shall connect to the Bioamplifier via a USB port.
2.3.16 The Software Test Tool shall display and write to the Log file and CSV results file in English.
2.3.17 The Software Test Tool shall display the current date and time during execution.
2.3.18 The Software Test Tool shall allow exit of the script executable at the end of the Test to start a new test procedure.
2.3.19 The Hardware Test Laptop shall provide login authentication.
2.3.20 The Software Test Tool shall send a signal to the Bioamplifier to initiate the test.
2.3.21 The Software Test Tool shall save the LOG and CSV files with unique names for each test performed. <barcode id><timestamp>.<extension>
2.3.22 The Hardware Test Laptop shall store generated LOG and CSV files locally on the device.
2.3.23 The Software Test Tool shall provide an io-test shortcut icon on the desktop for selection to execute the testing software.

2.3.24 The Hardware Test Laptop shall send power via the connected USB port and cable to the Bioamp DUT and display the Bioamp DUT is receiving power.
2.3.25 The Software Test Tool shall prompt the user for selection of the Port connected to the DUT if multiple devices are connected to the system.
2.3.26 The Software Test Tool shall prompt the user for selection of the “Enter” command to continue with test upon entering the DUT external label - serial number.

2.4 Barcode Scanner

2.4.1 The Barcode Scanner shall be connected to the Hardware Test Laptop via a bluetooth connection to a bluetooth enabled fob connected to a USB port.
2.4.2 The Barcode Scanner shall allow instant transmitting of read barcodes in translated ASCII format to the Software Test Tool.
2.4.3 The Barcode Scanner shall read barcodes from a non reflective barcode.
2.4.4 The Barcode Scanner shall allow trigger reading when the user compresses a scan button.
2.4.5 The Barcode Scanner shall be compatible with the Linux Operating System.
2.4.6 The Barcode Scanner shall make a sound ‘beep’ when a barcode has been scanned.
2.4.7 The Barcode Scanner shall read a UDI (Unique Device Identifier) compliant Barcode.

2.5 Assembly Fixture

2.5.1 The Assembly Fixture shall ensure the Bioamp fixture - PCB pins align correctly.

2.6 Sticker Fixture

2.6.1 The Sticker fixture shall align on the bottom of the Bioamp to ensure correct placement of the sticker around the feet.

3.0 Specifications

3.1 Bioamplifier Test Fixture

3.1.1 32 channels of 300 uVpp square waves at 2,4,8 and 32 Hz signal

3.1.2 Input signals in the range of ±0.5 mV, varying at a rate to 12 mV/s, shall be reproduced on the output with an error of ≤ ±20 % of the nominal value of the output or ±10 µV, whichever is greater.
3.1.3 With a d.c. offset voltage in the range of ±300 mV and differential input signal voltages of ±0.5 mV that vary at rates up to 12 mV/s, when applied to any lead wire, the time-varying output signal amplitude shall not change by more than ±10 % over the specified range of d.c. offset.
3.3.4 A frequency response (bandwidth) of at least 0.5 Hz to 50 Hz when tested with sinusoidal input signals. The output at 0.5 Hz and 50 Hz shall be within 71 % to 110 % of the output obtained with a 5 Hz sine wave input signal.

3.2 Headset Tester (Sensor Test Fixtures)

3.2.1 4 X 4.5mm female snap connectors available for test 3 or 4 sensor montage.
3.2.2 Bias and Reference snaps included.

3.3 Hardware Testing - Linux Laptop w/ Software Test Tool

3.3.1 Software Specification

Operating System Software	Linux DebianStretch 9.8
Additional Installed Packages	Python 2.7.3 Python libraries: pyserial v3.4 numpy v1.16.0 Scipy v 1.2
USB Port software	FTDI Driver USB Serial driver supported on Linux USB HID device driver support

3.3.2 Hardware Specification

CPU	Intel Core i5-8400H or greater
RAM	8GB+
Storage	100GB (HDD or SDD)
Monitor	15”+ (1x15x10)

Battery	56 WHr+
Communications Port (DUT)	USB 2.0 Port Type A
External Barcode Scanner Port	USB 2.0 Port Type A
External Thumbdrive Port	USB 2.0 Port Type A
Weight	<4lbs

3.4 Barcode Scanner

3.4.1 Hardware Specification

OS	Linux compatible
Communication Port	USB 2.0 Type A OR Bluetooth Wireless enabled (via USB 2.0 Type A fob
Barcode Format	2D barcode format
Other Features	Sound for scan Configurable Instant Upload Scanning Trigger Key Scanning

4.0 Appendix

4.1 Headset Tester (Sensor Test Fixture(s)) Image Examples

Fig. 3 channel Headset Tester

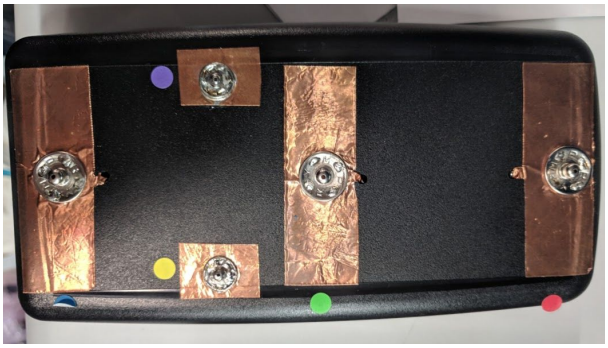
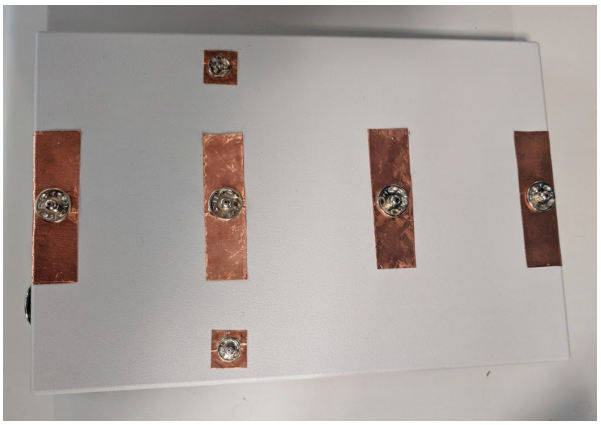


Fig. 4 Channel Headset Tester



4.2 Bioamp Test Fixture Image Example

Fig. Bioamplifier Test Fixture (Top View)

Fig. Bioamplifier Test Fixture (Bottom View)