

SUMMARY OF: P980016 S382 AND P890003/S259

**EVERA IMPLANTABLE CARDIOVERTER DEFIBRILLATORS AND CARELINK HOME
MONITOR/MEDTRONIC**

EXECUTIVE SUMMARY/BACKGROUND

The purpose of this PMA-Supplement is to request approval for the Evera ICD devices, which include the following models:

- Evera™ XT DR ICD (DDBB1D4)
- Evera™ XT DR ICD (DDBB1D1)
- Evera™ S DR ICD (DDBC3D4)
- Evera™ S DR ICD (DDBC3D1)
- Evera™ XT VR ICD (DVBB1D4)
- Evera™ XT VR ICD (DVBB1D1)
- Evera™ S VR ICD (DVBC3D4)
- Evera™ S VR ICD (DVBC3D1)

The Evera ICD devices are single and dual chamber implantable cardioverters that are multiprogrammable cardiac devices that monitor and regulate a patient's heart rate by providing single or dual chamber rate responsive bradycardia pacing.

The Evera devices are the ICD members of the Viva/Brava/Evera family of devices. The Viva/Brava CRT-D devices (P010031/S318) were submitted to FDA on July 3, 2012 and approved on January 29, 2013. Because of the close relationship between the Viva/Brava and Evera devices, a significant amount of the information and documentation submitted to support approval of the Evera devices is identical to that which was submitted for the Viva/Brava devices. Therefore, the sponsor has included a table which identifies the sections of this submission that are identical (only with modifications to the model and product name references) to the Viva/Brava submission and which sections have been updated. This table is summarized below:

Same information as the corresponding Viva/Brava submission section	Updated for the Evera devices (not including those that were only updated for reference purposes)
Sponsor Name and Address Manufacturing Information Sterilization Performance Standards Non-Clinical Studies Intro	Cover Letter Executive Summary Indications for Use Detailed Device Description Detailed Description of Changes

Same information as the corresponding Viva/Brava submission section	Updated for the Evera devices (not including those that were only updated for reference purposes)
Firmware Software Biocompatibility Shelf Life Device Samples Environmental Assessment Medical Procedure and EMI Precautions Manual Explanation of Symbols Insert Radio Regulatory Compliance Information Insert Software Universal Serial Bus (USB) Label and USB Shipper Label Website Care Patient Management Other Applicable Manufacturing Changes approved on Predecessor Products	Hardware & Mechanical Subsystem Testing Battery Modeling – Longevity Projection Design Assurance Unit Testing (DAU) System Verification System Validation Risk Management Clinical Experience Bibliography Labeling and Packaging Intro Change Tables & Device Manuals Change Tables & Reference Manual Patient Manual Device Package Labels Clinical Study Information Changes Made After Design Assurance Builds Changes Reported Pursuant to 21 CFR 814.39(b): Annual Reportable Changes

The same reviewers were issued consults for the Evera devices that reviewed the Viva/Brava devices in order to maintain consistency in the review process. Many of them have referenced their review for the Viva/Brava submission and have made only minor adjustments based on any new information provided in this submission.

The Viva/Brava submission was reviewed and put on hold in October 2012 for major deficiencies. The sponsor sent an amendment to address these deficiencies which was received by FDA on November 16, 2012. Because much of the information for the Evera devices is identical to the Viva/Brava devices, the Evera submission review concluded that many of the same deficiencies needed to be addressed for the Evera devices. Knowing this, the sponsor requested to send an amendment with the deficiency responses addressed for the Viva/Brava submission as they apply to the Evera devices. However, there were other concerns that came up in this review that did not apply to the Viva/Brava devices and based on consultation with branch management and PMA staff, the decision was made, instead of receiving an unsolicited amendment from the sponsor that did not address all questions related to the Evera devices, to send a major deficiency letter including the Viva/Brava deficiencies as well as the new concerns that directly apply to the Evera devices.

A major deficiency letter was sent on December 11, 2012. The sponsor provided a response to FDA's deficiencies included in this letter, which was received on

January 15, 2013. Interactive review was performed (via e-mail and teleconference) to complete the review and resolve any remaining issues.

Much like the Viva/Brava devices, the development of Evera devices was based on the electrical and mechanical platforms of the Protecta XT / Protecta devices. This approach provides efficiencies to the development effort, formal test and manufacturing since similar hybrid components and manufacturing process can be used, rather than a unique hybrid for each device type. The differences in electrical and mechanical aspects and manufacturing processes are further discussed in detail in the submission. Also, these devices all contain the same firmware image, use the same programmer software application and use the same monitor firmware reported in the 2490C, 2020A, 2020B and the same software of the DDMA model 2491. This approach provides efficiencies to the development effort and formal test suite.

(b)(4) Trade Secret

DESCRIPTION OF CHANGES/ REASON FOR SUPPLEMENT

The Evera devices are largely based on the Protecta XT/Protecta ICD devices previously approved and therefore the sponsor has provided a comparison of these devices in the table below. Physically, the Evera devices utilize a can with a new shape and size as compared to the Protecta devices. The DF-1 connector module configuration (DR: 2 IS-1/2 DF-1, VR: 1 IS-1/2 DF-1) is identical to the connector modules used for DF-1 connector configuration of the Protecta XT / Protecta devices, in both lead connection configurations and materials

(b)(4) Trade Secret

. For the Evera devices with the DF4 connector configurations (DR: 1 IS-1/1 DF4, VR: 1 DF4), (b)(4) Trade Secret materials are used (chemical characterization and biological safety testing for the Elasthane material are included in this submission). Please see below for further comparison of characteristics.

Configuration / Feature	Protecta XT/ Protecta ICD (P980016/S211 approved March 25, 2011 and P980016/ S218 approved November 9, 2011 and P980016/ S280, approved May 2, 2012).	Evera ICD (Subject of this submission)
Lead Connections Offered	DR: Two IS-1 / Two DF-1 One IS-1 / One DF4 VR: One IS-1 / Two DF-1 One DF4	DR: Two IS-1 / Two DF-1 One IS-1 / One DF4 VR: One IS-1 / Two DF-1 One DF4
Body Thickness (mm)	15	13
Volume (cc)	DR: Two IS-1 / Two DF-1 = 36.5 One IS-1 / One DF4 = 40.8 VR: One IS-1 / Two DF-1 = 36.5 One DF4 = 38.4	DR: Two IS-1 / Two DF-1 = 33 One IS-1 / One DF4 = 34 VR: One IS-1 / Two DF-1 = 33 One DF4 = 33
Mass (g)	DR: Two IS-1 / Two DF-1 = 68 One IS-1 / One DF4 = 73 VR: One IS-1 / Two DF-1 = 68 One DF4 = 73	DR: Two IS-1 / Two DF-1 = 76.6 One IS-1 / One DF4 = 78 VR: One IS-1 / Two DF-1 = 76.6 One DF4 = 76.6
Longevity (yrs)	DR: 7.5 years VR: 8.6 years	DR: 9.1 years VR: 10.7 years
Rate Response Sensor	Accelerometer (2-beam)	Accelerometer (1-beam)
Capacitors	(b)(4) Trade Secret	
Maximum Energy (joules)	35	Same
Telemetry	Telemetry B and Telemetry C	Telemetry B, Telemetry C and Telemetry M (Telemetry M module operating in Telemetry C protocol mode)
Case material	(b)(4) Trade Secret	
Battery		

NEW AND MODIFIED FEATURES

The features available in the Evera DR and VR ICD devices are available in Protecta XT/Protecta DR and VR ICD devices, with the inclusion of the features listed in the table below. These new features are a subset of the new and modified features presented in the approved Viva/Brava PMA-S.

Added Feature	Description
Remaining Longevity Estimator	Provides graphical and numerical representation of device remaining longevity.
PhysioCurve	Provides devices with a new size and shape. The device can size is smaller and the shape is redesigned with a tapered side and a tapered connector module. The devices will be available with various connector modules to give physicians choices for lead connections. Change of the size and shape will address patient comfort.
Telemetry Extensibility	Provides for future use of a distance telemetry system designed to provide faster speed and remote wake up capabilities. NOTE: This capability is not enabled for the devices described in this submission.
Data Storage	Provides Medtronic Research increased storage of daily impedance measurements of 90 days from the original 14 days storage. This is for all of the measured impedance vectors. This change is not visible to the user.
Right Ventricular Pacing Vectors	Provides user programmability of the RVtip to RVcoil pacing vector.
Session Management	Provides Cardiac Compass® diagnostics and Rate Histograms diagnostics for on-screen display via the programmer.
Shipping / Nominal Parameter Settings	VF NID parameter is be updated to shipped / nominal setting at 24/32, a change from the previous shipped / nominal setting of 18/24. NOTE: The subject of this PMA-Supplement is focused on the Evera ICD devices. Therefore, the ATR parameter update is not available for the devices described in this submission.
System Surveillance / RV Lead Integrity Alert (LIA)	The added RVtip to RVcoil vector's impedance data will be analyzed by the LIA algorithm in the same way the RVtip to RVring data is currently analyzed by the LIA algorithm.

Therapy Sequencing	Provides therapy sequencing to allow less aggressive therapies while providing assurance that the final therapies that may be delivered for an episode are the most aggressive, thereby alleviating the opportunity for the last therapy accelerating the rhythm when all more aggressive therapies are exhausted (i.e. all six shock therapies)
Oversensing Discrimination	<p>Provides incremental improvement to the TWave Discrimination and the RV Lead Noise Discrimination features. This includes:</p> <ul style="list-style-type: none"> □ Improvement to the Discrimination feature's performance for subjects who have T-Wave Oversensing (TWOS) in the presence of large-amplitude R-waves. The feature improvement has no impact to the feature safety (i.e. VT/VF sensitivity). □ Improvement to the RV Lead Noise Discrimination feature to enhance the ability of the device to recognize lead noise by allowing Lead Noise algorithm processing to occur when the underlying rate is too fast for the TWave Discriminator feature to withhold detection. These modifications do not alter the method of discrimination between Lead Noise and VT/VF and have no impact on the Lead Noise feature's safety (i.e., VT/VF sensitivity).

LEAD REVIEWER COMMENTS: *A clarification question was interactively sent to the sponsor regarding the Shipping/Nominal Parameter Settings and was resolved. This information was found to be acceptable.*

INDICATIONS FOR USE

The indications for use (IFU) for the Evera devices are the same as FDA-approved indications for the Protecta XT and Protecta ICDs (P980016/S211, approved March 25, 2011; P980016/S218, approved November 9, 2011; and P980016/S280, approved May 2, 2012). It should be noted that since the Protecta devices received approval and after some negotiations with FDA, Medtronic has agreed to remove the indications regarding the atrial intervention features in legacy products and future products. Therefore, the Evera devices do not include the following statement that was included in the original Protecta IFUs:

Atrial rhythm management features such as Atrial Rate Stabilization (ARS), Atrial Preference Pacing (APP), and Post Mode Switch Overdrive pacing (PMOP) are indicated for the suppression of atrial

tachyarrhythmias in ICD-indicated patients with atrial septal lead placement and an ICD indication.

EVERA XT DR MODEL DDBB1D4 AND EVERA XT DR MODEL DDBB (same IFU as Protecta XT DR D314DRG ICD and Protecta XT DR D314DRM ICD, with the removal of the atrial intervention features indication)

“The Evera XT DR system is indicated to provide ventricular antitachycardia pacing and ventricular defibrillation for automated treatment of life-threatening ventricular arrhythmias in patients with NYHA functional class II/III heart failure. In addition, the device is indicated for use in the above patients with atrial tachyarrhythmias, or those patients who are at significant risk of developing atrial tachyarrhythmias.

Notes:

- The ICD features of the device functions the same as other approved Medtronic market-released ICDs.
- Due to the addition of the OptiVol diagnostic feature, the device indications are limited to the NYHA functional class II/III heart failure patients who are indicated for an ICD.
- The clinical value of the OptiVol fluid monitoring diagnostic feature has not been assessed in those patients who do not have fluid retention related symptoms due to heart failure.
- The use of the device has not been demonstrated to decrease the morbidity related to atrial tachyarrhythmias.
- The effectiveness of high-frequency burst pacing (atrial 50 Hz Burst therapy) in terminating device classified atrial tachycardia (AT) was found to be 17%, and in terminating device classified atrial fibrillation (AF) was found to be 16.8%, in the VT/AT patient population studied.
- The effectiveness of high-frequency burst pacing (atrial 50 Hz Burst therapy) in terminating device classified atrial tachycardia (AT) was found to be 11.7%, and in terminating device classified atrial fibrillation (AF) was found to be 18.2% in the AF-only patient population studied.”

EVERA S DR DDBC3D4 AND DDBC3D1 (same IFU as Protecta DR D334DRG ICD and Protecta DR D334DRM ICD, with the removal of the atrial intervention features indication)

“The Blackwell ICD-DR system is indicated to provide ventricular antitachycardia pacing and ventricular defibrillation for automated treatment of life-threatening ventricular arrhythmias. In addition, the device is indicated for use in the above patients with atrial tachyarrhythmias, or

those patients who are at significant risk of developing atrial tachyarrhythmias.

Notes:

- The use of the device has not been demonstrated to decrease the morbidity related to atrial tachyarrhythmias.
- The effectiveness of high-frequency burst pacing (atrial 50 Hz Burst therapy) in terminating device classified atrial tachycardia (AT) was found to be 17%, and in terminating device classified atrial fibrillation (AF) was found to be 16.8%, in the VT/AT patient population studied.
- The effectiveness of high-frequency burst pacing (atrial 50 Hz Burst therapy) in terminating device classified atrial tachycardia (AT) was found to be 11.7%, and in terminating device classified atrial fibrillation (AF) was found to be 18.2% in the AF-only patient population studied.”

EVERA XT VR DVBB1D4 AND DVBB1D1 (same IFU as Protecta XT VR D314VRG ICD and Protecta XT VR D314VRM ICD)

“The Evera XT VR system is indicated to provide ventricular antitachycardia pacing and ventricular defibrillation for automated treatment of life-threatening ventricular arrhythmias in patients with NYHA functional class II/III heart failure.

Notes:

- The ICD features of the device functions the same as other approved Medtronic market-released ICDs.
- Due to the addition of the OptiVol diagnostic feature, the device indications are limited to the NYHA functional class II/III heart failure patients who are indicated for an ICD.
- The clinical value of the OptiVol fluid monitoring diagnostic feature has not been assessed in those patients who do not have fluid retention related symptoms due to heart failure.”

EVERA S VR DVBC3D4 AND DVBC3D1 (same IFU as Protecta VR D334VRG ICD and Protecta VR D334VRM ICD)

“The Evera S VR system is indicated to provide ventricular antitachycardia pacing and ventricular defibrillation for automated treatment of life-threatening ventricular arrhythmias.”

*All of the Evera ICD devices contain the Lead Integrity Alert (LIA) feature. The LIA indication is provided in the Evera DR ICD and Evera VR ICD Reference Manuals.

CARELINK MONITOR MODEL 2490C/CARDIOSIGHT READER MODEL 2020A/CARELINK EXPRESS MONITOR MODEL 2020B

Indications for the CareLink Monitor Model 2490C, CardioSight Reader Model 2020A and the CareLink Express Monitor Model 2020B are unchanged and are located in the “Patient Management and Monitoring” section of this memorandum.

DEVICE DESCRIPTION

The Evera single chamber (VR) and dual chamber (DR) Implantable Cardioverter Defibrillators (ICD) are multi-programmable cardiac devices that monitor and regulate a patient’s heart rate by providing single or dual chamber rate-responsive bradycardia pacing, ventricular tachyarrhythmia therapies, and/or atrial tachyarrhythmia therapies. The subject of this submission is focused on the Evera DR (Two IS-1/Two DF-1 and One IS-1/One DF4) and VR (One IS-1/ Two DF-1 and One DF4) devices.

SYSTEM DESCRIPTION

The Evera system is comprised of the following components:

- ICD DR and VR devices listed in the submission
- SW016 Software Application
- CareLink Programmer Model 2090 (P890003/S080, approved February 18, 2005)
- Conexus Activator Model 27901 (P010031/S031, approved May 12, 2006)
- CareLink Monitor Model 2490C and 2491 Device Data Management Application (DDMA) (P890003/S102, approved August 31, 2006)
- 2020A CardioSight Reader (P890003/S082 number, approved July 25, 2005)
- 2020B CareLink Express Monitor (PS90003/S228, approved August 25, 2011)
- InCheck Patient Assistant Model 2696 (P980050/S002, approved February 13, 2001)
- Commercially available pace/sense and cardioversion/defibrillation leads, and the same commercially available implant support instruments and accessories used with the Evera system.

FIRMWARE CHANGES

Similar to the approved Protecta XT/Protecta device firmware, the Evera firmware was modified to support new and modified features in the Evera devices. The changes made to currently-approved firmware functionality and a review of the testing performed to support the safety and effectiveness of the modified firmware is included in the “Firmware” section of this memorandum.

SOFTWARE CHANGES

Similar to the approved Protecta XT/ Protecta device software application, the Model 009 software application (P010031/S171, approved March 25, 2011) served as a baseline to create the Evera software application (Model SW016). This existing software was modified to support new and modified features in the Evera devices. The changes made to currently-approved software functionality and a review of the testing performed to support the safety and effectiveness of the modified software is provided in the "Software" section of this memorandum.

MANUFACTURING

The Evera devices will be manufactured at the facilities identified in the table below. These are the same manufacturing facilities that are approved for the Protecta devices (P010031/S171 and P980016/S211, approved March 25, 2011).

<div>(b)(4) Trade Secret</div>	Most Recent FDA Inspection: January 11 – February 1, 2012 No 483 Observations
	Most Recent FDA Inspection: April 4-May 11, 2011 This 2011 inspection had a 483 issued with 4 observations
Cardiac Rhythm Disease Management <div>(b)(4) Trade Secret</div>	Most Recent FDA Inspection: June 18-21, 2012 No 483 Observations

(b)(4) Trade Secret		
		<p>Most Recent FDA Inspection:</p> <p>November 16-19, 2009</p> <p>No 483 Observations</p>

LEAD REVIEWER COMMENTS: *The firm provided the names and address of the manufacturing facilities in Table 1-17(as seen above) of the submission. These facilities are approved manufacturing sites and have not undergone any changes since previous submissions. Additionally, none of these manufacturing sites appear on the OAI list. This information is acceptable.*

MANUFACTURING PROCESSES FOR EVERA DEVICES

The device manufacturing process flow for the Evera devices is exactly the same as that of the Viva/Brava devices, approved on January 29, 2013 (P010031/S318). A mechanical engineer reviewed the manufacturing process flow, manufacturing process steps and their changes from Protecta device manufacturing steps and finds them acceptable. His review comments can be found below.

CONSULTANT COMMENTS: *There were very minor changes to the manufacturing process of the Viva/Brava/Evera devices compared to the manufacturing process for the Protecta devices. Such changes include*

(b)(4) Trade Secret

Based on the Device Manufacturing Process Flow chart and the Device Manufacturing Process Steps table provided in the submission, there are no significant changes to the approved manufacturing process. All process qualifications appear to have been successfully completed.

LEAD REVIEWER COMMENTS: *Based on the engineer's review of the changes in the manufacturing processes for the Viva/Brava/Evera devices, I believe they are acceptable based on the reasoning presented above. I have no further concerns with this section of the review.*

MANUFACTURING PROCESS FOR EVERA BATTERY (MECC)

The manufacturing process for the Evera battery is identical to the Viva/Brava devices. This process is carried out at Medtronic's vertically integrated supplier Medtronic Energy and Component Center (MECC) and does not appear to be

significantly different than the manufacturing process for Protecta battery. Figure 1-19 in the submission provides a high-level overview of the manufacturing process flow for the Evera battery. Again, a mechanical engineer reviewed the Viva/Brava/Evera battery manufacturing process and his comments can be found below.

CONSULTANT COMMENTS: *There were very minor changes to the manufacturing process of the Viva/Brava/Evera battery compared to the manufacturing process for the Protecta battery. Such changes include*

(b)(4) Trade Secret

. Based on the process flow chart and the description provided in the submission, there are no significant changes to the approved manufacturing process. All process qualifications appear to have been successfully completed.

LEAD REVIEWER COMMENTS: *Based on the mechanical engineer's reasoning, I find the manufacturing process for the Evera battery to be acceptable.*

MANUFACTURING PROCESS FOR EVERA CAPACITOR (MECC)

The manufacturing process for the Evera capacitor is identical to the capacitor manufacturing flow for the approved Viva/Brava devices. The process, carried out at Medtronic's vertically integrated supplier Medtronic Energy and Component Center (MECC), appears somewhat different than the manufacturing process flow for the Protecta capacitor. The mechanical engineer provided an analysis of the capacitor manufacturing process for the Viva/Brava/Evera capacitor and his comments can be found below.

CONSULTANT COMMENTS: *The changes to the manufacturing process are largely dictated by the*

(b)(4) Trade Secret

Based on the design changes described in the submission, they appear to have been reflected in the manufacturing process changes. Based on the process flow chart and the description provided in the submission, the firm adequately described the manufacturing process for the capacitor. All process qualifications appear to have been successfully completed. I have no concerns with this section of the review.

LEAD REVIEWER COMMENTS: *Based on the engineer's acceptance of the Viva/Brava/Evera capacitor manufacturing process, I believe this information is acceptable.*

MANUFACTURING PROCESS FOR VIVA / BRAVA DF4 CONNECTOR (MECC)

The manufacturing process for the Evera DF4 connector is identical to the Viva/Brava DF4 connector and does not appear significantly different than the manufacturing process for Protecta DF4 connector. The submission provides a high-level overview of the manufacturing process flow for the Evera DF4 connector. The mechanical engineer has reviewed this process and his comments can be found below.

CONSULTANT COMMENTS: There were very minor changes to the manufacturing process of the Viva/Brava/Evera connector as compared to the manufacturing process for the Protecta connector. Based on the process flow chart and the description provided in the submission, there are no significant changes to the approved manufacturing process. All process qualifications appear to have been successfully completed

LEAD REVIEWER COMMENTS: Based on the engineer's acceptance of the Viva/Brava/Evera connector manufacturing process, I believe this information is acceptable.

MANUFACTURING CHANGES

CHANGES MADE AFTER DESIGN ASSURANCE UNIT BUILDS

The firm provided changes that were made after the Design Assurance Units (DAU) were built for testing. These changes were tested independently to ensure that there was no impact to safety or effectiveness. These changes were organized into groups to facilitate review.

Category A: Changes that depend upon test data to demonstrate that there was no impact to safety and efficacy.

The mechanical engineer provided a consult to review these changes and his review comments can be found below.

CONSULTANT COMMENTS: I have reviewed all of the changes as well as the testing to support the described changes. The majority of the changes appear to be improvements in the manufacturing based upon lessons learned from the Design Assurance Units (DAU). The firm has provided adequate testing of each of the changes that provide reasonable assurance that changes do not affect the safety and effectiveness of the devices. In addition, there appears to be process monitors and downstream activities to verify the effectiveness of these changes. I have no further concerns with the Category A changes.

Category B: Changes that do not depend upon test data to establish no impact to safety or efficacy. Because these changes do not depend upon test data to

demonstrate that there is no impact to safety and efficacy test data is not included in this submission for the Category B changes.

CONSULTANT COMMENTS: *I have reviewed all of the changes provided within this category and agree that the changes do not require test data. Many of the changes are changes in manufacturing setup procedures, clarifications to manufacturing work instructions, inspection clarifications, and drawing clarifications. I feel the firm has provided sufficient information to confirm that the changes provide reasonable assurance that the safety and effectiveness is not impacted. In addition there appears to be process monitors and downstream activities to verify the effectiveness of these changes. I have no further concerns with the Category B changes.*

LEAD REVIEWER COMMENTS: *Based on the engineer's assessment of the Category A and B changes, I believe this information is acceptable.*

MANUFACTURING CHANGES APPROVED ON PREDECESSOR PRODUCTS

The sponsor has provided several manufacturing changes that have been previously approved by FDA on the predecessor products and are applicable to the Evera ICDs covered in this supplement.

The changes pertain to the same manufacturing processes and the same components that are used to manufacture the Evera ICDs. There are no changes included that are specific to the Evera design. These manufacturing changes do not require additional testing to support use with the Evera products and do not require additional documentation to be submitted for FDA review.

It should be noted that:

- There are no increased patient risks associated with these changes
- These changes do not impact device performance
- These changes are not being made due to any field actions

These changes have been reviewed by a mechanical engineer and his review comments can be found below.

CONSULTANT COMMENTS: *I have reviewed the changes that are approved on predecessor products and the introduction of this new family of devices does not appear to increase patient risks associated with these changes. Additionally, these changes do not appear to impact device performance. The changes appear to be for process improvement, yield improvement and/or supply chain risk mitigation. Since all changes have been successfully tested on previous products and no new or increased risks appear to have been identified, I have no further concerns.*

***LEAD REVIEWER COMMENTS:** Based on the consultant's assessment of these manufacturing changes, I have no outstanding concerns and therefore find this information acceptable.*

ANNUAL REPORTABLE CHANGES

The sponsor has provided annual reportable changes, which are traditionally reported in the "Changes Reported Pursuant to 21 CFR 814.39(b)" section in standard PMA annual reports. These are minor modifications made to the sponsor's devices which were not submitted as PMA supplements because the sponsor believes they do not affect the safety or effectiveness of the device and do not impact the Conditions of Approval listed in the FDA approval letters. This section of the submission provides the annual reportable changes that impact the Evera devices.

The firm's decision to include annual reportable changes in this supplement was driven by a consultation involving FDA reviewers and management in the Implantable Electrophysiological Devices Branch (IEDB) and PMA staff. Specifically, FDA has requested that "submissions for a new model should include a 'manufacturing changes section' where you list all new, pending and previously accepted annual-reportable changes that were not used to manufacture the tested devices but will be incorporated when the device is approved and marketed."

Many of the changes submitted in this supplement are identical to those submitted in the Viva/Brava PMA-S and were found acceptable in the review of that supplement. For the new changes that only affect the Evera devices, the mechanical engineer provided a consult to review these changes. These changes include minor clarifications, updated work instructions, minor enhancements to manufacturing processes, etc.

***LEAD REVIEWER COMMENTS:** Based on the mechanical engineer's review, I believe that these changes appear to be appropriate as annual reportable and do not appear to impact the safety and effectiveness of the device. This information is acceptable.*

PRECLINICAL/BENCH

BIOCOMPATIBILITY/MATERIALS

BIOCOMPATIBILITY

The Evera dual chamber and single chamber ICD family of devices is composed of tissue-contacting materials and components that have the potential for direct and/or indirect patient body tissue/fluid contact. This is the same for all the models in the Blackwell (Viva/Brava/Evera) family of devices. Therefore the biocompatibility documentation submitted in this PMA-S is identical to the

documentation that was submitted for the approved Viva/Brava 180-day PMA-S (P010031/S318).

The firm provided a list of materials and their corresponding device components in the submission. The firm has performed biological safety testing on each of these materials separately and provided data to show the safe history of clinical use of each material in currently market-approved devices. This testing used the "ISO 10993-1:2009 Biological Evaluation of Medical Devices Part 1: Evaluation and Testing" as a guide for evaluation and assessment. The history of use of the materials in predicate devices, existing biological safety test data available for the materials, and additional biological safety testing, chemical characterization, and toxicological risk assessment showing no additional biological safety concerns resulting from the connector module processing, demonstrate acceptable biological safety risk for the Viva/Brava/Evera devices as guided by ISO 10993-1:2009. The biocompatibility study was conducted in compliance with U.S. Food and Drug Administration Good Laboratory Practice regulation set forth in 21 CFR Part 58.

Because of the addition of the new (b)(4) Trade Secret) connector module, focused chemical characterization and biological safety testing was performed on the new connector module and detailed in an evaluation report included in the submission.

The new (b)(4) Trade Secret material is a widely used polymer that has an established history of safe clinical use in Medtronic devices. However, this material has not been used in this application (device connector module) in predicate devices; it has been used in more invasive applications such as transvenous leads. The (b)(4) Trade Secret as used in Viva/Brava/Evera devices is processed equivalently to the (b)(4) Trade Secret in the predicate devices with the addition a cleaning process. Therefore, an analysis was performed on connector modules to assess the biological safety of the material. The results of this testing determined that none of the extractables or toxic leachables were present in quantities that would pose a health risk to the patient.

LEAD REVIEWER COMMENTS: Although the sponsor has not submitted biocompatibility testing for the finished device, I do not think it is necessary because the Evera devices use the same materials and manufacturing processes as the predecessor device, with the exception of the (b)(4) Trade Secret cleaning process. The firm has provided adequate testing to support the cleaned (b)(4) Trade Secret produces similar biological safety results as the predicate connector module. Results for these and previous biological safety tests and the material characterization appear to demonstrate the biological safety of the cleaned Evera connector module. The (b)(4) Trade Secret has been used in other market approved devices and the addition of the cleaning process does not appear to affect the overall biocompatibility of the connector module. Therefore, I believe the

previous biological safety testing and history of use data is appropriate to support the biological safety of the cleaned Blackwell connectors. I have no further concerns with this section of the submission.

PACKAGING

The outer packaging and inner tray seal for the Viva/Brava/Evera product family are identical to the D2 platform, approved March 17, 2008, via P010031/S084, P980016/S114 and P890003/S131. The firm conducted packaging tests to verify that the packaging protects the device and media during transportation and storage. A specific device model in the OUS packaging configuration was used as the test vehicle as it appears to be the worst case packaging configuration. This was based on the fact that this configuration has the most amount of literature in the package and the device has the greatest mass.

A (b)(4) Trade Secret package samples for package qualification test samples were built to demonstrate 90% reliability at a 90% confidence interval. Package assembly builds were assembled per standard assembly processes, with the exception of marking the test samples for traceability and marking them "Not for Human Use". Additionally, during manufacturing, sterile package assemblies were subjected to (b)(4) Trade Secret sterilization and aeration (maximum allowed sterilization which represents the worst case package degradation) according to Medtronic Specification and using the maximum process parameters. The temperature in the chamber was recorded (measured by a chart recorder). Personnel from Packaging Engineering or Manufacturing performed and documented a visual inspection of the sterile package seals after the last sterilization/aeration cycle, and any anomalies were reported to the Reliability Engineer.

Two deviations from the plan were noted and one issue was found during the package testing. The deviations resulted in updates to reports and test software initially listed in the test plan. The issue observed was mitigated by the fact that the device remained successfully protected and passed functional tests.

The package design verification testing was successfully completed. All package device environmental specification requirements were met and thereby readiness for device use in clinical and market applications was established.

***LEAD REVIEWER COMMENTS:** The test protocol, sample size, and results are acceptable for verifying that the packaging is sufficient for protecting and housing the device. The firm stated the packaging is identical to a previously approved device except for the shape of the inner tray. This configuration appears to provide the worst case shipping scenario for the device based on the mass of the package. FDA noted the two deviations from the protocol, but does not have any concerns with them. The outer packaging still appears to adequately protect the contents in the inner package with the updated specification. I have no other concerns with the packaging of this device.*

SHELF LIFE

The firm states the packaged and sterile Evera devices are labeled with an 18-month shelf life. The shelf life evaluations addressed integrity of the sterile barrier system and reduction in projected service life during shelf storage.

The Blackwell System Requirements Document contains the following shelf life description (the term “Blackwell” refers to the Viva/Brava/Evera device families):

- The device Shelf Life (for purpose of “Use By” labeling) shall be 18 months calculated from the date of manufacture, defined as the time of battery attach.
- The “typical shelf storage time” for estimation of longevity shall be defined as 5 months for both low voltage devices (IPG) and high voltage devices (ICD) at nominal shipping parameters and no-load current drain.

The D2 Shelf Life assessment (as documented in the approved P010031/S084, P980016/S114 and P890003/S131) demonstrated support for assignment of an 18-month shelf life to the D2 product family. The Blackwell product family derives its packaging from the D2 product platform. The outer packaging and inner tray seal for the Blackwell product family are identical to the D2 platform. The only change for the Blackwell platform’s packaging is the inner tray cavity which now accommodates the new shape of the Blackwell device. The change to the inner tray cavity did not change the seal design of the inner tray. Based on this, and the testing results documented in Blackwell Device DAU Packaging Design Verification Report, the D2 Shelf Life assessment for the purpose of a device “Use By” date appears to apply to the Blackwell models by equivalency.

The mechanical testing outlined in the documents, Blackwell Device DAU Mechanical Design Verification Report, Blackwell DAU Packaging Design Verification Report, and Blackwell Device DAU Mechanical Design Equivalency Report appears to prove that the device can withstand an 18 month shelf-life. The devices were subjected to accelerated shelf life testing and it was confirmed that the devices still perform per specification after the testing was complete.

The longevity analysis conducted for the Blackwell project is contained in the document Blackwell Longevity and Charge Time Summary. This analysis assumed a standard shelf-life of 5 months. If a device experiences a worst case shelf life of 18 months, it will reduce Projected Service Life (PSL) by 6.5%, depending on device parameters and pacing impedance, compared to values published in the Blackwell manuals. The CRT case examined in this analysis appears to represent a worst case for Blackwell devices.

The documentation provided for the Evera shelf life assessment is identical to the documentation submitted for approved Viva/Brava PMA-S.

LEAD REVIEWER COMMENTS: *This shelf life review for the Evera devices was based on the testing of the packaging and mechanical performance. Because the firm is using nearly identical outer packaging and inner tray seal for the Blackwell product (as the approved D2 platform), I have no concerns with the shelf life test report and analysis. The only difference in the packaging is the shape of the inner tray cavity to accommodate the new shape of the Blackwell device, which does not significantly alter the integrity of the package. The accelerated shelf life testing and mechanical testing, combined with the similarity to the D2 platform are appropriate for supporting the 18 month shelf life.*

A consult was issued for the longevity estimates to a battery expert consultant. The sponsor provided that shelf life tests at room temperature for the battery, with durations of 1 month, 2 months, 3 months, 6 months, and 12 months, were to be performed, however the full 12 month data set has not accumulated at the time of the FDA decision date for this supplement. Therefore, this data will be requested as a condition of approval in the final correspondence sent to the sponsor.

STERILIZATION

The sponsor confirms that the sterilization for the Evera devices is the same as approved sterilization for currently FDA-approved Medtronic implantable devices. Therefore, the firm has provided qualification rationale documentation in which the Evera devices are compared to existing “qualified devices” to show that no additional sterilization testing is required for the Evera devices. Additionally, to comply with the updated standard (ISO 10993-7: 2008), irritation testing was performed to demonstrate negligible irritation as specified in ISO 10993-10. The documentation provided is identical to the documentation submitted for the approved Viva/Brava devices. As documented in the sterilization report, all testing passed.

LEAD REVIEWER COMMENTS: *Based on the information provided in the submission, I believe the subject devices have been successfully qualified by equivalency into the current sterilization processes for the sponsor’s currently approved implantable devices. This information is acceptable.*

ANIMAL STUDIES

No animal studies were submitted to support the review of the Evera devices.

ELECTRICAL SAFETY/EMC

ELECTRICAL DESIGN VERIFICATION

The firm conducted testing on a device which was described as the “worst case” scenario for the Viva/Brava/Evera family of devices. The sponsor conducted some testing of the Evera device in areas where the design differed from the worst-case device. The sponsor also provided “model” specific testing, which incorporates system level testing on devices that configured as final devices. This testing applies the software configuration of the final device. This allows the sponsor to use the most complex device for the majority of testing and still provide configuration specific tests to ensure proper functionality.

The sponsor also provided a complete Design Verification Testing (DVT) of the new capacitor. The sponsor notes that there were some issues with the capacitor DVT, but provided rationale to explain these issues.

An electrical engineer reviewed the Electrical Design Verification by assessing the testing performed for several changes to the Evera devices from the Protecta/Protecta XT device models (see “New and Modified Features” and “Hardware and Mechanical Subsystem Testing” for a description of these changes) which are compared in detail in the submission. He focused his review on the following changes: Change from Telemetry C to Telemetry M, Patient Alert (PA) Flex, Electronic Module Assembly (EMA/Hybrid), Integrated Circuits (IC), High Voltage Capacitor (detailed review can be found in the following “Capacitor” section of this memo), and Programmable Parameters. Because much of the information regarding the EDVT is similar, if not identical, to the Viva/Brava EDVT, much of the engineer’s review was leveraged from his review of the Viva/Brava submission. During his previous review of the Viva/Brava EDVT, several concerns arose that were resolved interactively, and the engineer believes that the sponsor’s justification for these concerns can be applied to the Evera EDVT as well.

However, the engineer found a new issue during his review of the Evera EDVT regarding (b)(4) Trade Secret that does not apply to the Viva/Brava devices. Therefore, FDA attempted to resolve this issue interactively by sending the a deficiency to the sponsor via e-mail on December 4, 2012.

The sponsor responded to this deficiency via e-mail on December 5, 2012. After review of the sponsor’s reply, the engineer did not feel that the deficiency was addressed adequately, and a clarified deficiency was sent to the sponsor with specific requests for Capacitor Design Verification testing. This deficiency was included in the December 11, 2012 Major Deficiency Letter.

The sponsor responded to this deficiency in Amendment 1. An electrical engineer was again consulted to review this response. His review comments can be found below.

CONSULTANT COMMENTS: *The sponsor provided specific Capacitor Design Verification requested in the deficiency. The sponsor also added additional real time and accelerated data on the plot. This data was collected outside of the DVT testing. In summary, I feel that the sponsor had adequately addressed this deficiency. There are no further concerns.*

LEAD REVIEWER COMMENTS: *I agree with the engineer's assessment that the sponsor adequately addressed the deficiency. I have no further concerns with this section of the review.*

BATTERY MODELING

The sponsor provided the Evera battery longevity projections and described the methods of calculating the longevity projections used for labeling. Evera uses the same method to calculate longevity projections as was used for Protecta family of devices.

The Evera battery (referred to as the H3 battery) uses (b)(4) Trade Secret chemistry. It contains (b)(4) Trade Secret as part of cathode mix with a (b)(4) Trade Secret coating on the cathode current collector. The Evera battery is (b)(4) Trade Secret whereas the Protecta battery is (b)(4) Trade Secret.

The longevity model uses the battery model and circuit model to produce the longevity projections used in longevity labeling. Each longevity value was computed by performing (b)(4) Trade Secret random simulations (Monte Carlo simulation) using variability contained within the battery and circuit models.

LEAD REVIEWER COMMENTS: *A consult was issued to a battery engineer to review the battery modeling for the Evera devices. Because much of the information provided for the Evera battery is similar, if not identical, to the Viva/Brava battery, the engineer stated that his review of the Viva/Brava submission can be applied to the Evera devices. The reviewer had an initial concern during his review, which was resolved interactively, regarding the specifics of the battery longevity model. The sponsor provided a response that included justification and a supplemental test report – R139676. The reviewer had follow-up questions regarding this report that were incorporated into the December 11, 2012 Major Deficiency Letter. Additionally, the reviewer had noted concerns with the battery longevity estimate in his review of the Viva/Brava submission and found many of the same concerns for the Evera battery longevity estimate as well as new concerns that independently apply to the Evera submission. Deficiencies were sent regarding these concerns in the Major Deficiency letter as well.*

The sponsor responded to these deficiencies in Amendment 1, which was subsequently reviewed by the same engineer. Review of Amendment 1 led to several follow up questions sent to the sponsor via e-mail on March 8, 2013. However, the engineer had additional concerns with the responses to these follow up questions, and so a teleconference was held on March 26, 2013. The sponsor sent a clarification document to guide the discussion on battery self-discharge. In this discussion, the sponsor discussed their calculations for battery self-discharge. Based on the conversation, the engineer requested that the sponsor submit explanations for the amount of current drain used to measure battery self-discharge (and how these amounts relate to real-life situations) and another sensitivity analysis calculation to show that the Upper 95% value of the confidence interval can still provide an acceptable calculated self-discharge rate which will not affect the device labeling longevity estimates. I asked the sponsor to provide justification that there are safety mitigations in place to account for patient safety if the battery discharges faster than the calculated rate.

A final round of interactive review proceeded as the battery engineer had two minor clarification questions regarding the responses sent by the sponsor following the teleconference. I believe that the sponsor has adequately addressed the battery concerns, as they have shown that their calculated self-discharge rate is the best estimation they can get with the 4-5 years of data they currently have. Also, they have provided safety features already built into the device that can detect if a battery needs to be replaced. Finally, the sponsor has stated that worst case self-discharge and worst case device analysis would not impact the longevity labeling. The battery engineer believes the information is acceptable and recommends approval of this supplement with regards to the battery modeling. Based on the consultant's and my assessment of the sponsor's battery self-discharge calculations and appropriate safety mitigations in place, I have no further concerns with this information.

CAPACITOR

The Evera high voltage capacitor uses a wet electrolytic tantalum capacitor technology. This technology offers higher energy density than the aluminum electrolytic technology, but the voltage capability per individual capacitor is lower. Therefore, the capacitor assembly requires three single capacitors in series to achieve the required output voltage. The overall capacitor assembly size is reduced because each capacitor is smaller. In addition, the tantalum capacitor technology allows for shape flexibility.

The Evera high voltage capacitor has been designed for manufacturability and reliability. The testing was conducted first on the single capacitors and later on the capacitor triple configuration. The test plan and report contain results for both the single and triple testing.

The Evera high voltage capacitor is identical to the Viva/Brava high voltage capacitor. The sponsor made minor deviations from the Viva/Brava test plan, however these deviations did not detract from the overall testing of the capacitor. An electrical engineer reviewed the documentation regarding the high voltage capacitor in this submission and a summary of his review can be found below.

LEAD REVIEWER COMMENTS: To summarize the engineer's review, the information provided was acceptable. The reviewer leveraged most of his review for this section from his review of the Viva/Brava capacitor, which is identical to that of the Evera devices. Several issues were found during his initial review of the capacitor and were resolved interactively via e-mail correspondence in September 2012. He believes that these resolutions can be applied to the Evera devices. Therefore, the engineer believes that the sponsor adequately addressed the issues and finds no outstanding concerns with the high voltage capacitor. I agree with the reviewer's assessment and have no further concerns.

EMC DESIGN VERIFICATION/TELEMETRY

Electromagnetic compatibility (EMC) testing was performed to verify that the device maintained appropriate functionality of intracardiac signal sensing with stresses imposed by radiation environments and to verify compliance to ISO 14706-6, EN45502-2-2 and device labeling. This testing was done for the worst case physical configuration model. This is deemed the most fully featured model of the product family, and as such, the full EMC test regimen was performed on this model prior to testing other device models. This was done in order to avoid redundant testing. The test model is sufficiently similar in design to the other models of the Evera product family and the testing was qualified by equivalency to this worse case physical configuration of this family of devices.

LEAD REVIEWER COMMENTS: A consult was issued to an EMC expert consultant to review the EMC design verification testing and Telemetry for the Evera devices. Because much of the documentation is similar, if not identical, to the Viva/Brava submission, the consultant cited his review and deficiencies from his Viva/Brava EMC consult. His concerns with the EMC and Telemetry for the Viva/Brava devices included clarification on exposure to modulated fields from 16.6Hz to 450Hz as well as susceptibility to RFID and EAS. The consultant also noted that during a pre-IDE discussion the firm was asked to provide the anticipated testing for when the firm enables the Telemetry M capability within this submission. The firm did not include this anticipated testing. Finally, the consultant found a new concern in his review of the Evera EMC testing found in document DSN007969, which was not included in the Viva/Brava submission. Deficiencies were sent to the sponsor regarding these issues in the December 11, 2012 Major Deficiency letter.

These deficiencies were addressed in Amendment 1, which was again reviewed by the EMC consultant. He had one remaining follow-up question regarding the information provided in Amendment 1, which was sent to the sponsor interactively (via e-mail) on March 8, 2013. The sponsor provided a response on March 14, 2013, which was again reviewed by the consultant. The consultant found this response acceptable. I have no further concerns with this section of the review.

MECHANICAL SAFETY

CONNECTOR MODULE DESIGN ASSURANCE UNIT (DAU) TESTING

The purpose of connector testing was to verify that the connector, or header, will maintain functional integrity throughout the life of the device. The verification was done both for mechanical and electrical performance of the connector.

Mechanical testing included fatigue, strength, insertion/withdrawal, suture hole, retention force, setscrew requirements and bore dimensioning tests. Electrical testing included leakage impedance, electrical isolation, absolute contact resistance, variable contact resistance and current carrying tests. These tests were preceded by the pre-conditioning and were performed on the worst case physical models for each connector.

The Evera connector will use (b)(4) Trade Secret material. The (b)(4) Trade Secret material is more transparent than previous material and a thorough review of the new material's biocompatibility is provided in the "Biocompatibility" section of this memo. A review of the connector module testing is provided below.

VIVA/BRAVA CONNECTOR MODULE

The firm provided the test plan and test report for the Viva/Brava Connector Module. This device is not the subject of this submission, but it is being used to qualify the devices under this submission. Per environmental specification provided by the firm, verification required a (b)(4) Trade Secret devices for these tests. Zero failures in a sample size (b)(4) Trade Secret demonstrate 90% reliability at a 90% confidence level. A mechanical engineer provided a consult for the testing of the connector module and his review comments are copied below:

CONSULTANT COMMENTS: Although this submission is not seeking approval for the test devices, I feel it is necessary to comment on the testing provided as it will be used to qualify the Blackwell DR (IS-1/DF4) and VR (DF4) by equivalency. The test plan, preconditioning, sample size, and tests results for the Viva/Brava Connector Module are appropriate for demonstrating the safety and effectiveness of the device. I agree with the firm's assessment of this connector module as the worst case due to the number of feedthroughs and the analysis provided. The increased number of feedthrough pins appears to produce the most wire stresses during

fatigue and strength conditions. The firm provided a description of the deviations from the test plan and issues observed during the testing, along with adequate descriptions of the deviations as well as resolutions to the issues. I have reviewed all of the deviations and feel the firm addressed the issues appropriately and provided adequate corrections for the issues observed. All testing met the required specifications and I have no further concerns with this section of the review.

LEAD REVIEWER COMMENTS: *I agree with the mechanical engineer's assessment and have no further concerns with this section of the review.*

BLACKWELL DR (IS-1/DF4) AND VR (DF4)

The Blackwell DR (IS-1/DF4) and VR (DF4) connector models are being qualified by equivalency (QBE) to the testing conducted on a worst-case device, with the exception of a few attributes. These attributes require repeating a few tests, with the purpose of evaluating suture hole dimensions, insertion/withdrawal force, bore cavity dimensions, and High Voltage (HV) electrical isolation. Additionally, connector strength and fatigue performance was qualified by equivalence to the worst-case device.

The mechanical engineer has provided a consult for this testing and his review comments can be found below:

CONSULTANT COMMENTS: *I agree with the firm's rationale for qualification by equivalency to worst-case model connector because this connector produces the most feedthrough wire stresses during fatigue and strength conditions with an equivalent connector attachment footprint. However the firm has elected to repeat some the testing as stated above to further verify and validate the connector module design. All the remaining and repeated connector mechanical and electrical DAU tests (refer to figure above), with the exception of connector strength and fatigue, were verified via testing of the DR (IS-1/DF4) and VR (DF4) connector configurations. The remaining electrical and dimensional test plan (including preconditioning), sample size, and tests results for the DR (IS-1/DF4) and VR (DF4) Connector Modules were appropriate and adequate for demonstrating the safety and effectiveness of the device. The firm provided a description of the deviations from the test plan and issues observed during the testing. The firm provided adequate descriptions of the deviations as well as resolutions to the issues. All testing met the required specifications and I have no further concerns with this section of the review.*

LEAD REVIEW COMMENTS: *I agree with the mechanical engineer's assessment and have no further concerns with this section of the review.*

BLACKWELL DR (IS-1/DF-1) AND VR (IS-1/DF-1)

The Blackwell DR (IS-1/DF-1) and VR (IS-1/DF-1) connector are identical to Concerto/Virtuoso connectors. The testing provided in the submission shows that these connectors were qualified by equivalency to the already verified and market-released Concerto/Virtuoso product family for all connector mechanical DAU tests (with the exception of connector strength and fatigue testing). Connector strength and fatigue testing is being performed on the VR (IS-1/DF-1) configuration, which was determined by the firm through modeling to be the worst case configuration. Therefore, the Blackwell DR (IS-1/DF-1) connector models will be qualified by equivalency to a worst-case model for connector strength and fatigue performance.

The mechanical engineer has provided a consult for this testing and his review comments can be found below:

CONSULTANT COMMENTS: Since the Blackwell DR (IS-1/DF-1) and VR (IS-1/DF-1) connectors are identical to Concerto/Virtuoso connectors, I agree that they can be qualified by equivalency to the Concerto/Virtuoso product family. The test plan (including preconditioning, sample size, and tests results for the connector strength and fatigue testing of a worst-case device was appropriate and adequate for demonstrating the safety and effectiveness of the device. The testing conducted was thorough and well documented in the submission. The firm provided adequate descriptions of the deviations as well as resolutions to the issues found in the testing. All testing met the required specifications and I have no further concerns with this section of the review.

LEAD REVIEWER COMMENTS: I agree with the mechanical engineer's assessment and have no further concerns with this section of the review.

CAN MECHANICAL TESTING

The firm provided mechanical testing, which was completed to verify that the device Can will maintain functional integrity throughout the life of the device. The verification was done for a worst case physical Can configuration. The firm stated the Can mechanical tests were preceded by pre-conditioning activities. The testing used a minimum (b)(4) Trade Secret devices to demonstrate 90% reliability at a 90% confidence level. A flow chart describing the testing performed can be seen on the following page.

The test report for the Can mechanical testing is identical to the test report submitted for the Viva/Brava devices. A mechanical engineer provided a consult for this testing and his comments can be found below:

CONSULTANT COMMENTS: This test report was the identical test report submitted for the Viva/Brava devices (P010031/S318). Based on the design equivalency report, I agree that testing (except for physical

dimensions) for the Evera ICD Can assembly are appropriate to be qualified by equivalency to the worst-case test model. I have reviewed all test plan deviations and discrepancies that were identified. I believe that all issues have been resolved appropriately and there is no need to retest. There were no product performance anomalies that were observed during testing found in test data review and analysis. While the testing was largely acceptable, I had one overall concern with the information provided in the report as noted in the review of the Viva/Brava devices (P010031/S318). The firm stated in the submission that the mechanical testing was preceded by appropriate preconditioning activities. I was unclear on what the preconditioning activities were and asked the firm to provide this information. Since the Can testing provided in this submission is identical to the Viva/Brava submission (P010031/S318) the response provided by the firm for Viva/Brava was included in this review. This clarification provided adequately addresses my concerns about the preconditioning activities and can be applied to the Evera devices. There were no concerns with the dimensional verification for the Evera ICD devices.

LEAD REVIEWER COMMENTS: Based on the engineer's assessment, I believe the sponsor has adequately verified the functional integrity of the can through mechanical testing. This information is acceptable.

HEAT GENERATION

The firm provided heat generation testing to demonstrate the device's thermal performance. A sample size of three devices was used in order to demonstrate safe thermal performance. The test device used contains the same hardware and firmware as the Evera ICD Can assembly.

A mechanical engineer provided a consult for this section of the submission and his review comments can be found below.

CONSULTANT COMMENTS: The testing provided and the sample size are appropriate for demonstrating the thermal performance of the device. I was concerned with a low sample size; however, the Environmental Specification included in the submission provides adequate rationale for the sample size of three. This sample size rationale is appropriate given the non-destructive nature of the heat generation test. Also, past test history appears to indicate that these devices will respond similarly in these test environments. All of the testing was completed successfully and all of the requirements were met. The firm provided definitive pass/fail criteria for the testing. All test plan deviations and discrepancies were reviewed, and I believe they are acceptable. I have no further concerns with this section of the review.

LEAD REVIEWER COMMENTS: *Based on the consulting engineer's assessment, I believe the sponsor has adequately verified the thermal performance of the device through the heat generation testing. This information is acceptable.*

SYSTEM VALIDATION

System Verification is the functional testing of the system (device, programmer, CareLink) against system requirements. The full suite of Systems Engineering design verification testing performed included:

- System verification which is testing against the system level requirements.
- Model Configuration verification which verifies that the device model is configured via the normal manufacturing process using the device memory file input
- Regression Design Verification was performed utilizing ambulatory and follow-up scenarios to stress the functional capabilities of device operation

System validation is testing against user/stakeholder requirements and intended use scenarios. This testing was performed by evaluating the compatibility, interaction and functional operation of the system (device, programmer, CareLink and manuals) using typical and stressing simulated use scenarios covering all functions defined by the project. Also included in this testing was the device manual validation, which validated that the technical statements as written, were true and reflect the actual operation of the system.

A consult was issued to a consulting reviewer to review the System Verification and Validation. The information is identical to that which was submitted in the Viva/Brava PMA Supplement, which was also reviewed by the same consultant.

LEAD REVIEWER COMMENTS: *The consultant found the information within the Systems Engineering Design Verification Plan, the RV Lead Noise and T-wave Tape Testing Plan and Report, and the Systems Validation Test Report to be acceptable. I agree with the reviewer's assessment of the system verification and validation and have no further concerns with this section of the review.*

RISK MANAGEMENT

Formal risk analysis and risk assessment for the Evera systems was conducted according to the Blackwell System Risk Management Plan and in compliance with ISO 14971. The assessment included risk management of the application software, Model SW016.

This assessment concluded that the Evera system and corresponding products are safe and acceptable for patient implantable use from a safety perspective.

The field performance of the Protecta devices was used as a baseline for risk assessment, as these devices are the predecessors of the Evera devices. From that baseline, the sponsor evaluated the risk of each of the changes and associated hazard scenarios of the Evera devices from their predecessors.

It appears all identified system hazard scenarios have been either mitigated or are at an acceptable level of residual risk, and there is no incremental risk of critical harm due to the use of new or changed features, design, components, or processes of the Evera systems, over the device population life, as compared to legacy devices.

LEAD REVIEWER COMMENTS: The risk assessment seems adequate and I have no outstanding concerns with the results presented. This information is acceptable.

FIRMWARE/SOFTWARE

FIRMWARE

Similar to the approved Protecta XT/Protecta device firmware, the Evera firmware was modified to support new and modified features in these devices. Firmware functional level requirements were tested via firmware verification and were not model specific since the same code is used for all models in the subject product family.

LEAD REVIEWER COMMENTS: A consult was issued to a software engineer to review the firmware for the Evera devices. The reviewer states that the firmware information provided in this submission is identical to that which was submitted for the Viva/Brava devices. During the course of his review of the Viva/Brava devices, a deficiency regarding two missing verification tests was interactively sent to the sponsor and resolved. Therefore, there are no outstanding concerns with the firmware of the Evera devices based on the software engineer's Viva/Brava review. I agree with the reviewer's assessment of the firmware and have no further concerns with this section of the review. The reviewer recommended approval of the submission; however there are outstanding concerns in other sections of the review that need to be addressed prior to approval.

SOFTWARE

The CareLink Programmer Application software SW016 was planned, designed and implemented to be common throughout the Blackwell family of devices (Viva/Brava/Evera). Therefore, the documentation submitted in this supplement is identical to that which was submitted for the approved Viva/Brava 180-day PMA-S. A software engineer provided a thorough consult for SW016 in his review of the Viva/Brava devices, and found no outstanding issues with that software.

The following documents and test reports were submitted to support the SW016 in the Viva/Brava file: Software Description, Device Hazard Analysis, Software Requirements Specification (SRS), Architecture Design Description, Software Design Description, Traceability Analysis, Software Development Environment Description, Verification Test Reports, Revision Level History, and Software Anomalies.

In the engineer's review of the Evera software, he leveraged his review of the Viva/Brava software and believes this information is acceptable as it applies to the Evera devices.

LEAD REVIEWER COMMENTS: Based on the software engineer's review of the Viva/Brava software information, I believe the information is acceptable and can be applied to the Evera devices as the identical information was submitted for these devices. The sponsor has provided adequate information on the software characteristics, verification and validation. All anomalies have been properly assessed and addressed. I have no further concerns with this section of the review.

CYBER SECURITY/INFORMATION SECURITY

The system uses the same communication protocol as legacy ICD systems (Telemetry B– close proximity; Telemetry C – distance telemetry) which rely on close proximity to the patient to provide information security. During system validation testing, cyber security/information security was assessed as the sponsor believes that the stakeholders/users need the system to be secure.

LEAD REVIEWER COMMENTS: It is clear that the sponsor considered the potential threat of an information security breach in their design verification testing. This is further secured by the fact that, although Telemetry C is considered distance telemetry, it still relies on close proximity to the patient therefore helping to provide information security. This information is acceptable.

CLINICAL DATA

There was no clinical data submitted for the Evera devices. However, labeling was reviewed by a clinician.

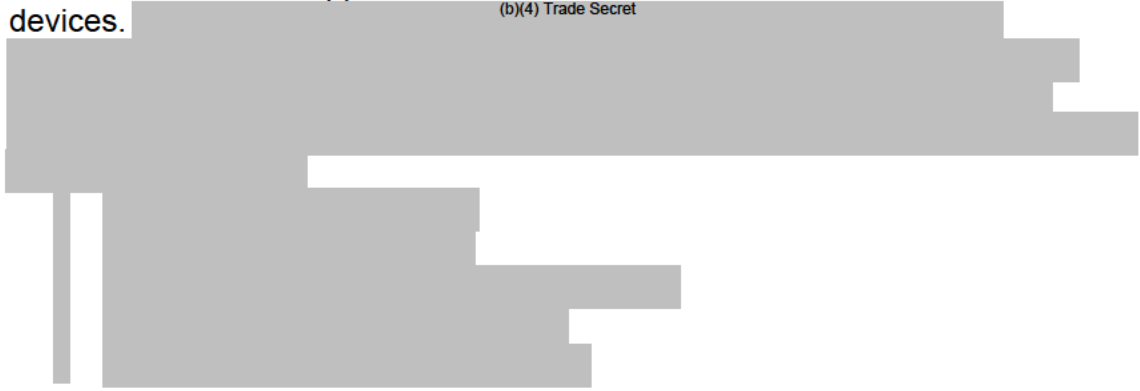
LABELING

The labeling for the Evera devices is based upon the approved labeling for Protecta XT / Protecta devices and Protecta DF4 DR and VR4 devices. The information provided in the Manual Architecture, Overview of Current Device Manual Architecture and Overview of New Device Manual Architecture portions of this Labeling section are identical to the information provided in the FDA-approved Viva/Brava PMA-S. Additionally, the Medical Procedure and EMI Precautions Manual and associated Change Table, the Explanation of Symbols

of ICD/CRT-D Devices Insert and the Explanation of Symbols of ICD/CRT-D Devices Insert are identical to the labeling provided in the Viva/Brava PMA-S.

DEVICE MANUALS

The Evera device manuals for the physician are based upon the Clinician Manuals which were approved for the Protecta XT/ Protecta DF4 DR and VR devices. (b)(4) Trade Secret



The new Evera Device manuals contain the following information:

- Device implant information
- Device description, features, specification and shipping and reset parameters
- Indications and contraindications,
- Warnings and precautions, and includes sterilization and device handling, potential adverse events.

DEVICE PACKAGE LABELS

The package labels for the Evera devices are based on package labels for other FDA-approved Medtronic implantable devices including symbols used in conjunction with the symbol's corresponding English definition. Minor change and editorial/style updates have been made to the device package labels which will be used for the Evera devices package labels.

SOFTWARE LABELS

The media used for the software distribution is the same as previously approved software distribution media. The labeling used, a keytag and shipping label, will be similar to previously FDA-approved labels, with appropriate changes made to the labeling to indicate the applicable software information for use for the Viva/Brava/Evera family of devices.

PATIENT MANUALS

The Implantable Cardioverter Defibrillator Patient manual is based upon the patient manual which was approved for the Protecta XT/Protecta ICD devices. Minor changes, editorial/style updates and re-arrangement of information were required given the architectural changes made to the Device manuals. The patient manual is provided to those patients receiving the Evera ICD devices.

LEAD REVIEWER COMMENTS: *A consult was issued to a medical officer to review the labeling for the Evera devices. This clinician did not note any concerns with the proposed labeling as it based off of predecessor devices and all changes have been appropriately incorporated. I agree with the reviewer's assessment of the labeling and there are no further concerns. The reviewer recommended approval of the submission based on his review of the labeling.*

PATIENT MANAGEMENT AND MONITORING

The CareLink Monitor Model 2490C, CardioSight Reader Model 2020A, CareLink Express Model 2020B and the Device Data Management Application (DDMA) Model 2491 require updates for the release of the Evera devices. There are no hardware changes to these already approved devices. They only require software and firmware updates for compatibility with the Evera devices. These updates are identical to those made for the Viva/Brava devices.

DEVICE DESCRIPTION

CARELINK MONITOR MODEL 2490C

The CareLink Monitor Model 2490C is an external, line powered monitor that is indicated for use in the transfer of patient and device data from implanted Medtronic devices (P890003/S195 approved March 17, 2011). The CareLink Monitor Model 2490C interrogates implanted devices and temporarily stores these data; collaborates with the appropriate Medtronic server to confirm the establishment of an Internet connection with the server; performs any required file translation functions necessary for data transfer; executes the data file transfer, and collaborates with the appropriate Medtronic server to confirm the data file transfer through the Internet connection with the server. The CareLink Monitor 2490C is not a programmer and cannot be used to program implanted device parameters.

CARDIOSIGHT READER MODEL 2020A

The CardioSight Reader Model 2020A is an external, battery-powered interrogator that allows Heart Failure clinicians without access to a Medtronic programmer to interrogate Medtronic implanted devices (P890003/S238 approved December 6, 2011). The CardioSight Reader Model 2020A, using an analog telephone connection, transmits stored implanted device data to the clinician. The CardioSight Reader Model 2020A is used in a clinical setting where a subset of the patient's recorded data from the implanted device is sent to the clinic via fax. The CardioSight Reader cannot be used to program an implanted device.

CARELINK EXPRESS MONITOR MODEL 2020B

The Medtronic CareLink Express Monitor Model 2020B assists clinicians in the viewing of patient diagnostic device data in the healthcare setting (P890003/S238 approved December 6, 2011). The displayed patient device data is the same data presented as for the 2020A. Using a CareLink Express Monitor Model 2020B, clinicians have the ability to review the data using the CareLink Network, in-clinic, remotely or in the healthcare setting for more timely review of patient device data. The 2020B Monitor is an in-clinic monitor that interrogates a device by means of an RF head, which retrieves patient device diagnostic data from the implanted device, then establishes communication with the secure Medtronic server by means of an analog connection.

The 2020B Monitor includes the monitor itself, four “AA” batteries, a physical interface used for connecting to telephone landlines, also referred to as an RJ11 port. The Model 2020B CareLink Express Monitors are used to interrogate Medtronic patient implanted devices only.

MODEL 2491 DDMA

The Device Data Management Application (DDMA) is the remote (server-resident) software responsible for translating the binary data uploaded from the CareLink Monitor Model 2490C, the CardioSight Reader Model 2020A, or the CareLink Express Monitor Model 2020B into industry-standard XML (Extensible Markup Language). The types of data uploaded from the CareLink Monitor Model 2490C, CardioSight Reader Model 2020A, and CareLink Express Monitor Model 2020B include: Asset/Header information that contains basic asset information, a binary image of presenting waveform, and a memory map from the implantable device. The DDMA analyzes and converts the raw data into an XML text string for each element of the implantable memory map. The DDMA currently consists of four parts, the XML Translation Utility (XMLTU), the Presenting Waveform Translation Utility (PWFTU), the Session Data Decode Utility (SDDU), and the Deconvolution Algorithm.

ACCESSORIES

There are no medical device accessories to the CareLink Monitor Model 2490C, CardioSight Reader Model 2020A, CareLink Express Model 2020B, and DDMA Model 2491. The device’s RF head is not detachable. The monitor and reader are provided to the user with the following items:

- Industry standard RJ-11 telephone cord extension
- Cellular Accessory
- Four “AA” Batteries (2020A and 2020B models)

The telephone cord extension and batteries are off-the-shelf products, and are not promoted as medical devices or medical device accessories. The telephone cord extension and batteries are easily obtainable by the user through common commercial sources, but are provided to the user as a courtesy.

INDICATIONS FOR USE

The indications and usage of the CareLink Monitor Model 2490C, the CardioSight Reader Model 2020A and CareLink Express Monitor Model 2020B remain unchanged with this submission.

CARELINK MONITOR MODEL 2490C

The CareLink Monitor Model 2490C is indicated for use in the transfer of patient data from some Medtronic implantable cardiac devices based on physician instructions and as described in the product manual. This product is not a substitute for appropriate medical attention in the event of an emergency and should only be used as directed by a physician.

CARDIOSIGHT READER MODEL 2020A

The CardioSight Reader Model 2020A is indicated for use in the transfer of patient and device data from Medtronic implantable devices.

CARELINK EXPRESS MONITOR MODEL 2020B

The CareLink Express Monitor Model 2020B is indicated for use in the transfer of patient and device data from Medtronic implantable devices.

DESCRIPTION OF CHANGES

For the Evera devices, the sponsor has made the following changes to the CareLink Monitor Model 2490C, the Model 2020A CardioSight Reader, the CareLink Express Monitor Model 2020B, and Model 2491 Device Data Management Application (DDMA).

CARELINK MONITOR MODEL 2490C

The firmware was upgraded to support the Evera devices and to address several firmware enhancements. There are no changes to the CareLink Monitor Model 2490C hardware.

CARDIOSIGHT READER MODEL 2020A

The firmware was upgraded to support the Evera devices and for several firmware enhancements. There are no changes to the CardioSight Reader Model 2020A hardware.

CARELINK EXPRESS MONITOR MODEL 2020B

The firmware is upgraded to support the Evera devices and for several firmware enhancements. There are no changes to the CareLink Express Monitor Model 2020B hardware.

DEVICE DATA MANAGEMENT APPLICATION (DDMA) MODEL 2491

The XML Translation Utility (XMLTU) and Presenting Waveform Translation Utility (PWFTU) software were updated for the release of the Evera devices. No updates to the Session Data Decode (SDD) and Deconvolution Algorithm were needed.

RISK ANALYSIS

The sponsor provided the risk analysis and evaluation for the Blackwell CareLink monitor updates. The risk assessment activities performed for the Blackwell CareLink monitor updates are focused on the changes made to the existing CareLink monitors to accommodate the support of the Blackwell devices on CareLink. The features of the CareLink monitors already in use are considered to have an acceptable level of risk mitigation based upon acceptable field performance. Following market release, risk management for design or process changes will be addressed by the normal process/design change procedures established in the CRDM Quality System.

LEAD REVIEWER COMMENTS: Overall the risk analysis report demonstrated that the updates associated with the CareLink monitors performed for the Blackwell project do not affect the safety of the existing CareLink system. It does not appear to introduce new failure modes that could result in a safety hazard, nor does it have any impact on previously identified failure modes or their mitigations. With no incremental risk identified for the CareLink monitor (CLM) updates for the Evera devices, the overall residual risk is comparable to predecessor CareLink monitors and is at an acceptable level. The risk analysis is appropriate based on the changes described for the monitor updates. This information is acceptable.

MANUFACTURING

The manufacturing for the CareLink Monitor Model 2490C, CardioSight Reader Model 2020A and CareLink Express Monitor Model 2020B was not impacted and has not been changed with this update for the Evera devices, since the updates are to software/firmware only. The manufacturing processes which have been previously developed, released, and approved for the CareLink Monitor Model 2490C, the CardioSight Reader Model 2020A and the CareLink Express Monitor Model 2020B (P890003/S217 approved April 6, 2011, and P890003/S228 approved August 25, 2011) remain applicable.

LEAD REVIEWER COMMENTS: Because there are no changes to the manufacturing of the patient management devices, I have no further concerns with this section of the review. This information is acceptable.

PACKAGING

The packaging for the CareLink Monitor Model 2490C, CardioSight Reader Model 2020A, and CareLink Express Monitor Model 2020B was not impacted and has not been changed with this update for the Evera devices.

LEAD REVIEWER COMMENTS: *The sponsor indicates that there are no changes to the packaging for the patient management devices. This information is acceptable.*

LABELING

Patient labeling, device labels, and the Product Information for Clinician sheet for the CareLink Monitor Model 2490C, CardioSight Reader Model 2020A, and CareLink Express Monitor Model 2020B were not impacted and did not change with the update for the Evera devices.

FIRMWARE/SOFTWARE/VERIFICATION AND VALIDATION

The firm provided testing of the firmware and software as well as verification and validation testing for the patient management devices.

LEAD REVIEWER COMMENTS: *A consult was issued for a review of the firmware, software, and system verification and validation for the Evera devices. A software engineer provided a review for these sections of the submission and he found no outstanding issues with this information and finds it to be acceptable. I agree with his assessment and have no further concerns with this section of the review.*

CONCLUSION

Based on the sponsor's responses to the deficiencies and subsequent interactive review, I believe this supplement should be approved. Although there are issues remaining regarding the battery self-discharge calculations, I believe these issues are out of the scope of this review and should be followed up further by the battery reviewer and branch management. I believe that these concerns are properly mitigated with design features that protect patient safety. There is one outstanding test report that needs to be submitted by the sponsor regarding shelf life calculations for the battery, and this will be written as a condition of approval in the letter. I have no further concerns.