

Notorious EMG

EGR4899

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# Test plan results

<b>Test Name</b>	<b>Test ID</b>	<b>Specifications</b>	<b>Test Type</b>	<b>Results</b>
Wire Length	T001	S001 – Wire Length	Black Box	COMPLETE PASS
Sleeve Conductivity	T002	S002 – Sleeve Conductivity	Black Box	COMPLETE PASS
Battery/Electrical Safety	T003	S003 – Current Exposure S006 - Battery/Electrical Safety	White Box	COMPLETE PASS
Power Supply & Battery Life	T004	R006 – Power Supply R007 – Battery Life	Black Box	PARTIAL PASS
Signal Conditioning	T005	R003 – Signal Conditioning	White Box	PARTIAL PASS

# Test plan results

<b>Test Name</b>	<b>Test ID</b>	<b>Specifications</b>	<b>Test Type</b>	<b>Results</b>
Data Rate	T006	R009 – Data Rate	Black Box	FAIL
Data Calculation	T007	L001 – Array Size L003 – Data Calculation	Black Box	COMPLETE PASS
Muscle Integration & Display	T008	L002 – EMG Signal Display R001 - Integration	White Box	PARTIAL PASS
Data Acquisition	T009	R002 – Data Acquisition	Black Box	COMPLETE PASS
Sampling Rate	T010	R005 – Sampling Rate	Black Box	COMPLETE PASS
Data Storage	T011	R008 – Data Storage	Black Box	FAIL

# Test plan results

Test Name	Test ID	Specifications	Test Type	Results
Ease of Use	T012	CA001 - Arm Unit Weight CA003 - Size	Black Box	COMPLETE PASS
Weight	T013	CA001 - Arm Unit Weight	Black Box	COMPLETE PASS
Size	T014	CA003 - Size	Black Box	COMPLETE PASS
Water Resistance	T015	D001 – Water Resistance	White Box	PARTIAL PASS
Strength	T016	D002 - Strength	White Box	COMPLETE PASS

# Specifications Status

<b>Specification Number</b>	<b>Specification</b>	<b>Status</b>	<b>Results</b>
S001	Wire Length	All wires are contained within the EMG wearable arm unit	MET
S002	Sleeve Conductivity	Continuity between fabric electrodes and cable button snaps	MET
S003	Current Exposure	0.001 amps between electrodes and PCB inputs verifies no current back feed	MET
S004	Ease-of-Use	No setup required – device is embedded on wearable sleeve	MET
S005	FDA Marketing Clearance	Standards compliant with FDA 501(k) Review Process	MET
S006	Battery & Electrical Safety	0.001 amps between electrodes and PCB inputs verifies no current back feed	MET

# Specifications Status

Specification Number	Specification	Status	Results
CA001	Arm Unit Weight	0.4 pounds meets specification for EMG module	MET
CA002	RTC Unit Weight	0.6 pounds does not meet specification for RTC module	PARTIALLY MET
CA003	Size	Meets 100x80x30 mm <sup>3</sup> specification	MET
D001	Water Resistance	Ingress Protection meets 'solids' (IP5X) but does not meet 'liquids' protection (IPX6)	PARTIALLY MET
D002	Strength	Structurally supportive and strong	MET

# Specifications Status

<b>Specification Number</b>	<b>Specification</b>	<b>Status</b>	<b>Results</b>
R001	Integration	EMG electrodes integrated with circuit	PARTIALLY MET
R002	Data Acquisition	Circuit successfully receives data input from electrodes	MET
R003	Signal Conditioning	Circuit successfully filters and amplifies EMG input	PARTIALLY MET
R004	Data Processing & Reporting	TFT screen not functional for proper data reporting	PARTIALLY MET
R005	Sampling Rate	Recorded frequency around 1.7 kHz, within range of 1 kHz – 2 kHz	MET
R006	Power Supply	The system is designed with rechargeable lithium ion batteries	MET
R007	Battery Life	Not all components fully integrated – battery life determined theoretically/mathematically	UNMET

# Specifications Status

<b>Specification Number</b>	<b>Specification</b>	<b>Status</b>	<b>Results</b>
R008	Data Storage	SD card not functioning for data storage	UNMET
R009	Data Rate	Failed to execute TeraTerm for test plan	UNMET
L001	Array Size	Arrays continuously save data to be calculated without overflow	MET
L002	EMG Signal Display	TFT screen not functional for proper data reporting	UNMET
L003	Data Calculation	11% difference between the MyoWare sensor and the SCU circuit	UNMET



# RTC Unit Weight Partially Met

- The reason this is partially met is because it does not weigh less than our objective set upon in our specifications (less than 0.6 lbs.)
- We could have met this specification with some mass reduction of the housing.

# Water Resistance Partially Met

- Ingress Protection meets 'solids' (IP5X) but does not meet 'liquids' protection (IPX6)
- This specification (IPX6) is considered partially met because the LED holes and ON/OFF switches are not sufficiently protected against liquids
- A potential solution to this problem would be silicone, FLEX SEAL, or other similar waterproofing materials

# Integration

## Partially Met

- EMG Electrodes are integrated with the MCU since the MCU reads in values that vary with the user's muscle activity
  - For this reason, Specification R001 is met
- TFT screen is coded to display muscle force values and graph, but integration with the MCU could not be accomplished due to uncertainty over connecting pins with the breakaway board
  - For this reason, Specification L002 is not met since verification cannot take place on the TFT screen

# Battery Life Unmet

- R007 is unmet because theoretical calculations suggest that battery life is less than 4.4 hours due to extra power dissipation in voltage-regulating resistors used with the MCU and optoisolator
- Additional costs incurred would include only labor costs for full integration and further analysis of datasheets for the components that we are not familiar with

# Signal Conditioning Partially Met

- The SCU successfully filters out noise and amplifies the final signal, but does not drop to 0 V when the user rests
- Noise is produced instead
- At this point in time, we believe there is too much gain in the circuit

# Data Processing & Reporting

## Partially Met

- Fail to report maximum power values and muscle fatigue alerts due to non-functioning TFT screen
- Data is successfully processing and reporting to a putty terminal on a PC
- Data successfully received by transmitter and sent to receiver

# Data Storage Fail

- SD card module not integrated into RTC unit
- Backup plan to use PSoC 6 onboard memory unsuccessful
- Use of Putty data logging to save data on PC

# Data Rate Fail

- Due to prioritizing troubleshooting the PCB and circuit design on a breadboard, time did not allow us to write and execute a test code to determine the data rate of the Bluetooth
- TeraTerm to connect to MCU to determine data rate
- Putty terminal to calculate throughput



# EMG Signal Display Fail

- Use of TFT screen for compatibility with PSOC6
- Use of WinEm library to program TFT screen, different library from PSOC4
- Failed to configure and write to the proper GPIO pins to display EMG waveform on TFT screen

# Data Calculation Fail

- Specification assumes the EMG signal read at 60mV
  - Met if within 5% difference
- MyoWare Muscle reads a maximum voltage of 2.84 V
- Circuit reads an average maximum voltage of 2.54 V
- This yields 11% difference

QUESTIONS?