**Part 1: Comprehensive hierarchical test plan.**

1. Unit Tests

- Test Power Supply Stability: Ensure the power supply consistently outputs a stable voltage (9V to 5V).
- Test LED Functionality: Verify both red and green LEDs light up and match footswitch height.
- Test Footswitch Bypass: Check the footswitch bypass functionality for continuity and operational integrity.

2. Verification Tests

- Verify Audio Signal Integrity: Test if the pedal correctly processes and outputs the audio signal without unwanted alterations.
- Verify Bypass Signal Path: Ensure the audio signal bypasses the effects when the pedal is in bypass mode.
- Verify PCB Component Placement: Confirm that all components, including soldered ones, are placed and function as intended.

3. Validation Tests

- Validate System Functionality with Different Batteries: Confirm that the system functions correctly with different types of 9V batteries, including the 1604A 9V battery.
- Validate Response to Code Changes: Test the system's response to the new code developments, especially the bypass signal issue.

**Part 2: Detailed Test Cases.**

| **Test Author: Lynn, Ali, Roberto, Daniel** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Test Case Name:** | Power Supply Stability Test (Unit Test) | | | | **Test ID #:** | 001 |
| | **Description:** | Testing the stability and accuracy of voltage regulation from 9V to 5V in the system. | | | | **Type:** | ■ white box<br>□black box<br>□ _____ |
| **Tester Information** | | | | | | | |
| | **Name of Tester:** | | | | | **Date:** | Nov 27 |
| | **HW/SW Version:** | 1.0 | | | | **Time:** | 11 pm |
| | **Setup:** | *Standard lab power supply, multimeter, oscilloscope.* | | | | | |
| **STE** | **Action** | **Expected Result** | **PAS** | **FAI** | **N/A** | **Comments** | |

| P | | | S | L | | |
|---|---|---|---|---|---|---|
| 1 | Apply 9V input from the power supply | Stable output of 5V | | | | |
| 2 | Vary input voltage slightly ($\pm\ 1V$) | Output voltage remains stable at 5V | | | | |
| 3 | Check for ripple voltage using an oscilloscope | Minimal ripple voltage | | | | |
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| 9 | | | | | | |
| | **Overall test result:** | | | | | |

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| **Test Author:** | | | | |
| | **Test Case Name:** | User Interface Testing | **Test ID #:** | 002 |
| | **Description:** | | **Type:** | □ white box<br>■ black box<br>□ _____ |
| **Tester Information** | | | | |
| | **Name of Tester:** | | **Date:** | |
| | **HW/SW Version:** | 1.0 | **Time:** | |
| | **Setup:** | | | |

| TEST | INPUTS | EXPECTED OUTPUTS | PASS | FAIL | N/A | Comments |
|---|---|---|---|---|---|---|
| 1 | Power Off | No signal<br>All LEDs off | | | | |
| 2 | Bypass Switch | Clean output guitar signal<br>Green LED off | | | | |
| 3 | Effect on | Audibly distorted guitar signal<br>Green LED on | | | | |
| 4 | | | | | | |
| | **Overall test result:** | | | | | |

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|---|---|---|---|---|---|---|---|
| **Test Author:** | | | | | | | |
| | **Test Case Name:** | Potentiometer Response and Accuracy Test | | | | **Test ID #:** | 003 |
| | **Description:** | Testing the potentiometer's responsiveness and accuracy in controlling the pedal's parameters. | | | | **Type:** | □ white box<br>□black box<br>□ _____ |
| **Tester Information** | | | | | | | |
| | **Name of Tester:** | | | | | **Date:** | 29 Nov |
| | **HW/SW Version:** | 1.0 | | | | **Time:** | 10 pm |
| | **Setup:** | | | | | | |
| **STEP** | **Action** | **Expected Result** | **PASS** | **FAIL** | **N/A** | **Comments** | |
| 1 | Rotate the potentiometer from minimum to maximum. | Smooth increase in the parameter value (e.g., gain, tone) with no sudden jumps or inconsistencies. | | | | | |
| 2 | Set the potentiometer to a mid-point and measure the output. | The parameter value corresponds to the mid-range as per design specifications. | | | | | |
| 3 | Connect an audio source and rotate the potentiometer while playing. | Audible changes in the sound effect correlating with the potentiometer's position. | | | | | |
| 4 | Use an oscilloscope or multimeter to measure the voltage variation across the potentiometer while adjusting. | Voltage changes proportionally with the potentiometer's rotation. | | | | | |
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| 6 | | | | | | | |
| 7 | | | | | | | |
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| | **Overall test result:** | | | | | | |