

SUMMARY OF: PMA # P010031/S442 AND P890003/S309

VIVA/BRAVA QUADRIPOLAR CRT-Ds

Executive Summary

The purpose of this submission is to request approval for the Medtronic Viva/Brava CRT-D quadripolar devices. The Viva / Brava CRT-D quadripolar devices are dual chamber implantable cardioverter defibrillators with cardiac resynchronization therapy that are multi-programmable cardiac devices that monitor and regulate a patient's heart rate by providing single or dual chamber rate responsive bradycardia pacing, sequential biventricular pacing, ventricular tachyarrhythmia therapies, and/or atrial tachyarrhythmia detection and therapies.

The Viva / Brava devices, that are the subject of this submission, are based on the Protecta™ XT CRT-D D314TRG and Protecta CRT-D D334TRG (PMA-S P010031/S171, approved March 25, 2011), the Protecta XT CRT-D D314TRM and Protecta CRT-D D334TRM (PMA-S P010031/S178, approved November 9, 2011) and the Viva XT CRT-D DTBA1D4/DTBA1D1, Viva S CRT-D DTBB1D4/DTBB1D1 and Brava CRT-D DTBC1D4/DTBC1D1 (PMA-S P010031/S318, approved January 29, 2013).

The development name of this family of devices is the Blackwell family of devices. This family of devices includes the Viva / Brava / Evera devices. The internal development names may appear throughout the supporting information and should be considered synonymous to the Viva / Brava / Evera market brand names. Much of this submission is heavily based on the previously approved Viva/Brava CRT-D non-quadripolar devices. The main difference with these devices is the incorporation of an IS4 connector into the header and the addition of VectorExpress.

Regulatory Background

Medtronic has submitted the following in preparation for presenting this product line to FDA:

- Adaptive Cardiac Resynchronization Therapy pre-IDE (I090058)
- Adaptive CRT IDE (G090170)
- Blackwell CRT-D/ICD Device pre-IDE (I100290)
- LV Automated Test pre-IDE (I110889)
- VF NID pre-IDE (I110289)
- VF NID pre-IDE (I120622)

Since these pre-IDE submissions, the Viva / Brava CRT-D devices and the Evera ICD devices have been submitted to FDA and approved via the following PMA-S submissions:

- P010031/S318, P890003/S253; approved January 29, 2013

Adaptive CRT Pre-IDE

The Adaptive Cardiac Resynchronization Therapy (aCRT) pre-IDE (I090058) was submitted to FDA on January 30, 2009. The conclusion of the pre-IDE process covering I090058 was that the proposed clinical study design for the AdaptivCRT feature was acceptable, and the Adaptive CRT Clinical Study was submitted and approved as IDE (G090170).

Adaptive CRT IDE

The Adaptive CRT IDE (G090170) was submitted to FDA on August 31, 2009, followed by conditional approval on October 1, 2009 and full approval on December 9, 2009. The clinical study was closed on April 30, 2013. Medtronic included the Adaptive CRT Clinical Report in the Viva / Brava CRT-D device PMA-S submission to support market approval of the AdaptivCRT feature. This PMA-S was approved via P010031/S318 on January 29, 2013.

Blackwell CRT-D/ICD Device pre-IDE

The Viva/Brava/Evera CRT-D, DR/VR ICD pre-IDE (I100290) was submitted to the FDA on April 2, 2010. The conclusion of the pre-IDE process, covering I100290, was that the proposed bench testing is suitable for proving performance as well as safety and effectiveness to support the Viva/Brava/Evera CRT-D, DR/VR ICDs.

LV Automated Test pre-IDE

A separate pre-IDE was initiated in parallel for the LV Automated Test (VectorExpress is the market name for this feature, internally this feature has been referred to (b)(4) TS/CC, and to FDA this feature was called the LV Automated Test) (I110889). The conclusion of the pre-IDE process covering I110889 was that FDA agreed with the proposed testing strategies for software, firmware, systems testing, and GLP animal study. With respect to no clinical data being required for approval of the LV Automated Test feature, FDA will not require human clinical data – but FDA did encourage Medtronic to consider some type of “limited confirmation or evaluation of the LV Automated Test feature” in the quadripolar lead (Attain Performa) clinical study (I100094). This feature is specifically used with the Viva / Brava quadripolar devices, the devices that are the subject of this submission.

VF NID pre-IDE

A pre-IDE proposing a change to the Ventricular Fibrillation Number of Intervals to Detection (VF NID) parameter was submitted April 8, 2011. The conclusion of the pre-IDE process covering I110289 was that FDA had no significant concerns regarding the proposal and based on the clinical studies done to date, no additional clinical studies are warranted to support this change.

A second pre-IDE (I120622), submitted July 13, 2012, proposed allowing the Ventricular Fibrillation Number of Intervals to Detection parameter to change the current nominal and shipping setting from 24/32 to 30/40 without changing the programmable range for this setting. FDA agreed that this change can be implemented with no further clinical study required.

Device Description

The Viva / Brava quadripolar dual chamber Implantable Cardioverter Defibrillators (ICD) with cardiac resynchronization therapy (CRT-D) are multi-programmable cardiac devices that monitor and regulate a patient’s heart rate by providing single or dual chamber rate-responsive bradycardia pacing, sequential biventricular pacing, ventricular tachyarrhythmia therapies, and/or atrial tachyarrhythmia therapies.

Device Model	Brand Name
DTBA1QQ	Viva™ Quad XT CRT-D
DTBA1Q1	Viva™ Quad XT CRT-D
DTBB1QQ	Viva™ Quad S CRT-D
DTBB1Q1	Viva™ Quad S CRT-D
DTBC1QQ	Brava™ Quad CRT-D
DTBC1Q1	Brava™ Quad CRT-D
DTBX1QQ*	Viva™ Quad C CRT-D

*Note that the Viva Quad C Model DTBX1QQ was used in the Attain Performa clinical investigation (G120213). From a mechanical and electrical standpoint, it is identical to the Viva / Brava CRT-D quadripolar devices that are the subject of this PMA-Supplement. All testing performed and presented in this submission is applicable to all devices. (b)(4) TS/CCI

The Viva / Brava devices all contain the same device firmware code and use the same software application.

System Description

The Viva / Brava system is comprised of the following components:

- CRT-D devices listed in table above
- SW016 Software Application (P010031/S414, approved February 27, 2014)
- 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)
- CareLink Encore™ Programmer Model 29901 (P890003/S254, approved March 13, 2013)
- 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 Viva/Brava system.

Indications for Use

Viva Quad XT CRT-D Model DTBA1QQ, Viva Quad XT CRT-D Model DTBA1Q1, Viva Quad S CRT-D Model DTBB1QQ and Viva Quad S CRT-D Model DTBB1Q1

The indications for use for the Viva Quad XT CRT-D Model DTBA1QQ, Viva Quad XT CRT-D Model DTBA1Q1, Viva Quad S CRT-D Model DTBB1QQ and Viva Quad S CRT-D Model DTBB1Q1 are identical to those approved for Viva XT CRT-D Model DTBA1D1, Viva XT CRT-D Model DTBA1D4, Viva S CRT-D Model DTBB1D1 and Viva S CRT-D Model

DTBB1D4 (P010031/S318, approved January 29, 2013) with the exception of the addition of the BLOCK HF indication text.

“The [name of device] CRT-D system is indicated for patients who require ventricular antitachycardia pacing and ventricular defibrillation for automated treatment of life-threatening ventricular arrhythmias, for use in patients with atrial tachyarrhythmias, or those patients who are at significant risk for developing atrial tachyarrhythmias and for providing cardiac resynchronization therapy in heart failure patients on stable, optimal heart failure medical therapy if indicated, and meet any of the following classifications:

- New York Heart Association (NYHA) Functional Class III or IV and who have a left ventricular ejection fraction $\leq 35\%$ and a prolonged QRS duration
- Left bundle branch block (LBBB) with a QRS duration ≥ 130 ms, left ventricular ejection fraction $\leq 30\%$, and NYHA Functional Class II
- NYHA Functional Class I, II, or III and who have left ventricular ejection fraction $\leq 50\%$ and atrioventricular block (AV block) that are expected to require a high percentage of ventricular pacing that cannot be managed with algorithms to minimize right ventricular pacing. Optimization of heart failure medical therapy that is limited due to AV block or the urgent need for pacing should be done post implant.”

Brava Quad CRT-D Model DTBC1QQ and Brava Quad CRT-D Model DTBC1Q1

The indications for use for the Brava Quad CRT-D Model DTBC1QQ and Brava Quad CRT-D Model DTBC1Q1 are identical to those approved for Brava CRT-D Model DTBC1D1 and Brava CRT-D Model DTBC1D4 (P010031/S318, approved January 29, 2013) with the exception of the addition of the BLOCK HF indication text.

“The Brava Quad CRT-D system is indicated for ventricular antitachycardia pacing and ventricular defibrillation for automated treatment of life-threatening ventricular arrhythmias and for providing cardiac resynchronization therapy in heart failure patients on stable, optimal heart failure medical therapy if indicated, and meet any of the following classifications:

- New York Heart Association (NYHA) Functional Class III or IV and who have a left ventricular ejection fraction $< 35\%$ and a prolonged QRS duration
- Left bundle branch block (LBBB) with a QRS duration > 130 ms, left ventricular ejection fraction $< 30\%$, and NYHA Functional Class II
- NYHA Functional Class I, II, or III and who have left ventricular ejection fraction $< 50\%$ and atrioventricular block (AV block) that are expected to require a high percentage of ventricular pacing that cannot be managed with algorithms to minimize right ventricular pacing. Optimization of heart failure medical therapy that is limited due to AV block or the urgent need for pacing should be done post implant”

LEAD REVIEWER COMMENTS: At the time of this submission the BLOCK HF submission was under review. However, the BLOCK HF submission was approved April 10, 2014.

Therefore, I believe it appropriate to include the information from that submission in the indications statement.

Lead Integrity Alert

All models of the Viva / Brava CRT-D devices contain the Lead Integrity Alert (LIA) feature. The LIA indication has been updated to match the indication as approved via P010031/S387 and P9800016/S426 (approved October 4, 2013). This indication is provided in the Viva / Viva Quad, Brava / Brava Quad CRT-D Reference Manual.

“The RV Lead Integrity Alert feature is intended for patients who have a Medtronic ICD or CRT-D device and a Sprint Fidelis lead (Models 6949, 6948, 6931, and 6930), based on performance data.”

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 listed below:

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.”

Detailed Description of Changes

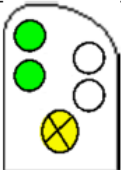
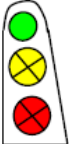
The Viva / Brava CRT-D Quadripolar devices are based on the Protecta XT / Protecta CRT-D D314TRG, D334TRG and Protecta XT / Protecta CRT-D D314TRM, D334TRM (P010031/S171 approved March 25, 2011 and P010031/S178 approved November 9, 2011), and on the Viva / Brava CRT-D non-quadripolar devices (P010031/S318, approved January 29, 2013).

With the exception of the IS4 portion of the connector and the VectorExpress LV Automated Test feature, all other features found on the Viva / Brava CRT-D Quadripolar devices are identical to the features described and provided for the approved Viva / Brava CRT-D Devices (PMA-Supplement P010031/S318, approved January 29, 2013) and the Evera ICD Devices (P980016/S382, approved April 3, 2013).

LEAD REVIEWER COMMENTS: For a complete description of the identical features previously approved, please refer to the review for P010031/S318. Below is a description of the new features that were not included in the Viva/Brava Non-Quadripolar devices.

Connector Module

These Viva / Brava devices provide two new quadripolar connectors, a QP DF-1 CRT-D (IS-1/DF-1/IS4) connector configuration and a QP DF4 CRT-D (IS-1/DF4/IS4) connector configuration.

CRT-D Connector Modules		Lead Connection	Tissue Contacting Connector Module Material
QP DF-1 CRT-D		2x IS-1 2x DF-1 1x IS4	Elasthane™ silicone, and titanium
QP DF4 CRT-D		1x IS-1 1x IS4 1x DF4	Elasthane™ silicone, and titanium

-  IS-1 Bore
-  DF-1 Bore
-  DF4 Bore
-  IS4 Bore

VectorExpress LV Automated Test

This feature is used with the devices that are the subject of this submission that support quadripolar left ventricular (LV) leads. The feature allows automated testing of clinician-selected pacing polarities to determine the patient’s LV capture thresholds and pacing impedances. Capture threshold information may be used to determine appropriate pace polarities, amplitude settings, and pulse width settings to ensure capture while minimizing output to maximize battery longevity.

The VectorExpress LV Automated Test feature is an in-office test that tests each clinicians elected LV vector -- measuring pacing impedance and capture thresholds at the clinician selected pulse width. The test executes in DDD mode if the device is currently operating in a tracking mode, and the test executes in VVI mode otherwise. When the test completes, the measured pacing impedances and capture thresholds for all LV vectors are presented in a table of results, along with an estimated longevity impact of programming each LV vector as compared to the other vectors (i.e., relative longevity). The VectorExpress LV Automated Test feature uses the same capture detection method as the Left Ventricular Capture Management

(LVCM) feature. Capture detection is based on the timing of an RV sense (or lack thereof) following an LV pace.

Non Clinical Studies, Device Qualification, Verification and Validation

Biocompatibility

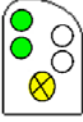
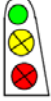
The Viva / Brava CRT-D Quadripolar (Viva / Brava) family of devices is composed of the following tissue-contacting materials and components that have the potential for direct and/or indirect patient body tissue/fluid contact. This is the same for all the models in the Viva/Brava/Evera family of devices (Viva/Brava P010031/S318, approved January 29, 2013; Evera P980016/S382, approved April 3, 2013).

Material	Device Components
(b)(4) TS/CCI	Left-hand shield Right-hand shield Fastener bracket Connector attach pin
	End cap
	Adhesive
	Connector module (new connectors)
	Split grommet
	IS4 seal
	Connector module (legacy connectors)

LEAD REVIEWER COMMENTS: As there are no new materials with the proposed device compared to previously approved devices there are no biocompatibility concerns. All testing was reviewed and found acceptable under the submission noted above.

Hardware Mechanical Subsystem Testing

With the exception of the connector, the information provided in the submission for this testing is identical to the information provided for the approved Viva / Brava CRT-D Devices (PMA-Supplement P010031/S318, approved January 29, 2013) and the Evera ICD Devices (P980016/S382, approved April 3, 2013). Therefore the review of this section focuses on the new connector design. The Viva / Brava devices provide two new quadripolar connectors, a QP DF-1 CRT-D (IS- 1/DF-1/IS4) connector configuration and a QP DF4 CRT-D (IS- 1/DF4/IS4) connector configuration.

CRT-D Connector Modules		Lead Connection	Tissue Contacting Connector Module Material
QP DF-1 CRT-D		2x IS-1 2x DF-1 1x IS4	Elasthane™ silicone, and titanium
QP DF4 CRT-D		1x IS-1 1x IS4 1x DF4	Elasthane™ silicone, and titanium

● IS-1 Bore
 DF-1 Bore
X DF4 Bore
X IS4 Bore

There are no changes to the material of the connector from the approved non-quadripolar devices. The firm provided testing for this connector configuration as a worst case for the devices approved under P010031/S318. The testing was found to be adequate and acceptable related to header attach strength as well as dimension testing for the IS-1 and DF-4 connectors per the standards (ISO-5841 and ISO 27186). The only exception that was not noted in that review was the inclusion of the IS-4 connector bore. The submitted reports by the firm have been updated to include this testing per ISO 21786. All testing has been reviewed and appears to be appropriate and adequate. There are no further concerns with this section of the review.

Battery Modeling/Longevity

The Viva / Brava CRT-D Quadripolar (Viva/Brava) longevity projections are based on the identical battery and circuit model assumptions as the Viva / Brava non-Quadripolar longevity projections approved under P010031/S318. Therefore, the longevity projections in this section are identical to those approved under P010031/S318.

LEAD REVIEWER COMMENTS: As the major change for this device is the addition of the IS-4 header and the overall therapy is not changing between the proposed device and the non-quadripolar devices, I believe the previously approved battery longevity projections remain valid.

EMC Design Verification/Telemetry

EMC testing is identical to that provided under P010031/S318. The quadripolar model was used to support that submission as a worst case physical configuration. This was 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 Quadripolar CRT-D (IS-1 /DF4/IS4) is sufficiently similar in design to the other models of the Viva / Brava product family. During the review the EMC reviewer had concerns with modulated fields from 16.6Hz to 450Hz as well as susceptibility to Radio-frequency identification (RFID) and Electronic article surveillance (EAS). Following and interactive review for P010031/S318, the reviewer indicated that the testing provided by the firm is adequate. There were no additional concerns related to EMC.

Software, Firmware, System Verification and Validation

The Software, Firmware, System Verification and Validation were reviewed in a review memo dated June 13, 2014. This submission is also seeking approval for the use of the Blackwell Programmer Application Software Model SW016 for the devices listed in the Executive Summary. The documentation submitted here is the same documentation that was submitted for the Viva/Brava 180-day PMA supplement (PMA-Supplement P010031/S318, approved January 29, 2013) and the Evera 180-day PMA supplement (P980016/S382, approved April 3, 2013). The version of firmware being discussed in this submission and the associated documentation (other than minor revision updates) has previously been provided to FDA and approved via PMA-S submissions for Viva/Brava (P010031/S318, approved January 29, 2013) and Evera (P980016/S382, approved April 3, 2013). The same firmware is installed on all Blackwell model devices. The system validation testing described in volume 8 of the submission is identical to that provided in P010031/S318 which was previously reviewed and found acceptable.

Packaging

There are no changes to the approved packaging from P010031/S318 (approved January 29, 2013).

LEAD REVIEWER COMMENTS: The packaging between the approved non-quadripolar device and quadripolar devices are identical. The quadripolar devices were used as a worst case for the non-quadripolar devices for package testing. There were no concerns from the review of P010031/S318.

Sterilization

The sterilization for the Viva / Brava Quadripolar CRT-D devices is the same as the approved sterilization for other FDA approved Medtronic implantable devices (Viva/Brava CRT-D devices (P010031/S318, approved January 29, 2013). The major difference between the proposed device and the previously approved Viva/Brava CRT-D devices is the incorporation of and IS-4 connector into the header replacing the IS-1 connector. I do not believe this change will increase the difficulty of sterilization. The firm provided a sterilization qualification for adopting the proposed devices in to the (b)(4) TS/CCI process. Much of the qualification was leveraged from previously approved devices. From the qualification the proposed devices appear to have been successfully qualified into the (b)(4) TS/CCI process. A Sterility Assurance Level (SAL) in excess of 10⁻⁶ is achieved when the devices were sterilized in the specific load configuration. All internal and external requirements have been met. The proposed device is qualified for (b)(4) TS/CCI sterilization (b)(4) TS/CCI sterilization process. As noted above the packaging has also been previously approved. 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. There are no further concerns regarding sterilization.

Shelf Life

Packaged and sterile Viva / Brava quadripolar devices are labeled with an 18-month shelf life. Shelf life evaluations addressed integrity of the sterile barrier system and reduction in projected service life during shelf storage. This is identical to that approved for P010031/S318 (Viva/Brava non-quadripolar devices. The report has been updated to include the quadripolar

models. I do not believe the changes proposed in this submission would impact the shelf life approved for the previous devices. Therefore, I believe the 18 months is appropriate.

Manufacturing

The Viva / Brava CRT-D Quadripolar devices (Viva / Brava) listed below 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 25 March 2011) and the Viva /Brava and Evera devices (P010031/S318, P890003/S253 approved January 29, 2013; and P980016/S382, P890003/S259 approved April 3, 2013). The only significant change is the addition of a new facility - at Medtronic Memphis. This facility was recently requested as a location for final pack shrink wrap operations (Master submission P980035/S319 approved 24 December 2013).

Cardiac Rhythm Disease Management	
Medtronic, Inc. 8200 Coral Sea Street NE Mounds View, MN 55112, United States (Includes Rice Creek and Mounds View) Establishment Registration Number: 2182208	Most Recent FDA Inspection: October 16- 31, 2013 No 483 Observations
MPROC Juncos	

MEDTRONIC PUERTO RICO OPERATIONS, JUNCOS ROAD 31, KM 24, HM 4 Juncos, Puerto Rico 00777, UNITED STATES Establishment Registration Number: 3004209178	Most Recent FDA Inspection: October 2-25, 2013 No 483 Observations
Cardiac Rhythm Disease Management	
Medtronic Swiss Manufacturing Facility Route du Molliau 31 TOLOCHENAZ, Vaud, CH-1131, SWITZERLAND Establishment Registration Number: 9614453	Most Recent FDA Inspection: June 18-21, 2012 No 483 Observations
Cardiac Rhythm Disease Management	
Medtronic, Inc. Swinnea 4340 Swinnea Road Building A Memphis, Tennessee 38118, United States Establishment Registration Number: 3009380063	Most Recent FDA Inspection: Nov 4-8, 2013 Two 483 Observations
EOC	
Medtronic B.V. Earl Bakkenstraat 10 Heeren, Limburg, 6422PJ, Netherlands Establishment Registration Number: 3002807561	Most Recent FDA Inspection: February 4-7, 2013 No 483 Observations

The manufacturing process flows for the Viva / Brava quadripolar devices are not significantly different than the manufacturing process flows for the previously approved Viva/Brava non-quadripolar devices (P010031/S318, P890003/S253 approved January, 29, 2013). The firm provided the following manufacturing flow chart for these devices.

(b)(4) TS/CCI

Table 1-17 in the submission describes the manufacturing process steps for the Viva / Brava quadripolar devices and compares these steps to the Viva / Brava non-quadripolar devices process steps. I have chosen to only highlight the differences between these device manufacturing processes.

(b)(4) TS/CCI

(b)(4) TS/CCI

LEAD REVIEWER COMMENTS: There were minor changes to the manufacturing process of the Viva/Brava Quad devices compared to the manufacturing process for the non-quadripolar devices. Such changes include specific programing for the quad devices as well as a specific final electrical test. All specific manufacturing changes are reviewed in another section of this memo. Based on the process flow chart provided in the submission; there are no significant changes to the approved manufacturing process. All process qualifications appear to have been successfully completed. I have no concerns with this section of the review.

Manufacturing/Design Changes

Changes Made after Design Assurance Builds

This section describes 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. Many of these changes were already been submitted to FDA under the Viva / Brava CRT-D (P010031/S318, approved January, 29, 2013) and Evera submission (P980016/S382, approved April, 03, 2013).

There are three changes that are unique to the Viva / Brava quadripolar devices, subject of this submission. All three are connector changes that are identified in Table 14-1 in Volume 14. The

change number and the page where the specific content on the change begins are identified below:

(b)(4) TS/CCI

LEAD REVIEWER COMMENTS: All other changes provide in volume 14 related to changes made after design assurance build have been previously reviewed under the identified submissions. As these changes apply in the exact same manner to the quadripolar devices there is no concern with incorporating them into the quadripolar models. The 3 change identified above have been reviewed as they are new changes. The firm provided adequate qualification reports for each of the 3 changes. Overall, the changes do not appear to impact the DAU/DVT testing therefore testing does not need to be repeated. All changed have been adequately qualified and I have no concerns with the changes.

Previously Submitted Changes

Volume 18 of the submission identifies changes previously approved by FDA on the predecessor products and the Viva / Brava / Evera products (P010031/S318, P890003/S253 approved January 29, 2013; and P980016/S382, P890003/S259 approved April 3, 2013) and are applicable to the Viva / Brava Quadripolar devices covered in this supplement. The changes pertain to the same manufacturing processes and the same components that are used to manufacture the Viva / Brava Quadripolar devices. There are no changes included that are specific to the Viva / Brava Quadripolar devices design.

LEAD REVIEWER COMMENTS: These changes apply in the exact same manner as the previously approved devices. Based on the similarities of the proposed device to the previously

approved devices, there appears to be no increased patient risks associated with these changes. All changes have been successfully tested and these changes have no impact to safety and effectiveness of the Viva / Brava Quadripolar devices.

Annual Reportable Change

The firm provided annual reportable changes that are applicable to the proposed device in volumes 19 and 20 of the submission. The firm provided changes that are only applicable to the proposed device (new changes) as well as previously submitted annual reportable changes.

LEAD REVIEWER COMMENTS: *The format used in this submission followed the format of the Annual Changes Report (ACR) typically submitted by the firm. The firm states that the changes provided are independent of the device models impacted for each change. The firm commits to applying the future FDA decisions from other reports to the pending changes listed in this report. The changes were separated into two different groups, new changes that only affect the Viva/Brava Quadripolar devices and changes that have been submitted under a previous Annual Report submission and also apply to the Viva/Brava. I have reviewed both groups of changes and believe the firm has provided adequate information to determine if the changes will impact the safety and effectiveness of the device. Changes include minor clarifications to drawings, updated work instructions, addition of duplicate/identical equipment, or minor enhancements to manufacturing process. All of the changes appear to be appropriate as annual reportable. The incorporation of these changes in to the Viva/Brava devices does not appear to impact the safety and effectiveness of the device. I have no further concerns with this section of the review.*

Clinical Studies

The clinical section of this submission was reviewed by a medical officer in a review memo dated June 4, 2014. This document is a sponsor submitted PMA-Supplement (P010031-S442) which proposes use of the VectorExpress feature with devices that support quadripolar left ventricular (LV) leads. “This feature allows automated testing of clinician-selected pacing polarities to determine the patient’s LV capture thresholds and pacing impedances. Capture threshold information may be used to determine appropriate pace polarities, amplitude settings, and pulse width settings to ensure capture while minimizing output to maximize battery longevity. Through Pre-Submission discussions with FDA, Medtronic agreed to provide an interim report on the performance of VectorExpress compared to manual pacing capture threshold (PCT) measurements, as part of the Attain Performa Quadripolar Lead clinical investigation (G120213).”

This submission provides the analyses of VectorExpress Confirmation Testing as stated in the Attain Performa Quadripolar Lead Clinical Study protocol. The Attain Performa Quadripolar Lead Clinical Study is a prospective, non-randomized, multi-center, single arm, Investigational Device Exemption (IDE) clinical study evaluating the safety and efficacy of the Medtronic Attain Performa Quadripolar Model 4298, Model 4398, and Model 4598 Left Ventricular (LV) leads.

The interim report study evaluates the VectorExpress feature comparing automatic versus manual pacing capture threshold (PCT) measurements in 65 subjects taken at Pre-Hospital Discharge (PHD).

“Of the 65 subjects with electrical testing, VectorExpress was able to initiate measurements in 62 (95%) of them, exceeding the anticipated performance of 85%. In these 62 subjects, there were 992 (62 X 16 LV pacing polarities) potential vectors; VectorExpress produced results for 790 (79.6%) vectors, exceeding the anticipated performance of 75%. When compared to conventional manual PCT testing, the agreement between VectorExpress and manual PCTs was 95.3% (95% CI: 92.6-97.1%). These data confirmed that VectorExpress performs as expected with no measurement bias induced. These results support using the automatic measurements from VectorExpress as record of PCTs for the clinical investigation.”

I have reviewed the clinical data provided by the sponsor as well as the physician manuals. The feature correlates well with conventional PTC testing and would offer a significant clinical convenience. The medical officer recommended approval of the VectorExpress feature.

REVIEWER COMMENTS: It is noted that this is the only new feature that has been incorporated into the pulse generator since the approval of P010031/S318. All other clinical studies (i.e., Adaptive CRT) were previously reviewed under S318. Please refer to the review package for that submission for further details.

Labeling

The labeling for the Viva / Brava Quadripolar devices is based upon the approved labeling for that approved non-quadripolar devices as well as the predecessors Protecta XT/Protecta devices and Protecta DF4 CRT-D6. Manual changes were presented in change tables with in the submission. Package labeling, and patient manuals are described in more detail in the labeling section of this submission.

LEAD REVIEWER COMMENTS: The labeling reviewer did not note any concerns with the proposed labeling as it based off of predecessor devices and all changes have been appropriately incorporated. Changes include, devices descriptions for the new models, updates based on the new connector configuration, the addition of the VectorExpress feature with experience. (b)(4) TS/CCI

*However, the pulse generator that is the subject of this submission is labeled to be used with **any** IS-4 compliant lead. I do not have concerns with this is the purpose of the IS-4 standard.*

Patient Management

With the exception of the Viva/Brava CRT-D Quadripolar devices, all of the Viva/Brava/Evera devices have been approved for use with the CareLink Monitor Model 2490C, CardioSight Reader Model 2020A, CareLink Express Model 2020B and the Device Data Management Application (DDMA) Model 2491 (P010031/S318, P890003/S253; approved January 29, 2013; P980016/S382, P890003/S259; approved April 3, 2013; P010031/S413, P980016/S451, P890003/S295; approved February 27, 2014).

The Viva/Brava CRT-D Quadripolar devices run on the identical firmware as the previously approved Viva/Brava/Evera devices. At the time of these previous approvals, testing for the CareLink Monitor Model 2490C, CardioSight Reader Model 2020A and CareLink Express Monitor Model 2020B included all of the Viva / Viva Quad / Brava / Brava Quad / Evera

device models. Therefore, no updates to the CareLink Monitor Model 2490C, CardioSight Reader Model 2020A, and CareLink Express Model 2020B are needed. The Device Data Management Application (DDMA) Model 2491 has had one minor update to the XMLTU software for the remaining longevity estimator feature. The change has been testing with all Viva / Viva Quad / Brava / Brava Quad / Evera devices and has been approved for all market released Viva / Brava / Evera devices (P010031/S413, P980016/S451, P890003/S295; approved February 27, 2014).

Facilities Check

A check of the OAI list was conducted by the lead reviewer, June 26, 2014. The Medtronic facilities identified in the manufacturing section of this memo were not found on the OAI list. Therefore full approval can be granted.

Recommendation

The Viva / Brava devices, that are the subject of this submission, are based on the Protecta™ XT CRT-D D314TRG and Protecta CRT-D D334TRG (PMA-S P010031/S171, approved March 25, 2011), the Protecta XT CRT-D D314TRM and Protecta CRT-D D334TRM (PMA-S P010031/S178, approved November 9, 2011) and the Viva XT CRT-D DTBA1D4/DTBA1D1, Viva S CRT-D DTBB1D4/DTBB1D1 and Brava CRT-D DTBC1D4/DTBC1D1 (PMA-S P010031/S318, approved January 29, 2013). The firm has leveraged a lot of the information and testing from previous submissions, which I find appropriate based on the similarity of the devices. Differences between the proposed devices and predecessors have been adequately evaluated. Overall, the firm has provided adequate and appropriate testing that provides a reasonable assurance that the device is safe and effective. I recommend approval of this PMA.