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|  | Design Verification Report - Network Cable Post-Test Evaluations | Doc. Number | Rev. |
| | | NNP-DVER-0005 | v1 |

NNP-DVER-0005 - Design Verification Report – Network Cable Post-Test Evaluations

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1.0 Document Purpose

This report documents design verification of the COSMIIC system against its functional requirements. This verification activity was conducted in accordance with NNP-DEVP-0005 – Design Verification Protocol - Network Cable Post-Test Evaluations.

2.0 Document Scope

This report addresses verification of the COSMIIC system against the functional requirements that are defined in NNP-REQ-0001 – Product Requirements Specification – Network Cable.

This includes the following cables:

| Cable | Part Number |
|--|---------------------|
| Cable Body, Insulated DFT Filars, Blue/Clear | NNP-DWG-140-012-001 |
| Cable Body, Insulated SS Filars, Red/Clear | NNP-DWG-140-012-002 |
| Cable Body, Insulated SS Filars, Green/Clear | NNP-DWG-140-012-003 |

3.0 Background

Initial design verification of the network cables against its functional requirements was conducted to verify against NNP-REQ-0001 for the IDE submission of the COSMIIC device.

4.0 Definitions

Terms used in this protocol are defined in the applicable requirements specification(s) and standards, where referenced.

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5.0 Requirements Addressed

This protocol addresses the requirement listed below from NNP-REQ-001 – Product Requirements Specification – Network Cable. The Requirement Text is for reference only; the listed Product Requirement Specification document is the definitive source for requirement content.

| Req ID | Requirement Text |
|--------|--|
| 1.0 | Cables must not exhibit an increase in DC resistance greater than 100% per unit length from initial pre-test values. |
| 2.0 | Cables must not show a decrease in impedance greater than 20% between pre-test and post-test measurements. |


6.0 Verification by Analysis

All tests were conducted using EnduraTEC TestBench (Bose Corporation, Minnetonka, MN) equipped with two pneumatic linear actuators and one electromagnetic torsion actuator. All tests were conducted under room temperature (nominally 22°C) laboratory conditions. Before mechanical testing, each sample was prepared for testing and connected to a Fluke 8711 True RMS multimeter to measure electrical resistance with resolution of 0.1W. Impedance of the sample was measured using the Electrochemical Impedance Spectroscopy technique. A Gamry PC4/FAS1 Femtostat with current detection resolution of 1pA was utilized to detect damage to the cable insulation layer. Each sample was placed in an electrochemical cell with a test solution of physiological saline solution of 0.9wt% NaCl. An AC voltage of 1V was applied to each filar of the test sample with frequency range varying from 100kHz to 100mHz.

Impedance of the cable and phase angle between response current and applied voltage were recorded. The sample was then mounted between two pin vise grips with an exposed sample length of 45mm between the grips.

6.1 General Approach

Verification was accomplished using test methods and inspection. Testing was used to confirm the Network Cable meets the strength and durability requirements. Inspection was used to verify there was no damage or fracture to the insulating tubing of the cable after testing.

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6.2 Sample Size

The sample size was four (4) Network Cable bodies. The test result was binary (pass/fail) for each test sample. A sample size of 4 was deemed sufficient primarily due to the extensive time required for each test cycle, with hundreds of thousands of cycles needed per sample, each taking a few seconds. This resulted in several days of continuous testing per sample, meaning that running four samples on a single fixture spanned a few weeks. Given the early development phase of the project, limited resources, and budget constraints, it was essential to balance thorough testing with the need to progress on multiple fronts. Contracting external experts in materials science further justified the decision to limit the sample size to four, as the associated costs and the high expense of the testing fixture necessitated a practical approach. Thus, four samples provided adequate data to inform decisions and allow the project to advance efficiently.

6.3 Test Article

The test samples were in a work in progress state; it was the finished cable body before the final assembly with the interconnect and electrodes.

6.4 Test Facility, Dates and Personnel

Verification was conducted in the Case Western Reserve University engineering laboratory under room temperature ($22\pm 2^{\circ}\text{C}$) conditions.

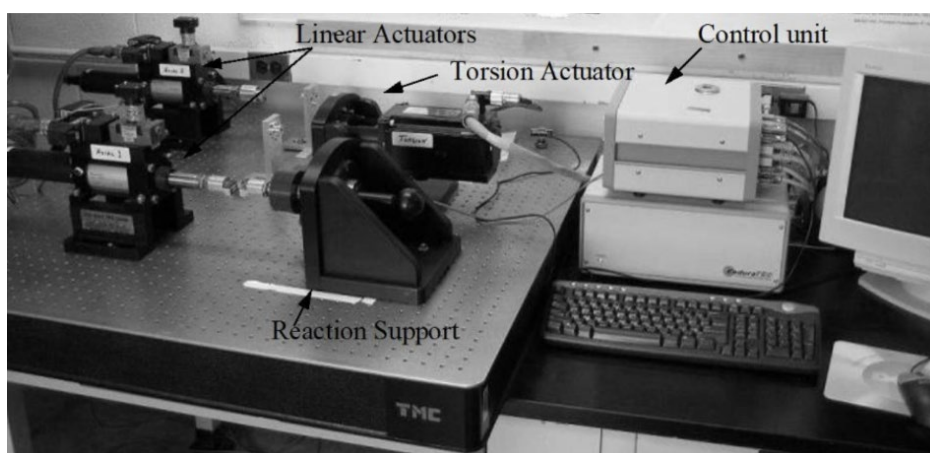



Figure 1. EnduraTEC TestBench with actuators and control unit.

6.5 Equipment and Materials

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All tests were conducted using EnduraTEC TestBench (Bose Corporation, Minnetonka, MN) equipped with two pneumatic linear actuators and one electromagnetic torsion actuator. After testing, each cable was examined under an Olympus DP20 (Olympus America Inc, Center Valley, PA) optical microscope at 45x magnification.

All data for this report is recorded on the attached traveler sheets of Appendix A.


6.6 Acceptance Criteria

The acceptance criterion for the mechanical tests were:

- No visual damage or fracture of the cable can be seen through the objective lens of the microscope while moving them slowly.
- The DC resistance per unit of length of the cable must not increase by more than 100% from the initial pre-test values. Any cable exceeding this threshold will be considered a failure.
- The impedance of the cable must not decrease by more than 20% between pre-test and post-test measurements. Any cable with an impedance reduction beyond this limit will be deemed to have an insulating failure.

7.0 Deviations

There were no deviations to the protocol.

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8.0 Test Results

The results for measured resistance and impedance of the samples is recorded in Table 1 below. The % change in resistance and impedance values is shown in Table 2.

Table 1. Pre and post test resistance and impedance values measured for the test samples

| Sample ID | Sample Type | Pre Test | | | | Post Test | | | | Notes |
|-----------|-----------------|--------------------|--------------------|-------------------|-------------------|--------------------|--------------------|------------------------|-------------------------|----------------|
| | | Min Resistance (Ω) | Max Resistance (Ω) | Min Impedance (Ω) | Max Impedance (Ω) | Min Resistance (Ω) | Max Resistance (Ω) | Impedance at 10kHz (Ω) | Impedance at 100kHz (Ω) | |
| 50-1 | 316LVM, 2-filar | 13.6 | 13.7 | 3133640 | 297119 | | | | | Fixture Failed |
| 50-2 | | 13.6 | 13.7 | 3167000 | 299000 | 8.1 | 8.1 | 2900000 | 280000 | |
| 50-3 | | 13.6 | 13.7 | 3203000 | 302000 | 8.2 | 8.2 | 2870000 | 270000 | |
| 50-4 | | 13.6 | 13.7 | 3002000 | 284000 | 8.2 | 8.3 | 3200000 | 300000 | |
| 50-5 | | 14.2 | 14.2 | 3090000 | 290000 | 8.1 | 8.1 | 3220000 | 300000 | |
| 52-1 | DFT, 2-filar | 0.6 | 0.7 | 3658193 | 343766 | 0.3 | 0.4 | 3143000 | 297000 | |
| 52-2 | | 0.6 | 0.6 | 3699707 | 346897 | 0.3 | 0.4 | 3120000 | 290000 | |
| 52-3 | | 0.6 | 0.6 | 3540307 | 332882 | 0.3 | 0.4 | 3239000 | 306000 | |
| 52-4 | | 0.6 | 0.7 | 3418140 | 322070 | 0.3 | 0.4 | 3272000 | 308000 | |
| 53-1 | DFT, 4-filar | 0.2 | 0.3 | 2900913 | 276523 | 0.1 | 0.2 | 2719000 | 271000 | |
| 53-2 | | 0.2 | 0.3 | 2958667 | 281144 | 0.1 | 0.2 | 2857000 | 272000 | |
| 53-3 | | 0.2 | 0.3 | 2862975 | 272658 | 0.1 | 0.2 | 2760000 | 270000 | |
| 53-4 | | 0.2 | 0.2 | 2864910 | 273296 | 0.1 | 0.2 | 2810000 | 270000 | |


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Table 2. % Change in the Resistance/Impedance of the Cables

| Sample ID | Sample Type | % Increase in Resistance | | Meets Acceptance Criteria? (% Increase <100%) | % Decrease in Impedance | | Meets Acceptance Criteria? (% Decrease <20%) |
|-----------|-----------------|--------------------------|----------------|--|-------------------------|---------------------|---|
| | | Min Resistance | Max Resistance | | Impedance at 10kHz | Impedance at 100kHz | |
| 50-1 | 316LVM, 2-filar | NA | NA | NA | NA | NA | NA |
| 50-2 | | -40.4% | -40.9% | Yes | -8.4% | -6.4% | Yes |
| 50-3 | | -39.7% | -40.1% | Yes | -10.4% | -10.6% | Yes |
| 50-4 | | -39.7% | -39.4% | Yes | 6.6% | 5.6% | Yes |
| 50-5 | | -43.0% | -43.0% | Yes | 4.2% | 3.4% | Yes |
| 52-1 | DFT, 2-filar | -50.0% | -42.9% | Yes | -14.1% | -13.6% | Yes |
| 52-2 | | -50.0% | -33.3% | Yes | -15.7% | -16.4% | Yes |
| 52-3 | | -50.0% | -33.3% | Yes | -8.5% | -8.1% | Yes |
| 52-4 | | -50.0% | -42.9% | Yes | -4.3% | -4.4% | Yes |
| 53-1 | DFT, 4-filar | -50.0% | -33.3% | Yes | -6.3% | -2.0% | Yes |
| 53-2 | | -50.0% | -33.3% | Yes | -3.4% | -3.3% | Yes |
| 53-3 | | -50.0% | -33.3% | Yes | -3.6% | -1.0% | Yes |
| 53-4 | | -50.0% | 0.0% | Yes | -1.9% | -1.2% | Yes |


For the 316LVM 2-filar sample type, one test iteration experienced an apparatus failure and thus an additional sample was tested. All additional 4 test samples passed testing.

For the DFT 2-filar sample type, all samples passed testing.

For the DFT 4-filar sample type, all samples passed testing.

All samples passed the visual inspection. This testing and its results are documented in the following reports:

- NNP-DVER-0001, Network Cable Stretch Test
- NNP-DVER-0002, Network Cable Crush Test
- NNP-DVER-0003, Network Cable Flex Test
- NNP-DVER-0004, Network Cable Torsion Test

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9.0 Conclusion

All samples that did not experience apparatus failure passed the acceptance criteria required in this protocol.

The COSMIIC system components, part numbers NNP-DWG-140-012-001, NNP-DWG-140-012-002, and NNP-DWG-140-012-003, successfully satisfied the functional requirements (REQ ID 1.0) defined in NNP-REQ-0001 - Product Requirements Specification – Network Cable.

10.0 References

| Document Identifier | Title |
|---------------------|--|
| NNP-DVEP-0005 | Design Verification Protocol – Network Cable Post-Test Evaluations |
| NNP-REQ-0001 | Product Requirements Specification – Network Cable |
| NNP-DWG-140-012-001 | Cable Body, Insulated DFT Filars, Blue/Clear |
| NNP-DWG-140-012-002 | Cable Body, Insulated SS Filars, Red/Clear |
| NNP-DWG-140-012-003 | Cable Body, Insulated SS Filars, Green/Clear |
| NNP-DVER-0001 | Network Cable Stretch Test |
| NNP-DVER-0002 | Network Cable Crush Test |
| NNP-DVER-0003 | Network Cable Flex Test |
| NNP-DVER-0004 | Network Cable Torsion Test |

11.0 Revision History

| Revision | Summary of Changes | Date | Author |
|----------|----------------------------|-----------|-------------|
| v1 | First version of document. | 7/15/2024 | J. Daghtani |

12.0 Approvals

See Document Change Request log for approvals



Appendix A

Traveler Sheets for Network Cable Post-Test Evaluations



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: S2-01

Cable: 316SS-24hr Supplied by: Ardian Stem Serial No: 03-30-0110 Part No: _____ Rev _____

Protocol: PRJ-NNPS-TST-PLN-07

1. Pre-Test Evaluations

Date: 8/4/08 Cable length: 71 mm, Initials: HT

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 13.6 Ω max 13.7 Ω , Impedance 10kHz 3133640 Ω , Impedance 100kHz 297119;

Data File S2-01-pretest-0154MNaCl-080608-

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 09/08/08 Gage length (Start): 45 mm, End Date: 09/12/08 Gage length (End): 47 mm,

Initials: Rv

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File .../S2-01/Stretch/S2-01-Stretch.txt

Notes:

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 09/13/08 Gage length (Start): 47 mm, End Date: 09/14/08 Gage length (End): 47 mm,

Initials: Rv

Data Acquisition: 10 cycles data for every 20,000 cycles;

Data File .../S2-01/Crush/S2-01-Crush.txt

Notes:

4. **Flex Test** (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date: 9/24/08 Gage length (Start): 47 mm, End Date: / / Gage length (End): mm,

Initials: *RV*

Test failed - Broke at lower grip

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File

Notes:

Nf - 424329

10:45 AM.

5. **Torsion Test** (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date: / / Gage length (Start): mm, End Date: / / Gage length (End): mm,

Initials: _____

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File

Notes:

6. Post-Test Evaluations

Date: / / Cable length: mm, Initials:

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min Ω max Ω , Impedance 10kHz Ω Impedance 100kHz Ω ;

Data File

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Filar: Resistance: min Ω max Ω , Impedance 10kHz _____, Impedance 100kHz _____;

Data File

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: S2-02

Cable: 316SS-2414r Supplied by: Ardeum from Medical Serial No: 03-30-0110 Part No: _____ Rev _____

Protocol: PRJ-NNPS-TST-PLN-01

1. Pre-Test Evaluations

Date: 8/4/08 Cable length: 71 mm, Initials: HT

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 13.6 Ω max 13.75 Ω , Impedance 10kHz 3167 Ω , Impedance 100kHz 299 Ω

Data File S2-02-pretest-0154MNa16-080608

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 09/30/08 Gage length (Start): 45 mm, End Date: 10/04/08 Gage length (End): 46 mm, Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... / S2-02 / stretch / S2-02-stretch.txt

Notes:

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 10/04/08 Gage length (Start): 46 mm, End Date: 10/05/08 Gage length (End): 46 mm, Initials: RV

Data Acquisition: 10 cycles data for every 20,000 cycles;

Data File ... / crush / S2-02-crush.txt

Notes:

4. Flex Test (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date: 10/16/08 Gage length (Start): 46 mm, End Date: 10/16/08 Gage length (End): 46 mm,

Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... / flex / S2-02-flex.txt

Notes:

5. Torsion Test (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date: 10/17/08 Gage length (Start): 46 mm, End Date: 10/18/08 Gage length (End): 46 mm,

Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... / torsion / S2-02-torsion.txt

Notes:

6. Post-Test Evaluations

Date: 10/22/08 Cable length: 45 mm, Initials: HH

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 8.1 Ω max 8.1 Ω , Impedance 10kHz 2.90M Ω Impedance 100kHz 0.28M Ω ;

Data File S2-02-postTest-0.154MNaCl-102208

Filar: C Resistance: min 15.9 Ω max 15.9 Ω , Impedance 10kHz 2.04M Ω , Impedance 100kHz 0.20M Ω

Data File S2-02-cyan filar-0.154MNaCl-102208

Filar: G Resistance: min 15.8 Ω max 15.8 Ω , Impedance 10kHz 1.91M Ω , Impedance 100kHz 0.20M Ω

Data File S2-02-postTest-green filar-0.154MNaCl-102208

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |

8. Additional post-test evaluation with 90° bending

Date: 03/10/09 Cable length: 45 mm, Initials: HH

Filar: C Resistance: min 14.5 Ω max 14.6 Ω ,

Filar: G Resistance: min 14.7 Ω max 14.9 Ω ,

Filar: Resistance: min Ω max Ω ,

Filar: Resistance: min Ω max Ω ,

Notes: Resistance values reported from 3 different measurements.



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: S2-03

Cable: 316SS - 241ar Supplied by: Ardisium Stem Medical Serial No: 03-31-010 Part No: _____ Rev _____

Protocol: PRJ-NNPS-TST-PLAN-17

1. Pre-Test Evaluations

Date: 8/4/08 Cable length: 71 mm, Initials: HT

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 13.6 Ω max 13.7 Ω , Impedance 10kHz 3203k Ω , Impedance 100kHz 302k Ω ;

Data File S2-03-pretest-0.154MNaCl-080608

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 10/06/08 Gage length (Start): 45 mm, End Date: 10/10/08 Gage length (End): 46 mm,

Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File .../S2-03/Stretch/S2-03-Stretch.txt

Notes:

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 10/13/08 Gage length (Start): 46 mm, End Date: 10/14/08 Gage length (End): 46 mm,

Initials: RV

Data Acquisition: 10 cycles data for every 20,000 cycles;

Data File .../Crush/S2-03-crush.txt

Notes:

4. Flex Test (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date: 10/19/08 Gage length (Start): 46 mm, End Date: 10/22/08 Gage length (End): 46 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... / flex / S2-03 - flex.txt

Notes:

5. Torsion Test (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date: 10/23/08 Gage length (Start): 46 mm, End Date: 10/24/08 Gage length (End): 46 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... / torsion / S2-03 - torsion.txt

Notes:

6. Post-Test Evaluations

Date: 10/27/08 Cable length: 45 mm, Initials: ++

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 8.2 Ω max 8.2 Ω , Impedance 10kHz 287M Ω Impedance 100kHz 0.27M Ω ;

Data File S2-03-posttest-0.154MNaCl-102708

Filar: C Resistance: min 16.2 Ω max 16.2 Ω , Impedance 10kHz 2.03M Ω , Impedance 100kHz 0.20M Ω

Data File S2-03-posttest-cyan-filar-0.154MNaCl-102708

Filar: G Resistance: min 16.2 Ω max 16.2 Ω , Impedance 10kHz 1.98M Ω , Impedance 100kHz 0.19M Ω

Data File S2-03-posttest-green-filar-0.154MNaCl-102708

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |

8. Additional post-test evaluation with 90° bending

Date: 03/10/09 Cable length: 45 mm, Initials: HH

Filar: G Resistance: min 15.5 Ω max 15.7 Ω ,

Filar: G Resistance: min 15.7 Ω max 15.8 Ω ,

Filar: Resistance: min Ω max Ω ,

Filar: Resistance: min Ω max Ω ,

Notes: Resistance values reported from 3 different measurements.



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: S2-04

Cable: 316SS - 2 filar Supplied by: Ardisys gram Medical Serial No: 03-70-0110 Part No: _____ Rev _____

Protocol: PRJ-NNPS-TST-PLN-07

1. Pre-Test Evaluations

Date: 8/4/08 Cable length: 71 mm, Initials: HF

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 13.6 Ω max 13.7 Ω , Impedance 10kHz 3002k Ω , Impedance 100kHz 284k Ω

Data File S2-04-pretest-0.154MNaCl-080608

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 10/13/08 Gage length (Start): 45 mm, End Date: 10/16/08 Gage length (End): 46 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... S2-04/Stretch/S2-04-Stretch.txt

Notes:

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 10/17/08 Gage length (Start): 46 mm, End Date: 10/18/08 Gage length (End): 46 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 20,000 cycles;

Data File ... crush/S2-04-crush.txt

Notes:

4. Flex Test (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date: 10/23/08 Gage length (Start): 46 mm, End Date: 10/29/08 Gage length (End): 46 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... flex / S2-04 - flex.txt

Notes:

5. Torsion Test (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date: 10/29/08 Gage length (Start): 46 mm, End Date: 10/30/08 Gage length (End): 46 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... torsion / S2-04 - torsion.txt

Notes:

6. Post-Test Evaluations

Date: 11/13/08 Cable length: 45 mm, Initials: HH

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 8.2 Ω max 8.3 Ω , Impedance 10kHz 0.2 M Ω Impedance 100kHz 0.304 Ω ^{M Ω}

Data File _____

Filar: C Resistance: min 16.5 Ω max 16.6 Ω , Impedance 10kHz 2.28 M Ω , Impedance 100kHz 0.22 M Ω ;

Data File _____

Filar: G Resistance: min 16.5 Ω max 16.6 Ω , Impedance 10kHz 2.27 M Ω , Impedance 100kHz 0.22 M Ω ;

Data File _____

Filar: _____ Resistance: min _____ Ω max _____ Ω , Impedance 10kHz _____, Impedance 100kHz _____;

Data File _____

Filar: _____ Resistance: min _____ Ω max _____ Ω , Impedance 10kHz _____, Impedance 100kHz _____;

Data File _____

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |

8. Additional post-test evaluation with 90° bending

Date: 03/10/09 Cable length: 45 mm, Initials: HH

Filar: C Resistance: min 16.1 Ω max 16.2 Ω ,

Filar: G Resistance: min 16.3 Ω max 16.4 Ω ,

Filar: A Resistance: min Ω max Ω ,

Filar: Resistance: min Ω max Ω ,

Notes: Resistance values reported from 3 different measurements.



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: S2-05

Cable: 316L-26hr Supplied by: Archie Grem Serial No: 07-30-0110 Part No: _____ Rev _____

Protocol: P2T-NNPS-TST-PLN-07

1. Pre-Test Evaluations

Date: 10/22/08 Cable length: 71 mm, Initials: HF

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 14.2 Ω max 14.2 Ω , Impedance 10kHz 309M Ω , Impedance 100kHz 0.29M Ω

Data File S2-05-preTest-0.154MNAck-102208

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 10/25/08 Gage length (Start): 45 mm, End Date: 10/29/08 Gage length (End): 46 mm,

Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... /S2-05/stretch/S2-05-stretch

Notes:

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 10/27/08 Gage length (Start): 46 mm, End Date: 10/30/08 Gage length (End): 46 mm,

Initials: RV

Data Acquisition: 10 cycles data for every 20,000 cycles;

Data File ... /crush/S2-05-crush.txt

Notes:

4. Flex Test (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date: 10/21/08 Gage length (Start): 46 mm, End Date: 11/3/08 Gage length (End): 46 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... /flex/52-05-flex.txt

Notes:

5. Torsion Test (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date: 11/4/08 Gage length (Start): 46 mm, End Date: 11/06/08 Gage length (End): 46 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... /torsion/52-05-torsion.txt

Notes:

6. Post-Test Evaluations

Date: 11/13/08 Cable length: 45 mm, Initials: HH

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 8.1 Ω max 8.1 Ω , Impedance 10kHz 3.22M Ω Impedance 100kHz 0.305M Ω

Data File _____

Filar: C Resistance: min 16.5 Ω max 16.6 Ω , Impedance 10kHz 3.22M Ω , Impedance 100kHz 3.05k Ω ;

Data File _____

Filar: G Resistance: min 16.5 Ω max 16.6 Ω , Impedance 10kHz 1.14M Ω , Impedance 100kHz 0.131M Ω ;

Data File _____

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File _____

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File _____

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |

8. Additional post-test evaluation with 90° bending

Date: 03/10/04 Cable length: 45 mm, Initials: HH

Filar: C Resistance: min 15.4 Ω max 15.5 Ω ,

Filar: G Resistance: min 15.1 Ω max 15.2 Ω ,

Filar: Resistance: min Ω max Ω ,

Filar: Resistance: min Ω max Ω ,

Notes: Resistance values reported from 3 different measurements.



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: D2-01

ARDIEM ITEM NO:

Cable: DFT 2-filar Supplied by: MEDICAL Serial No: 03-30-0240 Part No: _____ Rev _____

Protocol: PRJ-NNPS-TST-PLN-07 REV A

1. Pre-Test Evaluations

Date: 06/13/08 Cable length: 71 mm, Initials: AR

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.6 Ω max 0.7 Ω , Impedance 10kHz 3658193 Ω , Impedance 100kHz 34376652

Data File D2-01-pretest-0.154M NaCl - 061308

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 06/18/08 Gage length (Start): 45 mm, End Date: 06/21/08 Gage length (End): 46 mm,
Initials: AR 5:30 PM

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File C:/RAW/Phase-I/D2-01/~~D2-01-01~~ Stretch / D2-01-Stretch.txt

Notes: Gage length (end) measured at 11:15 PM on 6/23/08

Level 1 -2.1 ; Level 2 6.9 → Required To get
Level 1 -2.9 ; Level 2 7.7 → Used in this

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 6/23/08 Gage length (Start): 46 mm, End Date: 6/24/08 Gage length (End): 46 mm,
Initials: AR 3 PM

Data Acquisition: 10 cycles data for every 20,000 cycles;

Data File C:/RAW/Phase-I/D2-01/CRUSH/D2-01-Crush.txt

Notes: Gage length (end) measured at 11:AM on 6/24/08. Test Stopped much before that.

4. Flex Test (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date: 6/24/08 Gage length (Start): 46 mm, End Date: 06/30/08 Gage length (End): 46 mm,
Initials: VR 8:30PM

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File C:\Ravi\Phas-1\ D2-01\ ~~D2-01~~ Flex \ D2-01-Flex.txt

Notes: 6/25/8 - 11AM → found the actuator stopped @ 400,000 cycles

5. Torsion Test (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date: 06/30/08 Gage length (Start): 46 mm, End Date: 7/7/08 Gage length (End): 46 mm,
Initials: VR

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File \Torsion\ D2-01-Torsion.txt

Notes:

6. Post-Test Evaluations

Date: 8/18/08 Cable length: 45 mm, Initials: tt

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.3 Ω max 0.4 Ω , Impedance 10kHz 3143k Ω Impedance 100kHz 297k Ω ;

Data File D2-01-posttest-0.154MNaCl-081808

Filar: 1 Resistance: min 0.7 Ω max 0.7 Ω , Impedance 10kHz 188M Ω , Impedance 100kHz 0.18M Ω ;

Data File D2-01-posttest-gold filar-0.154MNaCl-092408-1

Filar: 2 Resistance: min 0.7 Ω max 0.7 Ω , Impedance 10kHz 286M Ω , Impedance 100kHz 0.22M Ω ;

Data File D2-01-posttest-green filar-0.154MNaCl-092408-1

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |

8. Additional post-test evaluation with 90° bending

Date: 03/12/09 Cable length: 45 mm, Initials: HH

Filar: 6 Resistance: min 0.7 Ω max 0.8 Ω ,

Filar: 7 Resistance: min 0.7 Ω max 0.7 Ω ,

Filar: Resistance: min Ω max Ω ,

Filar: Resistance: min Ω max Ω ,

Notes: Resistance values reported from 3 different measurements.



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: D2-02

Cable: DFT-24hr Supplied by: ARDIEM ^{ITEM} Serial No: 03-30-D2-10 Part No: _____ Rev _____
Med. cal. Inc

Protocol: PRJ-NNPS-TST-PLN-07

1. Pre-Test Evaluations

Date: 06/13/08 Cable length: 71 mm, Initials: AF

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.6 Ω max 0.6 Ω , Impedance 10kHz 3699707 Ω , Impedance 100kHz 346987 Ω

Data File D2-02-pretest-0.154MNaCl-061608

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 08/19/08 Gage length (Start): 46 mm, End Date: 08/25/08 Gage length (End): 46 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File D2-02/Stretch/D2-02-stretch.txt

Notes:

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 08/25/08 Gage length (Start): 46 mm, End Date: 08/26/08 Gage length (End): 46 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 20,000 cycles;

Data File D2-02/Crush/D2-02-crush.txt

Notes:

4. Flex Test (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date: 09/02/08 Gage length (Start): 46 mm, End Date: 09/08/08 Gage length (End): 46 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File: --/D2-02/Flex/D2-02-flex.txt

Notes:

5. Torsion Test (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date: 09/06/08 Gage length (Start): 46 mm, End Date: 09/08/08 Gage length (End): 46 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File: --/D2-02/Torsion/D2-02-torsion.txt

Notes:

6. Post-Test Evaluations

Date: 10/01/08 Cable length: 40 mm, Initials: HH

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.3 Ω max 0.4 Ω , Impedance 10kHz 3.12 M Ω Impedance 100kHz 0.29 M Ω

Data File D2-02-posttest-0.154MNaCl-100108

Filar: 1 Resistance: min 0.6 Ω max 0.6 Ω , Impedance 10kHz 1.73 M Ω , Impedance 100kHz 0.185 M Ω

Data File D2-02-posttest-gold filar-0.154MNaCl-100208

Filar: 2 Resistance: min 0.6 Ω max 0.6 Ω , Impedance 10kHz 1.92 M Ω , Impedance 100kHz 0.202 M Ω

Data File D2-02-posttest-green filar-0.154MNaCl-100208

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |

8. Additional post-test evaluation with 90° bending

Date: 03/12/09 Cable length: 40 mm, Initials: HH

Filar: G Resistance: min 0.7 Ω max 0.8 Ω ,

Filar: J Resistance: min 0.7 Ω max 0.7 Ω ,

Filar: Resistance: min Ω max Ω ,

Filar: Resistance: min Ω max Ω ,

Notes: Resistance values reported from 3 different measurements.



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: D2-03

Cable: DFT-2140 Supplied by: Ardiem Medical ^{ITEM} ~~Serial~~ No: 03-30-0210 Part No: _____ Rev _____

Protocol: PRJ-NNPS-TST-PLN-07

1. Pre-Test Evaluations

Date: 06/13/08 Cable length: 71 mm, Initials: ff

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.6 Ω max 0.6 Ω , Impedance 10kHz 3540307 Ω Impedance 100kHz 332882 Ω

Data File 02-03-pretest-0.154MNaCl-062408

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 7/8/08 Gage length (Start): 45 mm, End Date: 7/11/08 Gage length (End): 45 mm,
Initials: LAD

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File C:/Ravi/phase-1/D2-03/stretch/D2-03-stretch.txt
Notes: to get -1.2 - 7.8

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 7/12/08 Gage length (Start): 45 mm, End Date: 7/14/08 Gage length (End): 45 mm,
Initials: LAD

Data Acquisition: 10 cycles data for every 20,000 cycles;

Data File C:/Ravi/phase-1/D2-03/crush/D2-03-crush

Notes:

4. Flex Test (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date: 7/15/08 Gage length (Start): 45 mm, End Date: 7/19/08 Gage length (End): 45 mm, Initials: LAD

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File " / Flex / D2-03 flex.txt

Notes:

5. Torsion Test (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date: 7/23/08 Gage length (Start): 45 mm, End Date: 7/25/08 Gage length (End): 45 mm, Initials: LAD

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File " / Torsion / D2-03-torsion.txt

Notes:

6. Post-Test Evaluations

Date: 8/18/08 Cable length: 45 mm, Initials: HH

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.3 Ω max 0.4 Ω , Impedance 10kHz 3239k Ω Impedance 100kHz 306k Ω ;

Data File D2-03-posttest-0.154MNaCl-081808

Filar: 1 Resistance: min 0.6 Ω max 0.7 Ω , Impedance 10kHz 1.73M Ω , Impedance 100kHz 0.167M Ω

Data File D2-03-posttest-galvanic-0.154MNaCl-082408

Filar: 2 Resistance: min 0.6 Ω max 0.7 Ω , Impedance 10kHz 2.74M Ω , Impedance 100kHz 0.233M Ω

Data File D2-03-posttest-green filar-0.154MNaCl-082408

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |

8. Additional post-test evaluation with 90° bending

Date: 03/12/09 Cable length: 45 mm, Initials: HH

Filar: 6 Resistance: min 0.7 Ω max 0.8 Ω ,

Filar: 7 Resistance: min 0.8 Ω max 0.9 Ω ,

Filar: Resistance: min Ω max Ω ,

Filar: Resistance: min Ω max Ω ,

Notes: Resistance values reported from 3 different measurements.



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: D2-04

Cable: DFT-21lar Supplied by: Ardiem ITEM Medical Serial No: 03-30-0210 Part No: _____ Rev _____

Protocol: PRJ-NNPS-TST-PLN-07

1. Pre-Test Evaluations

Date: 06/13/08 Cable length: 71 mm, Initials: gt

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.6 Ω max 0.7 Ω , Impedance 10kHz 341814 Ω Impedance 100kHz 322070 Ω

Data File D2-04-pretest-0.154MNAcl-062408

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 7/21/08 Gage length (Start): 45 mm, End Date: 7/25/08 Gage length (End): 45 mm,
Initials: LAD

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File Phase one \ D2-04 \ Stretch \ D2-04-stretch.fdt

Notes: get -2.09 to 6.9

used -2.7 to 7.45

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 7/25/08 Gage length (Start): 45 mm, End Date: 7/26/08 Gage length (End): 45 mm,
Initials: LAD

Data Acquisition: 10 cycles data for every 20,000 cycles; crush

Data File D2-04 / crush / D2-04-~~stretch~~

Notes:

4. Flex Test (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date: 7/26/08 Gage length (Start): 45 mm, End Date: 7/30/08 Gage length (End): 45 mm,
Initials: LAD

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File D2-04 / ~~Torsion~~ / D2-04 - ~~Torsion~~ .txt ^{flex}

Notes: flex

5. Torsion Test (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date: 8/8/08 Gage length (Start): 45 mm, End Date: 8/16/08 Gage length (End): 45 mm,
Initials: LAD

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File D4-02 / Torsion / D4-02 - torsion

Notes:

6. Post-Test Evaluations

Date: 8/18/08 Cable length: 44 mm, Initials: ff

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.3 Ω max 0.4 Ω , Impedance 10kHz 3272 k Ω Impedance 100kHz 308 Ω ;

Data File D2-04 - posttest - 0.154MNaCl - 081808

Filar: 1 Resistance: min 0.6 Ω max 0.7 Ω , Impedance 10kHz 1.56M Ω , Impedance 100kHz 0.182M Ω

Data File D2-04 - posttest - gold filar - 0.154MNaCl - 082408

Filar: 2 Resistance: min 0.6 Ω max 0.7 Ω , Impedance 10kHz 2.26M Ω Impedance 100kHz 0.218M Ω

Data File D2-04 - posttest - green filar - 0.154MNaCl - 082408

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Filar: Resistance: min Ω max Ω , Impedance 10kHz , Impedance 100kHz ;

Data File

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |

8. Additional post-test evaluation with 90° bending

Date: 03/12/09 Cable length: 44 mm, Initials: HH

Filar: G Resistance: min 0.8 Ω max 0.9 Ω ,

Filar: F Resistance: min 0.7 Ω max 0.8 Ω ,

Filar: Resistance: min Ω max Ω ,

Filar: Resistance: min Ω max Ω ,

Notes: Resistance values reported from 3 different measurements.



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: D4-01

Cable: DFT-4-filar Supplied by: Ardion ^{ITEM} Serial No: 03-30-0510 Part No: _____ Rev _____
_{medical inc}

Protocol: PRJ-NNPS-TST-PLN-07

1. Pre-Test Evaluations

Date: 06/25/08 Cable length: 71 mm, Initials: VR

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.2 Ω max 0.3 Ω , Impedance 10kHz 2900913 Ω Impedance 100kHz 276523 Ω

Data File D4-01-pretest-0.154MNA00-062508

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 06/26/08 Gage length (Start): 45 mm, End Date: 06/30/08 Gage length (End): 46 mm,
Initials: VR _{8:30PM}

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File C:\Ravi\Phase-1\D4-01\Stretch\D4-01-Stretch.txt

Notes:

Scan time - 2.5

• Axial 2 at count 1

Level 1 -2.7 ; level 2: 7.5

Scan points - 500

• 10,000 points between scans.

used waveform.

no. of scans - 13

to get -2.7, 6.9

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 06/30/08 Gage length (Start): 46 mm, End Date: 7/1/08 Gage length (End): 46 mm,
Initials: VR _{8:30PM}

Data Acquisition: 10 cycles data for every 20,000 cycles;

Data File D4-01/Crush/D4-01-Crush.txt

Notes:

4. Flex Test (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date: 7/7/08 Gage length (Start): 46 mm, End Date: 7/11/08 Gage length (End): 46 mm,
Initials: LAD

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File D4-01/flex/D4-01-flex.fdt

Notes: Mandrel fell off sometime overnight - 300000 cycles when it was found

5. Torsion Test (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date: 7/19/08 Gage length (Start): 46 mm, End Date: 7/21/08 Gage length (End): 46 mm,
Initials: LAD

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File D4-01/torsion/D4-01-torsion.fdt

Notes:

6. Post-Test Evaluations

Date: 8/18/08 Cable length: 32 mm, Initials: HH

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.1 Ω max 0.2 Ω , Impedance 10kHz 279k Ω Impedance 100kHz 271k Ω ;

Data File D4-01-posttest-0.154MNaCl-081808

Filar: 1 Resistance: min 0.5 Ω max 0.5 Ω , Impedance 10kHz 7.68M Ω , Impedance 100kHz 0.644M Ω

Data File D4-01-posttest-gold filar-0.154MNaCl-082408

Filar: 2 Resistance: min 0.5 Ω max 0.5 Ω , Impedance 10kHz 6.17M Ω , Impedance 100kHz 0.648M Ω

Data File D4-01-posttest-green filar-0.154MNaCl-082408

Filar: 3 Resistance: min 0.4 Ω max 0.5 Ω , Impedance 10kHz 6.69M Ω , Impedance 100kHz 0.577M Ω

Data File D4-01-posttest-blue filar-0.154MNaCl-082408

Filar: 4 Resistance: min 0.4 Ω max 0.5 Ω , Impedance 10kHz 3.03M Ω , Impedance 100kHz 0.288M Ω

Data File D4-01-posttest-white filar-0.154MNaCl-082408

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |

8. Additional post-test evaluation with 90° bending

Date: 03/12/09 Cable length: 30 mm, Initials: HH

Filar: G Resistance: min 0.4 Ω max 0.5 Ω ,

Filar: B Resistance: min 0.3 Ω max 0.4 Ω ,

Filar: W Resistance: min 0.3 Ω max 0.4 Ω ,

Filar: Y Resistance: min 0.5 Ω max 0.6 Ω ,

Notes: Resistance values reported from 3 different measurements.



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: D4-02

Cable: DET-4pilar Supplied by: Ardem ^{ITEM} Serial No: 03-30-0510 Part No: _____ Rev _____

Protocol: PRJ-NNPS-TST-PLN-02

1. Pre-Test Evaluations

Date: 06/25/08 Cable length: 71 mm, Initials: HH

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.2 Ω max 0.3 Ω , Impedance 10kHz 29586670 Impedance 100kHz 2811440

Data File D4-02-pretest-0.154MNAW-062508

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 06/30/08 Gage length (Start): 45 mm, End Date: 7/9/08 Gage length (End): 47 mm,
Initials: VR 8:34pm

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... D4-02/D4-02-Stretch.txt

Notes: Level 1 -2.7, Level 2 7.5 \rightarrow used to get -2.9, 6.9

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 7/5/08 Gage length (Start): 47 mm, End Date: 7/6/08 Gage length (End): 47 mm,
Initials: LAD

Data Acquisition: 10 cycles data for every 20,000 cycles;

Data File !! D4-02-Crush

Notes:

4. Flex Test (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date: 7/11/08 Gage length (Start): 47 mm, End Date: 7/15/08 Gage length (End): 47 mm,
Initials: LAD

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File " D4-02-flex

Notes:

5. Torsion Test (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date: 7/21/08 Gage length (Start): 47 mm, End Date: 7/23/08 Gage length (End): 47 mm,
Initials: LAD

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File D4-02/torsion/D4-02-torsion

Notes:

6. Post-Test Evaluations

Date: 8/18/08 Cable length: 45 mm, Initials: H

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.1 Ω max 0.2 Ω , Impedance 10kHz 2857k Ω , Impedance 100kHz 272k Ω ;

Data File D4-02-postTest-0.154MNaCl-081808

Filar: 1 Resistance: min 0.5 Ω max 0.5 Ω , Impedance 10kHz 3.25M Ω , Impedance 100kHz 0.307M Ω

Data File D4-02-postTest-gold-filar-0.154MNaCl-082408

Filar: 2 Resistance: min 0.4 Ω max 0.5 Ω , Impedance 10kHz 3.40M Ω , Impedance 100kHz 0.32M Ω

Data File D4-02-postTest-green-filar-0.154MNaCl-082408

Filar: 3 Resistance: min 0.4 Ω max 0.5 Ω , Impedance 10kHz 3.307M Ω , Impedance 100kHz 0.312M Ω

Data File D4-02-postTest-blue-filar-0.154MNaCl-082408

Filar: 4 Resistance: min 0.5 Ω max 0.5 Ω , Impedance 10kHz 3.35M Ω , Impedance 100kHz 0.315M Ω

Data File D4-02-postTest-white-filar-0.154MNaCl-082408

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |

8. Additional post-test evaluation with 90° bending

Date: 03/12/09 Cable length: 38 mm, Initials: HH

Filar: G Resistance: min 0.5 Ω max 0.5 Ω ,

Filar: B Resistance: min 0.5 Ω max 0.6 Ω ,

Filar: W Resistance: min 0.5 Ω max 0.6 Ω ,

Filar: Y Resistance: min 0.5 Ω max 0.6 Ω ,

Notes: Resistance values reported from 3 different measurements.



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: D4-03

Cable: DET-4 Supplied by: Ardicor ^{ITEM} Serial No: 03-30-0570 Part No: _____ Rev _____
_{medical inc}

Protocol: PRJ-NNPS-TST-PLN-07

1. Pre-Test Evaluations

Date: 06/25/08 Cable length: 71 mm, Initials: JK

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.2 Ω max 0.3 Ω , Impedance 10kHz 28629570 Impedance 100kHz 27265852

Data File D4-03-pretest-0.154MNaCl-062508

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 08/30/08 Gage length (Start): 45 mm, End Date: 09/03/08 Gage length (End): 47 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File .../D4-03/Stretch/D4-03-Stretch.txt

Notes:

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 09/03/08 Gage length (Start): 47 mm, End Date: 09/04/08 Gage length (End): 47 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 20,000 cycles;

Data File .../Crush/D4-03-Crush.txt

Notes:

4. Flex Test (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date 09/08/08 Gage length (Start): 47 mm, End Date: 09/23/08 Gage length (End): 47 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... / Flex / D4-03-flex.txt

Notes:

5. Torsion Test (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date 09/22/08 Gage length (Start): 47 mm, End Date: 9/24/08 Gage length (End): 47 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File ... / Torsion / D4-03-Torsion.txt

Notes:

6. Post-Test Evaluations

Date: 10/01/08 Cable length: 40 mm, Initials: if

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.1 Ω max 0.2 Ω , Impedance 10kHz 2.76M Ω Impedance 100kHz 0.26M Ω ;

Data File D4-03-posttest-0.154MNaCl-100108

Filar: 1 Resistance: min 0.5 Ω max 0.5 Ω , Impedance 10kHz 1.45M Ω , Impedance 100kHz 0.15M Ω

Data File D4-03-posttest-gold filar-0.154MNaCl-100208

Filar: 2 Resistance: min 0.4 Ω max 0.4 Ω , Impedance 10kHz 1.41M Ω , Impedance 100kHz 0.14M Ω

Data File D4-03-posttest-green filar-0.154MNaCl-100608

Filar: 3 Resistance: min 0.4 Ω max 0.4 Ω , Impedance 10kHz 12.3M Ω , Impedance 100kHz 0.88M Ω

Data File D4-03-posttest-blue filar-0.154MNaCl-100608

Filar: 4 Resistance: min 0.5 Ω max 0.5 Ω , Impedance 10kHz 2.37M Ω , Impedance 100kHz 0.235M Ω

Data File D4-03-posttest-white filar-0.154MNaCl-100208

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |

8. Additional post-test evaluation with 90° bending

Date: 03/12/09 Cable length: 34 mm, Initials: HH

Filar: 6 Resistance: min 0.5 Ω max 0.5 Ω ,

Filar: 8 Resistance: min 0.6 Ω max 0.6 Ω ,

Filar: 10 Resistance: min 0.5 Ω max 0.9 Ω ,

Filar: 12 Resistance: min 0.3 Ω max 0.4 Ω ,

Notes: Resistance values reported from 3 different measurements.



Development of Networked Implantable Neuroprostheses (NNPS)

Traveler sheet for Cable Endurance Tests

SPECIMEN ID: D4-04

Cable: DET-4hr Supplied by: Ardiem ^{ITEM} Serial No: 03-30-0510 Part No: _____ Rev _____
_{med cal inc}

Protocol: PRJ-NNPS-TST-PLN-07

1. Pre-Test Evaluations

Date: 06/25/08 Cable length: 71 mm, Initials: gt

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.2 Ω max 0.2 Ω , Impedance 10kHz 2864910 Ω Impedance 100kHz 273296 Ω

Data File D4-04-pretest-0.154MNaCl-062608

Notes: Resistance value reported from 3 different measurements.

2. Stretch Test (Test Parameters: 2% Pre stretch, 20% Stretch, 4Hz, 1.2 million cycles)

Start Date: 09/03/08 Gage length (Start): 45 mm, End Date: 09/08/08 Gage length (End): 48 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File / D4-04 / Stretch / D4-04 - Stretch.txt

Notes:

3. Crush Test (Test Parameters: 1.2N Crush, 4Hz, 0.12 million cycles)

Start Date: 09/08/08 Gage length (Start): 48 mm, End Date: 09/09/08 Gage length (End): 48 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 20,000 cycles;

Data File / crush / D4-04 - crush.txt

Notes:

4. Flex Test (Test Parameters: 140° Flex, 4Hz, 1.2 million cycles)

Start Date: 09/13/08 Gage length (Start): 48 mm, End Date: 09/17/08 Gage length (End): 48 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File /flex/ D4-04-flex.txt

Notes:

5. Torsion Test (Test Parameters: 2% Pre stretch, 180° Twist, 4Hz, 0.6 million cycles)

Start Date: 09/19/08 Gage length (Start): 48 mm, End Date: 09/21/08 Gage length (End): 48 mm,
Initials: RV

Data Acquisition: 10 cycles data for every 100,000 cycles;

Data File /Torsion/ D4-04-Torsion.txt

Notes:

6. Post-Test Evaluations

Date: 10/01/08 Cable length: 40 mm, Initials: HH

Data Acquisition: scan from 100kHz to 100mHz, record rate 10point/decade

Cable Resistance: min 0.1 Ω max 0.2 Ω , Impedance 10kHz 2.81M Ω Impedance 100kHz 0.27M Ω ;

Data File D4-04-posttest-0.154M NaCl-100108

Filar: 1 Resistance: min 0.4 Ω max 0.4 Ω , Impedance 10kHz 1.24M Ω , Impedance 100kHz 0.18M Ω ;

Data File D4-04-posttest-^{gold filar}0.154M NaCl-100308

Filar: 2 Resistance: min 0.5 Ω max 0.5 Ω , Impedance 10kHz 2.48M Ω , Impedance 100kHz 0.28M Ω

Data File D4-04-posttest-green filar-0.154M NaCl-100308

Filar: 3 Resistance: min 0.5 Ω max 0.5 Ω , Impedance 10kHz 2.23M Ω , Impedance 100kHz 0.214M Ω

Data File D4-04-posttest-blue filar-0.154M NaCl-100308

Filar: 4 Resistance: min 0.4 Ω max 0.4 Ω , Impedance 10kHz 2.55M Ω , Impedance 100kHz 0.247M Ω

Data File D4-04-posttest-white filar-0.154M NaCl-100308

Notes: Resistance values reported from 3 different measurements.

7. Revision History

| REV | DESCRIPTION | AUTHOR | DATE | APPROVAL |
|-----|---------------|--------|--------|----------|
| A | Initial draft | RV/HH | 6/9/08 | |
| | | | | |

8. Additional post-test evaluation with 90° bending

Date: 03/12/09 Cable length: 35 mm, Initials: HHH

Filar: G Resistance: min 0.4 Ω max 0.5 Ω ,

Filar: B Resistance: min 0.8 Ω max 1.0 Ω ,

Filar: W Resistance: min 0.7 Ω max 0.7 Ω ,

Filar: Y Resistance: min 0.5 Ω max 0.5 Ω ,

Notes: Resistance values reported from 3 different measurements.