

### Medtronic, Inc.

PAL<sup>™</sup> Controller for HeartWare<sup>™</sup> HVAD<sup>™</sup> Pump Model Number: MCS3101CO

> FCC 15.247:2019 Bluetooth Low Energy

Report # MDTR0798 Rev. 1



TESTING

NVLAP LAB CODE: 200881-0







### Last Date of Test: June 20, 2019 Medtronic, Inc. PAL™ Controller for HeartWare™ HVAD™ Pump Model: MCS3101CO

### **Radio Equipment Testing**

**Standards** 

Specification	Method
FCC 15.207:2019	ANSI C63.10:2013
FCC 15.247:2019	KDB 558074

#### **Results**

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.1.1	Output Power	Yes	Pass	
11.9.1.1	Equivalent Isotropic Radiated Power	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	
11.12.1,				
11.13.2, 6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	

### **Deviations From Test Standards**

None

**Approved By:** 

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Eric Brandon, Department Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

## **REVISION HISTORY**



Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		
01	Updated the testing objective	2020-01-28	8

# ACCREDITATIONS AND AUTHORIZATIONS



### **United States**

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

### Canada

**ISED** - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

### **European Union**

European Commission – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

#### Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

#### Korea

MSIT / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

#### Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

#### Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

### Singapore

**IDA** – Recognized by IDA as a CAB for the acceptance of test data.

#### Israel

**MOC** – Recognized by MOC as a CAB for the acceptance of test data.

### Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

### Vietnam

**MIC** – Recognized by MIC as a CAB for the acceptance of test data.

### SCOPE

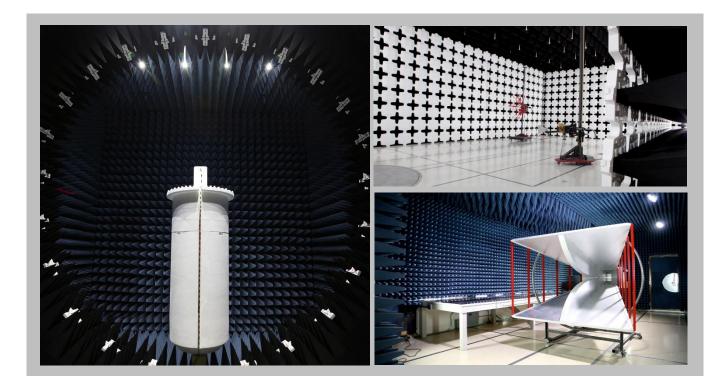
For details on the Scopes of our Accreditations, please visit: https://www.nwemc.com/emc-testing-accreditations

## FACILITIES





<b>California</b> Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	<b>Texas</b> Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	<b>Washington</b> Labs NC01-05 19201 120 <sup>th</sup> Ave NE Bothell, WA 98011 (425)984-6600	
		NVLAP			
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0	
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1	
		BSMI			
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R	
VCCI					
A-0029	A-0109	A-0108	A-0201	A-0110	
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	US0017	US0191	US0157	



## **MEASUREMENT UNCERTAINTY**



### **Measurement Uncertainty**

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

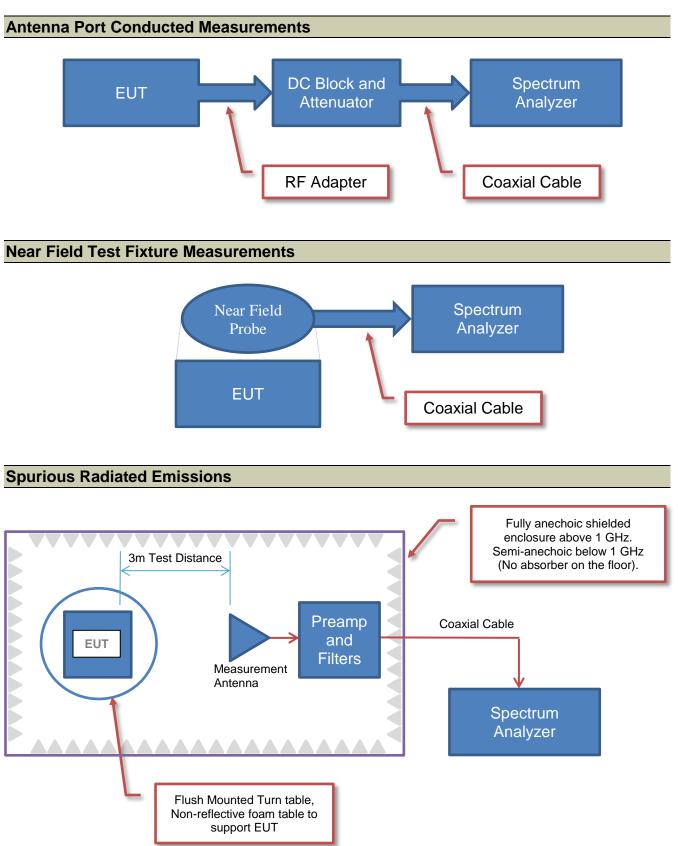
A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is on each data sheet. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

## **Test Setup Block Diagrams**





## **PRODUCT DESCRIPTION**



### **Client and Equipment Under Test (EUT) Information**

Company Name:	Medtronic, Inc.
Address:	710 Medtronic Parkway NE
City, State, Zip:	Minneapolis, MN 55432
Test Requested By:	Jeffrey Brown
Model:	PAL <sup>™</sup> Controller for HeartWare <sup>™</sup> HVAD <sup>™</sup> Pump, Model MCS3101CO
First Date of Test:	June 14, 2019
Last Date of Test:	June 20, 2019
Receipt Date of Samples:	June 14, 2019
Equipment Design Stage:	Production Equivalent
Equipment Condition:	No Damage
Purchase Authorization:	Verified

### Information Provided by the Party Requesting the Test

### Functional Description of the EUT:

Controller:

The controller transmits and receives data from the companion device via Bluetooth Low Energy. The BLE module is located within the controller.

System:

The PAL Commercial Heart Ventricular Assist Device (HVAD) is composed of several components, including: the Controller, the Monitor that is used by the Clinician to program the controller; and power sources in the form of an external dual battery and an AC adapters. System components can be connected in various configurations, depending on use of the system.

The implantable HVAD pump does not contain radio equipment and is not included in the equipment under test. All radio equipment is external to the patient.

### **Testing Objective:**

To demonstrate compliance of the Bluetooth Low Energy radio to FCC 15.247 requirements.

## **CONFIGURATIONS**



### Configuration MDTR0798-1

Software/Firmware Running during test			
Description	Version		
Protocol Tool	1.82.28.29661		
PAL System Functional Test Firmware	90		

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
HVAD PAL Commercial Controller	Medtronic, Inc.	MCS3101CO	PAL000404A
AC Adapter (HVAD PAL)	Medtronic, Inc.	CMP02974	PAC000093A
Ext. Battery	Medtronic, Inc.	CMP02432	PDB001167A

Remote Equipment Outside of Test Setup Boundary				
Description Manufacturer Model/Part Number Serial Number				
Spectrum Analyzer	Keysight	N99144	ES058324	

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Cable (HVAD PAL)	No	2.5 m	No	AC Adapter	AC Mains
DC Cable (HVAD PAL)	No	2.8 m	Yes	HVAD PAL	AC Adapter
Driveline Cable	No	1 m	Yes	HVAD PAL	Unterminated

## **CONFIGURATIONS**



### Configuration MDTR0798-2

Software/Firmware Running during test			
Description	Version		
Protocol Tool	1.82.28.29661		
PAL System Functional Test Firmware	90		

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
HVAD PAL Commercial Controller	Medtronic, Inc.	MCS3101CO	PAL000404A
AC Adapter (HVAD PAL)	Medtronic, Inc.	MP02974	PAC000093A
Ext. Battery	Medtronic, Inc.	CMP02432	PDB001167A

Peripherals in test setup boundary						
Description	Manufacturer	Model/Part Number	Serial Number			
Laptop	Dell	Latitude E6410	7KGKYN1			
Power Supply (Laptop)	Dell	LA90PM111	CN-0Y4M8K-72438-38R-C8D9- A01			
Mouse	Amazon Basics	MSU0939	7G184C1409B			

Cables							
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2		
AC Cable (HVAD PAL)	No	2.5 m	No	AC Adapter	AC Mains		
DC Cable (HVAD PAL)	No	2.8 m	Yes	HVAD PAL	AC Adapter		
Driveline Cable	No	1 m	Yes	HVAD PAL	Unterminated		
USB Cable	Yes	2.8m	Yes	HVAD PAL	Laptop		
AC Cable (Laptop)	No	1.0m	No	AC Mains	Power Supply (Laptop)		
DC Cable (Laptop)	No	1.8m	Yes	Power Supply (Laptop)	Laptop		
USB Cable (Mouse)	No	1.8m	No	Mouse	Laptop		

## **CONFIGURATIONS**



### Configuration MDTR0798-5

Software/Firmware Running during test				
Description	Version			
Monitor Firmware	0.67			
PAL System Functional Test Firmware	90			

EUT						
Description	Manufacturer	Model/Part Number	Serial Number			
HVAD PAL Commercial Controller	Medtronic, Inc.	MCS3101CO	PAL000405A			
Ext. Battery	Medtronic, Inc.	CMP02432	PDB001167A			

Peripherals in test setup boundary						
Description	Manufacturer	Model/Part Number	Serial Number			
AC Adapter (HVAD PAL)	Medtronic, Inc.	CMP02974	PAC000093A			
PAL Monitor	Medtronic, Inc.	1521	PMN000053			
AC Adapter (Monitor)	Medtronic, Inc.	1555	MAC093294			

Cables						
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2	
AC Cable (HVAD PAL)	No	2.5 m	No	AC Adapter	AC Mains	
DC Cable (HVAD PAL)	No	2.8 m	Yes	HVAD PAL	AC Adapter	
Driveline Cable	No	1 m	Yes	HVAD PAL	Driveline Ext. Cable	
USB Cable	Yes	2.8m	Yes	HVAD PAL	Monitor	
AC Cable (Monitor)	No	2.3m	No	AC Mains	AC Adapter (Monitor)	
DC Cable (Monitor)	No	1.8m	Yes	AC Adapter (Monitor)	Monitor	
Driveline Ext. Cable	No	3.2 m	Yes	Driveline Cable	Unterminated	

## **MODIFICATIONS**



### **Equipment Modifications**

Item	Date	Test	Modification	Note	Disposition of EUT
		Powerline	Tested as	No EMI suppression	EUT remained at
1	2019-06-14	Conducted	delivered to	devices were added or	Element following the
		Emissions	Test Station.	modified during this test.	test.
		Occupied	Tested as	No EMI suppression	EUT remained at
2	2019-06-17	Bandwidth	delivered to	devices were added or	Element following the
		Danawiati	Test Station.	modified during this test.	test.
			Tested as	No EMI suppression	EUT remained at
3	2019-06-17	Output Power	delivered to	devices were added or	Element following the
			Test Station.	modified during this test.	test.
		Equivalent	Tested as	No EMI suppression	EUT remained at
4	2019-06-17	Isotropic	delivered to	devices were added or	Element following the
		Radiated	Test Station.	modified during this test.	test.
		Power		_	
_		Power	Tested as	No EMI suppression	EUT remained at
5	2019-06-17	Spectral	delivered to	devices were added or	Element following the
		Density	Test Station.	modified during this test.	test.
•		Band Edge	Tested as	No EMI suppression	EUT remained at
6	2019-06-17	Compliance	delivered to	devices were added or	Element following the
		•	Test Station.	modified during this test.	test.
-	0040 00 47	Spurious	Tested as	No EMI suppression	EUT remained at
7	2019-06-17	Conducted	delivered to	devices were added or	Element following the
		Emissions	Test Station.	modified during this test.	test.
•		Spurious	Tested as	No EMI suppression	Scheduled testing
8	2019-06-20	Radiated	delivered to	devices were added or	was completed.
		Emissions	Test Station.	modified during this test.	



### **TEST DESCRIPTION**

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 500hm measuring port is terminated by a 500hm EMI meter or a 500hm resistive load. All 500hm measuring ports of the LISN are terminated by 500hm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due	
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	2019-03-15	2020-03-15	
Receiver	Rohde & Schwarz	ESR7	ARI	2018-06-26	2019-06-26	
Cable - Conducted Cable Assembly	Northwest EMC	MNC, HGN, TYK	MNCA	2019-03-13	2020-03-13	

#### **MEASUREMENT UNCERTAINTY**

Description		
Expanded k=2	2.4 dB	-2.4 dB

### **CONFIGURATIONS INVESTIGATED**

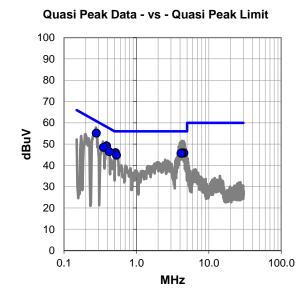
MDTR0798-1

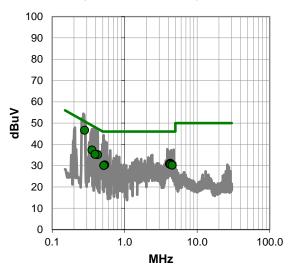
### **MODES INVESTIGATED**

BLE Mid Ch. 2442 MHz modulated



EUT:	PAL <sup>™</sup> Controlle	PAL <sup>™</sup> Controller for HeartWare <sup>™</sup> HVAD <sup>™</sup> Pump			Work Order:	MDTR0798
Serial Number:	PAL000404A			Date:	2019-06-14	
Customer:	Medtronic, Inc.			Temperature:	21.7°C	
Attendees:	Jeffrey Brown				Relative Humidity:	45.6%
Customer Project:	None				Bar. Pressure:	1009 mb
Tested By:	Chris Patterson	1			Job Site:	MN03
Power:	110VAC/60Hz				Configuration:	MDTR0798-1
TEST SPECIFIC	CATIONS					
Specification:				Method:		
FCC 15.207:2019				ANSI C63.10:	2013	
TEST PARAME	TERS					
Run #: 4	L	ine:	Neutral	Ad	d. Ext. Attenuation (dB	): 0
COMMENTS						
COMMENTS						
	nal via client Spec	c. Analyz	er (Ref # ES058324)			
	NG MODES	c. Analyz	er (Ref # ES058324)			





### Average Data - vs - Average Limit



### **RESULTS - Run #4**

Quasi Peak Data - vs - Quasi Peak Limit						
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)	
0.279	34.5	20.7	55.2	60.8	-5.6	
0.388	28.6	20.6	49.2	58.1	-8.9	
0.515	25.4	20.6	46.0	56.0	-10.0	
4.282	25.2	20.7	45.9	56.0	-10.1	
4.385	25.2	20.7	45.9	56.0	-10.1	
4.528	25.2	20.7	45.9	56.0	-10.1	
4.245	25.1	20.7	45.8	56.0	-10.2	
4.146	24.9	20.8	45.7	56.0	-10.3	
0.353	27.9	20.6	48.5	58.9	-10.4	
0.423	25.9	20.6	46.5	57.4	-10.9	
0.531	24.2	20.6	44.8	56.0	-11.2	

Average Data - vs - Average Limit						
_		_		Spec.		
Freq (MHz)	Amp. (dBuV)	Factor	Adjusted (dBuV)	Limit (dBuV)	Margin (dB)	
/	1 /	(dB)	· · · /	· · · /	. ,	
0.279	26.0	20.7	46.7	50.8	-4.1	
0.353	16.8	20.6	37.4	48.9	-11.5	
0.423	14.6	20.6	35.2	47.4	-12.2	
0.388	14.8	20.6	35.4	48.1	-12.7	
4.245	10.5	20.7	31.2	46.0	-14.8	
4.146	10.1	20.8	30.9	46.0	-15.1	
4.385	10.0	20.7	30.7	46.0	-15.3	
4.282	9.9	20.7	30.6	46.0	-15.4	
0.531	9.8	20.6	30.4	46.0	-15.6	
4.528	9.6	20.7	30.3	46.0	-15.7	
0.515	9.5	20.6	30.1	46.0	-15.9	

### CONCLUSION

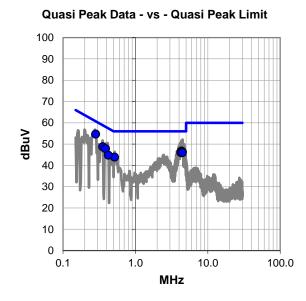
Pass

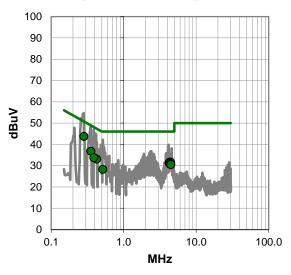
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Tested By



EUT:	PAL™ Contr	oller for He	eartWare™ HVAD™ P	ump	Work Order:	MDTR0798
Serial Number:	PAL000404/	4			Date:	2019-06-14
Customer:	Medtronic, Ir	IC.			Temperature:	21.7°C
Attendees:	Jeffrey Brow	n			Relative Humidity:	45.6%
Customer Project:	None				Bar. Pressure:	1009 mb
Tested By:	Chris Patters	son			Job Site:	MN03
Power:	110VAC/60H	łz			Configuration:	MDTR0798-1
TEST SPECIFIC	CATIONS					
Specification:				Method:		
FCC 15.207:2019				ANSI C63.	0:2013	
TEST PARAME	TERS					
Run #: 5		Line:	High Line		Add. Ext. Attenuation (dE	3): 0
COMMENTS						
Monitoring BLE sig	nal via client S	pec. Analy	zer (Ref # ES058324)			
BLE Mid Ch. 2442 I	viHz modulate	a				
DEVIATIONS F	ROM TEST	STAND	ARD			





#### Average Data - vs - Average Limit



### **RESULTS - Run #5**

Q	uasi Peak	Data - vs	- Quasi P	eak Limit	
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.283	34.1	20.6	54.7	60.7	-6.0
4.317	26.1	20.7	46.8	56.0	-9.2
4.458	25.7	20.7	46.4	56.0	-9.6
4.348	25.4	20.7	46.1	56.0	-9.9
4.238	25.4	20.7	46.1	56.0	-9.9
4.469	25.3	20.7	46.0	56.0	-10.0
0.353	28.2	20.6	48.8	58.9	-10.1
0.387	27.3	20.6	47.9	58.1	-10.2
0.514	23.3	20.6	43.9	56.0	-12.1
0.424	24.2	20.6	44.8	57.4	-12.6

	Average	Data - vs	<ul> <li>Average</li> </ul>	Limit	
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.283	23.2	20.6	43.8	50.7	-6.9
0.353	16.2	20.6	36.8	48.9	-12.1
0.424	12.5	20.6	33.1	47.4	-14.3
4.317	11.0	20.7	31.7	46.0	-14.3
0.387	13.2	20.6	33.8	48.1	-14.3
4.458	10.9	20.7	31.6	46.0	-14.4
4.238	10.6	20.7	31.3	46.0	-14.7
4.348	10.2	20.7	30.9	46.0	-15.1
4.469	9.9	20.7	30.6	46.0	-15.4
0.514	7.7	20.6	28.3	46.0	-17.7

### CONCLUSION

Pass

Cl 1

Tested By

## **DUTY CYCLE**



#### **TEST DESCRIPTION**

The Duty Cycle (x) were measured for each of the EUT operating modes. The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum. A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

The EUT operates at 100% Duty Cycle.



Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	E4422B	TGQ	15-Mar-18	15-Mar-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-18	13-Dec-19

#### **TEST DESCRIPTION**

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was set to the channels and modes listed in the datasheet.

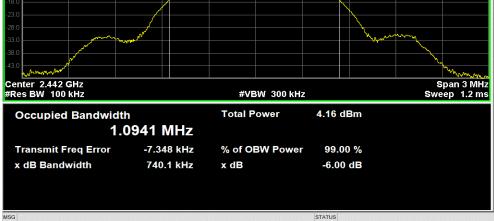
The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.0% occupied bandwidth was also measured at the same time which can be needed during Output Power depending on the applicable method.



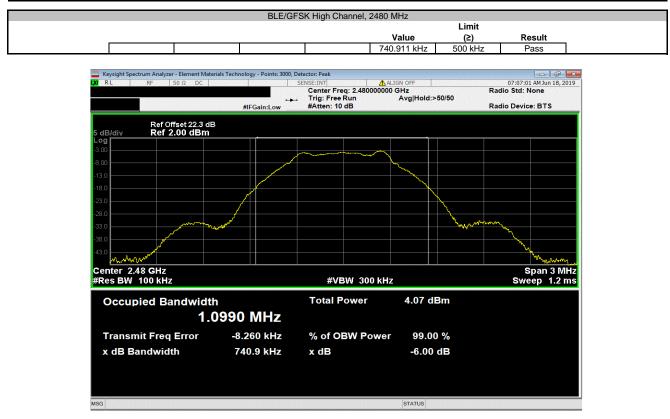
						TbtTx 2018.09.13	XMit 2019.05
		eartWare™ HVAD™ Pump			Work Order:		
Serial Number: PA	\L000404A				Date:	17-Jun-19	
Customer: Me	edtronic, Inc.				Temperature:		
Attendees: Je					Humidity:		
Project: No	one				Barometric Pres.:	1017 mbar	
Tested by: Du	ustin Sparks		Pow	er: 110VAC/60Hz	Job Site:	MN08	
TEST SPECIFICATION	IS			Test Method			
FCC 15.247:2019				ANSI C63.10:2013			
COMMENTS							
None							
DEVIATIONS FROM T	EST STANDARD						
None							
			6	$\bigcirc$			
Configuration #	2		X Turkan	Spards			
-		Signature		Sparas			
						Limit	-
					Value	(≥)	Result
BLE/GFSK Low Channe	el. 2402 MHz				741.534 kHz	500 kHz	Pass
BLE/GFSK Mid Channe					740.129 kHz	500 kHz	Pass
BLE/GFSK High Chann					740.911 kHz	500 kHz	Pass
DEE, C. C. C. Might Ondahi	0., 2 100 111 12				1.0.0111012	000 1112	. 455













XMit 2019.05.15

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	E4422B	TGQ	15-Mar-18	15-Mar-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-18	13-Dec-19

#### **TEST DESCRIPTION**

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.



	L <sup>™</sup> Controller for HeartW	/are™ HVAD™ Pump					v		MDTR0798	
Serial Number: PA	L000404A								17-Jun-19	
Customer: Me	dtronic, Inc.						Te	mperature:	21.4 °C	
Attendees: Jef	ffrey Brown							Humidity:		
Project: No	ne						Barom	etric Pres.:	1017 mbar	
Tested by: Du	stin Sparks			Pow	ver: 110VAC/60Hz			Job Site:	MN08	
FEST SPECIFICATION	S				Test Method					
CC 15.247:2019					ANSI C63.10:201	3				
COMMENTS										
lone										
None										
None										
	ST STANDARD									
DEVIATIONS FROM TE	EST STANDARD									
	EST STANDARD		6							
DEVIATIONS FROM TE None			29	),	2 0					
DEVIATIONS FROM TE	EST STANDARD	Signatura	D	Tustin	Sparls					
DEVIATIONS FROM TE None		Signature	D.	Tustin	Sparls				Limit	
DEVIATIONS FROM TE None		Signature	D.	Justin	Sparls			Value	Limit	
DEVIATIONS FROM TE None Configuration #	2	Signature	Þ.	Tustin	Sparlo			Value	(<)	Result
DEVIATIONS FROM TE None Configuration #	2 sl, 2402 MHz	Signature	D.	Justin	Sparlo		57	4.74 uW	<b>(&lt;)</b> 1 W	Pass
DEVIATIONS FROM TE None	2 N, 2402 MHz I, 2442 MHz	Signature	X.	Tustín	Sparlo		57 58		(<)	

Report No. MDTR0798 Rev. 1



	BLE/GFSK Low Char	nnel, 2402 MHz		
		Value	Limit (<)	Result
		574.74 uW	(<) 1 W	Pass
Keysight Spectrum Analyzer - Element Ma XI RL RF 50 Ω DC		ALIGN OFF	Dur	07:00:38 AM Jun 18, 2019
	PNO: Fast →→ Trig: Free Ru IFGain:Low #Atten: 10 di	#Avg Type: L un Avg Hold: 10 a	0/100	TRACE 1 2 3 4 5 TYPE M WWW DET P P P P P
Ref Offert 22.3 dB	IFGain:Low #Atten: 10 di	-	Mkr1	2.401 785 GH
Ref Offset 22.3 dB 5 dB/div Ref 2.500 mW				574.74 μV
	1			
791 µW				
250 μW				
79.1 µW				
25.0 μW				
20,0 HVV				
7.91 µW				
2.50 μW				
791 nW				
250 nW				
79.1 nW				
Contor 2 402000 CHz				Chan 2 500 MH
Center 2.402000 GHz #Res BW 2.0 MHz <sup>MSG</sup>	#VBW 6.0 MHz BLE/GFSK Mid Char		Limit	Span 3.500 MH: 3.46 ms (1000 pts
#Res BW 2.0 MHz	BLE/GFSK Mid Chan			3.46 ms (1000 pts Result Pass
#Res BW 2.0 MHz	BLE/GFSK Mid Chan	nel, 2442 MHz Value 583.55 uW	Limit (<) 1 W	8.46 ms (1000 pts Result Pass 07:04:17 AM Jun 18, 2015
#Res BW 2.0 MHz MSG WSG Keysight Spectrum Analyzer - Element Mk	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	3.46 ms (1000 pts Result Pass
#Res BW 2.0 MHz MSG MSG Keysight Spectrum Analyzer - Element ML RL RF 50 Q DC Ref Offset 22.3 dB	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz MSG MSG Keysight Spectrum Analyzer - Element Mi K RL RF 50 Ω DC	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	Result           Pass           07:04:17 AM Jun 18, 201           TRACE         22.44           YPER         YPER           DET         P.P.P.P.
#Res BW 2.0 MHz MSG MSG Keysight Spectrum Analyzer - Element ML RL RF 50 Q DC Ref Offset 22.3 dB	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz MSG MSG Keysight Spectrum Analyzer - Element Mt M RL RF 50 Ω DC 5 dB/div Ref 2.500 mW 791 μW	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz MSG MSG Keysight Spectrum Analyzer - Element Mi R RL RF 50 Ω DC S dB/div Ref Offset 22.3 dB Ref Offset 22.3 dB Ref 2,500 mW	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz MSG MSG Keysight Spectrum Analyzer - Element Mt M RL RF 50 Ω DC 5 dB/div Ref 2.500 mW 791 μW	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz           MSG           MSG           Keysight Spectrum Analyzer - Element Mic           RL         RF           So Q         DC           So QB/div         Ref Offset 22.3 dB           So QB/div         Ref 2.500 mW           791 μW         250 μW	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz           MSG           MSG           Keysight Spectrum Analyzer - Element Ma           W         RL           Ref Offset 22.3 dB           5 dB/div           Ref 2.500 mW           791 μW           250 μW           79.1 μW	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz           MSG           MSG           MSG           State           Ref Spectrum Analyzer - Element M.           N           RL           Ref Offset 22.3 dB           State           Ref 2,500 mW           791 μW           250 μW           791 μW           25.0 μW           7.91 μW	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz           Msg           Msg           Msg           Keysight Spectrum Analyzer - Element Million           R           R           Ref Offset 22.3 dB           Sog           791 µW           250 µW           79.1 µW           25.0 µW	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz           MSG           MSG           MSG           State           Ref Spectrum Analyzer - Element M.           N           RL           Ref Offset 22.3 dB           State           Ref 2,500 mW           791 μW           250 μW           791 μW           25.0 μW           7.91 μW	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz MSG MSG Keysight Spectrum Analyzer - Element Mic Ref Offset 22.3 dB 5 dB/div Ref 2.500 mW 791 µW 250 µW 791 µW 250 µW 7.91 µW 2.50 µW 7.91 µW 2.50 µW	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz           MSG	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz           Msg           Msg           Msg           Keysight Spectrum Analyzer - Element Mit           Msg           Keysight Spectrum Analyzer - Element Mit           Msg           RL         RF           S0 Q         DC           5 dB/div         Ref Offset 22.3 dB           791 µW         250 µW           79.1 µW         250 µW           79.1 µW         2.50 µW           791 µW         2.50 µW	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH
#Res BW 2.0 MHz           MSG	BLE/GFSK Mid Chan	Value           583.55 uW           #Aug Type: 1           #Avg Type: 1	Limit (<) 1 W .og-Pwr 0/100 Mkr1	<b>Result</b> Pass         07:04:17 AM Jun 18,2015         TYPE         TYPE         DET P P P P P         2,4442,293,GH



		Value		
		value	(<)	Result
		568.16 uW	1 W	Pass
s Technology				
s	ENSE:INT	ALIGN OFF		07:07:41 AM Jun 18, 201
PNO: Fast +++ IFGain:Low	Trig: Free Run #Atten: 10 dB	#Avg Type: Avg Hold: 1	00/100	TRACE 1 2 3 4 TYPE M DET P P P P
			Mk	r1 2.480 251 GF 568.16 μ\
	The second secon			
		. 1		
				Span 3.500 MH 73.46 ms (1000 pt
	PNO: Fast $\rightarrow$		PNO: Fast $\rightarrow$ Trig: Free Run Avg Hold: 10 IFGain:Low 4Atten: 10 dB	PNO: Fast $\leftrightarrow$ Trig: Free Run IFGain: Low #Avg Type: Log-Pwr Avg Hold: 100/100 Mk



XMit 2019.05.15

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	E4422B	TGQ	15-Mar-18	15-Mar-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-18	13-Dec-19

#### **TEST DESCRIPTION**

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio. The actual antenna gain of the EUT was added to the conducted output power to derive the EIRP values.

### EQUIVALENT ISOTROPIC RADIATED POWER



							TbtTx 2018.09.13	XMit 2019.0
EUT: P	AL <sup>™</sup> Controller for HeartWare <sup>™</sup> HVAD <sup>™</sup>	<sup>4</sup> Pump				Work Order:	MDTR0798	
Serial Number: P.	AL000404A					Date:	17-Jun-19	
Customer: M	Nedtronic, Inc.					Temperature:	21.4 °C	
Attendees: Je	effrey Brown					Humidity:	57.5% RH	
Project: N	ione					Barometric Pres.:	1017 mbar	
Tested by: D	Justin Sparks		Power: 110VAC/60Hz			Job Site:	MN08	
TEST SPECIFICATION	NS		Test Method					
FCC 15.247:2019			ANSI C63.10:2013					
COMMENTS								
None								
DEVIATIONS FROM T								
	IESI SIANDARD							
None	IEST STANDARD							
	2	X	Justin & parlo					
None	2	gnature	Tustin & parlo					
None	2	gnature	-(	Value	Antenna	EIRP	Limit	
None Configuration #	<b>2</b> Si	gnature	Value	(dBm)	Gain (dBi)	(dBm)	(< dBm)	Result
Configuration # BLE/GFSK Low Chann	2 Si	gnature	<b>Value</b> 574.74 uW	(dBm) -2.41	Gain (dBi) -0.6	(dBm) -3.01	<b>(&lt; dBm)</b> 36	Pass
None	2 Si nel, 2402 MHz nel, 2442 MHz	<i>∝</i> gnature	Value	(dBm)	Gain (dBi)	(dBm)	(< dBm)	

### EQUIVALENT ISOTROPIC RADIATED POWER



		BLE/GF	SK Low Channel, 2			
		Value	Antenna	EIRP	Limit	
	Value	(dBm)	Gain (dBi)	(dBm)	(< dBm)	Result
	574.74 uW	-2.41	-0.6	-3.01	36	Pass
Keysight Spectrum Analyze	er - Element Materials Techno	loav				
	50 Ω DC		SENSE:INT	ALIGN OFF		07:00:38 AM Jun 18, 201
		PNO: Fast 🔸	Trig: Free Run	#Avg Type Avg Hold:	e: Log-Pwr 100/100	TRACE 1 2 3 4 5 TYPE MWWWW
		IFGain:Low	#Atten: 10 dB			DET PPPP
Ref Offs	et 22.3 dB 00 mW				Mkr1	2.401 785 GH 574.74 μV
5 dB/div Ref 2.5			The second secon			
			<b>1</b>			
791 µVV						
250 µW						
200 μΨ						
79.1 µW						
25.0 μW						
7.91 µVV						
0.50 . 14/						
2.50 μW						
791 nW						
250 nW						
79.1 nW						
Center 2.402000 0						Span 3.500 MH
#Res BW 2.0 MHz		#VBW	6.0 MHz		#Sweep 73	.46 ms (1000 pts
MSG				STATUS		
			SK Mid Channel, 24	142 MHz		
		BLE/GF	SK IVIU GHAHHEI, 24			
		Value	Antenna	EIRP	Limit	_
	Value 583.55 uW		,		Limit (< dBm) 36	Result Pass

Center 2.442000 #Res BW 2.0 MH	) GHz Hz	#VBW	6.0 MHz		#Sweep	Span 73.46 ms	3.500 MHz (1000 pts
79.1 nW							
250 nW							
791 nW							
2.50 μW							
25.0 µW							
79.1 µW							
250 μΨ							

### EQUIVALENT ISOTROPIC RADIATED POWER



		SK High Channel,			
Val	Value ue (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Result
568.1		-0.6	-3.06	36	Pass
500.1	2.40	0.0	5.00		1 433
Keysight Spectrum Analyzer - Element Ma					- 2 -
🗶 RL RF 50Ω DC	S	SENSE:INT	ALIGN OFF	e: Log-Pwr	07:07:41 AM Jun 18, 2019
	PNO: Fast ↔→ IFGain:Low	Trig: Free Run #Atten: 10 dB	Avg Hold:	100/100	TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P
Ref Offset 22.3 dB				Mkr1	2.480 251 GHz
5 dB/div Ref 2.500 mW					568.16 µW
		Ĭ			
791 µW			<b>\</b> 1		
250 μW					
79.1 µW					
10.1 μ.					
25.0 μW					
7.91 µW					
2.50 µW					
791 nW					
250 nW					
79.1 nW					
Center 2.480000 GHz	<u> </u>				Span 3.500 MHz
#Res BW 2.0 MHz	#VBW	6.0 MHz		#Sweep 73	Span 3.500 MHz 3.46 ms (1000 pts)



Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due	
Generator - Signal	Agilent	E4422B	TGQ 15-Mar-18		15-Mar-21	
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	11-Apr-19	11-Apr-20	
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20	
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19	
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-18	13-Dec-19	

#### **TEST DESCRIPTION**

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The maximum power spectral density measurements was measured using the channels and modes as called out on the following data sheets.

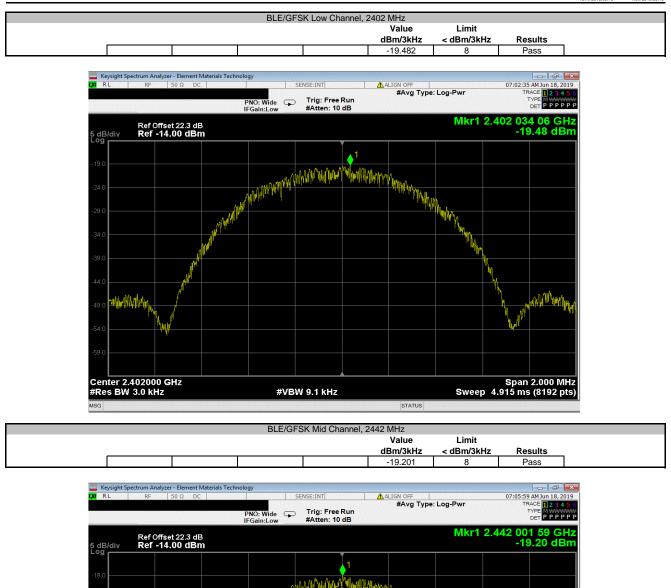
Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

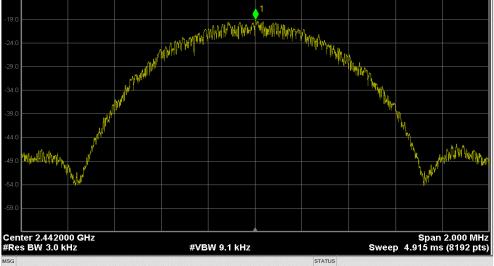


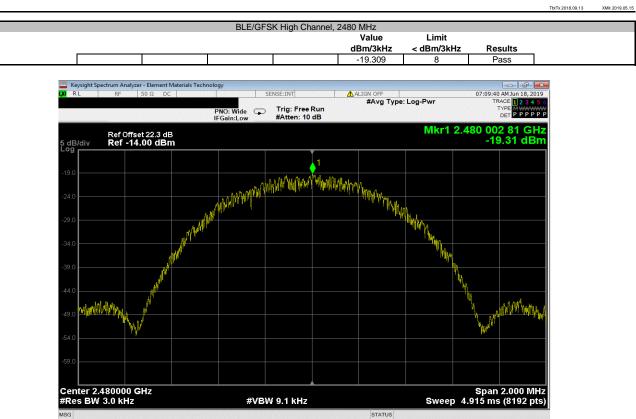
					TbtTx 2018.09.13	XMit 2019.0
	PAL <sup>™</sup> Controller for HeartWa	are™ HVAD™ Pump		Work Order:		
Serial Number: P.	AL000404A			Date:	17-Jun-19	
Customer: M	ledtronic, Inc.			Temperature:		
	leffrey Brown				56.9% RH	
Project: N				Barometric Pres.:		
Tested by: D	Dustin Sparks		Power: 110VAC/60Hz	Job Site:	MN08	
TEST SPECIFICATION	NS		Test Method			
FCC 15.247:2019			ANSI C63.10:2013			
COMMENTS						
None						
DEVIATIONS FROM T	FEST STANDARD					
Maria a						
None						
None			A at O a			
	2	6	Oustin & sals			
	2	Signature	Oustingowla			
	2	Signature	Oustin Sparls	Value	Limit	
	2	Signature	Oustin & parls	Value dBm/3kHz	Limit < dBm/3kHz	Results
Configuration #		Signature	Oustin & parls			Results Pass
Configuration # BLE/GFSK Low Chann BLE/GFSK Mid Chann	nel, 2402 MHz	Signature	Oustin & parlo	dBm/3kHz	< dBm/3kHz	

Report No. MDTR0798 Rev. 1











## **BAND EDGE COMPLIANCE**



XMit 2019.05.15

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due	
Generator - Signal	Agilent	E4422B TGQ		15-Mar-18	15-Mar-21	
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	11-Apr-19	11-Apr-20	
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20	
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19	
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-18	13-Dec-19	

#### **TEST DESCRIPTION**

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

### **BAND EDGE COMPLIANCE**

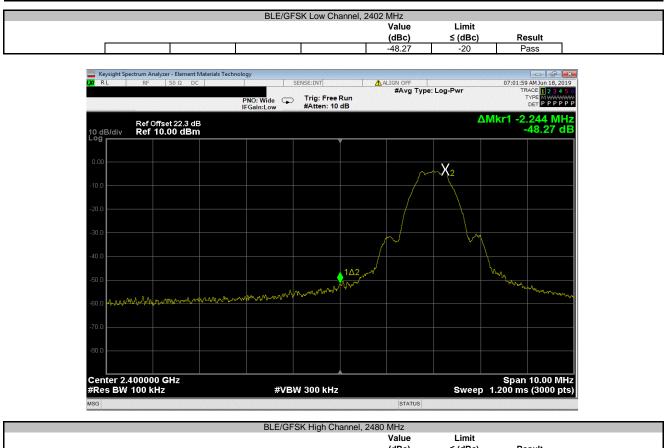


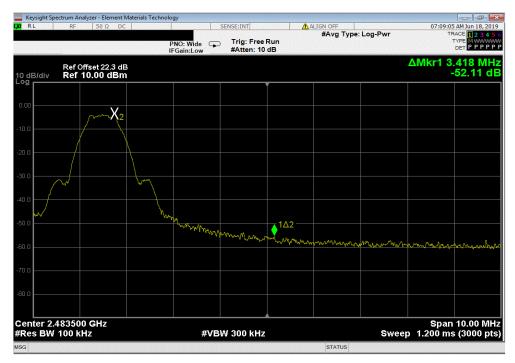
					TbtTx 2018.09.13	XMit 2019.05
	L <sup>™</sup> Controller for HeartWare™	M HVAD™ Pump		Work Order:		
Serial Number: PA	L000404A				17-Jun-19	
Customer: Me	dtronic, Inc.			Temperature:	21.3 °C	
Attendees: Jef	frey Brown			Humidity:		
Project: Nor				Barometric Pres.:		
Tested by: Dus			Power: 110VAC/60Hz	Job Site:	MN08	
TEST SPECIFICATIONS	S		Test Method			
FCC 15.247:2019			ANSI C63.10:2013			
COMMENTS						
None						
DEVIATIONS FROM TE	ST STANDARD					
None						
Configuration #	2	Signature	Justin Sparks			
				Value	Limit	
				(dBc)	≤ (dBc)	Result
BLE/GFSK Low Channel				-48.27	-20	Pass
BLE/GFSK High Channe	el, 2480 MHz			-52.11	-20	Pass

Report No. MDTR0798 Rev. 1

### **BAND EDGE COMPLIANCE**









XMit 2019.05.15

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#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	E4422B	TGQ	15-Mar-18	15-Mar-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-19	13-Feb-20
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-18	13-Dec-19

#### **TEST DESCRIPTION**

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.



EUT: PA	L <sup>™</sup> Controller for HeartWare	™ HVAD™ Pump			Work Order:	MDTR0798	
Serial Number: PA	L000404A				Date:	17-Jun-19	
Customer: Me	dtronic, Inc.				Temperature:	21.3 °C	
Attendees: Jef	ffrey Brown				Humidity:	56.5% RH	
Project: No	ne				<b>Barometric Pres.:</b>		
Tested by: Due			Power: 110VAC/60Hz		Job Site:	MN08	
EST SPECIFICATIONS	S		Test Method				
CC 15.247:2019			ANSI C63.10:2013				
COMMENTS							
lone							
DEVIATIONS FROM TE	EST STANDARD						
DEVIATIONS FROM TE	EST STANDARD						
	2	$\sim$	Justin Don la				
lone		Signature	Justin & parks				
lone		Signature	Frequency	Measured	Max Value	Limit	
lone		Signature	-{	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
lone Configuration #	2	Signature	Frequency				Result N/A
Configuration #	2 il, 2402 MHz	Signature	Frequency Range	Freq (MHz)	(dBc)	≤ (dBc)	
ione configuration # LE/GFSK Low Channel LE/GFSK Low Channel	2 91, 2402 MHz 91, 2402 MHz	Signature	Frequency Range Fundamental	Freq (MHz) 2402.23	(dBc) N/A	≤ (dBc) N/A	N/A
Ione configuration # LE/GFSK Low Channe LE/GFSK Low Channe LE/GFSK Low Channe	2 N, 2402 MHz N, 2402 MHz N, 2402 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz	Freq (MHz) 2402.23 4804.25	(dBc) N/A -46.92	≤ (dBc) N/A -20	N/A Pass
Ione Configuration # LE/GFSK Low Channel LE/GFSK Low Channel LE/GFSK Mid Channel LE/GFSK Mid Channel	2 sl, 2402 MHz sl, 2402 MHz sl, 2402 MHz zl, 2402 MHz , 2442 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz	Freq (MHz) 2402.23 4804.25 24069.1	(dBc) N/A -46.92 -46.59	≤ (dBc) N/A -20 -20	N/A Pass Pass
Ione IDE/GFSK Low Channel LE/GFSK Low Channel LE/GFSK Mid Channel LE/GFSK Mid Channel	2 N, 2402 MHz N, 2402 MHz N, 2402 MHz N, 2442 MHz NHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental	Freq (MHz) 2402.23 4804.25 24069.1 2442.23	(dBc) N/A -46.92 -46.59 N/A	≤ (dBc) N/A -20 -20 N/A	N/A Pass Pass N/A
Ione Configuration # BLE/GFSK Low Channel BLE/GFSK Low Channel BLE/GFSK Mid Channel BLE/GFSK Mid Channel BLE/GFSK Mid Channel	2 sl, 2402 MHz sl, 2402 MHz sl, 2402 MHz sl, 2442 MHz sl, 2442 MHz sl, 2442 MHz sl, 2442 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz	Freq (MHz) 2402.23 4804.25 24069.1 2442.23 4883.42	(dBc) N/A -46.92 -46.59 N/A -47.93	≤ (dBc) N/A -20 -20 N/A -20	N/A Pass Pass N/A Pass
lone	2 sl, 2402 MHz sl, 2402 MHz sl, 2402 MHz sl, 2402 MHz sl, 2442 MHz sl, 2442 MHz sl, 2442 MHz sl, 2442 MHz sl, 2442 MHz	Signature	Frequency Range Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz Fundamental 30 MHz - 12.5 GHz 12.5 GHz - 25 GHz	Freq (MHz) 2402.23 4804.25 24069.1 2442.23 4883.42 23934.81	(dBc) N/A -46.92 -46.59 N/A -47.93 -45.95	≤ (dBc) N/A -20 -20 N/A -20 -20 -20	N/A Pass Pass N/A Pass Pass



		LE/GFSK Low Channel, 2			
	Frequency	Measured	Max Value	Limit	
	Range	Freq (MHz)	(dBc)	≤ (dBc)	Result
	Fundamental	2402.23	N/A	N/A	N/A
	um Analyzer - Element Materials Technology				
LXI RL	RF 50 Ω DC	SENSE:INT	ALIGN OFF		07:01:00 AM Jun 18 2019
		le 🕞 Trig: Free Run	#Avg Type:	: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE M WWWW
	PNO: Wid IFGain:Lo				DET <u>PPPPP</u>
R	Ref Offset 22.3 dB			Mkr1 2.4	02 232 76 GHz
10 dB/div	Ref 10.00 dBm				-3.31 dBm
209		The second se			
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-10.0					~~~~~
					and the second s
-20.0					
-30.0					
-40.0					
-50.0					
co. o					
-60.0					
-70.0					
10.0					
-80.0					
Center 2.402	20000 GHz				Span 1.000 MHz
#Res BW 10		#VBW 300 kHz		Sweep 1.	.092 ms (8192 pts)
MSG			STATUS		
		LE/GFSK Low Channel, 2		Lineit	
	Frequency Range	Measured	Max Value (dBc)	Limit ≤ (dBc)	Result
	30 MHz - 12.5 GHz	Freq (MHz) 4804.25	-46.92	<u>≤ (dBc)</u> -20	Pass
I		1001.20	10.02	20	1 400
	um Analyzer - Element Materials Technology				- F <b>x</b>
LXI RL	RF 50 Ω DC	SENSE:INT	ALIGN OFF	Log Pur	07:01:21 AM Jun 18, 2019
	PNO: Fas	at 🕞 Trig: Free Run	#Avg Type:	Log-Pwr	TRACE 1 2 3 4 5 6 TYPE MWWWW

	RF 50 Ω D			SENSE:INT	<u>A</u>	LIGN OFF			AM Jun 18, 201
		 	PNO: Fast 🕞 FGain:Low	Trig: Free #Atten: 10	Run dB	#Avg Type			ACE 1 2 3 4 5 TYPE MWWW DET P P P P F
R dB/div R	tef Offset 22.3 d tef 10.00 dBr	B n						/lkr1 4.8 -5(	04 3 GH ).23 dBi
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	ويغطيك المتلافين المراجع	and the state of the second	and the second second	ويتارك والمرياح	مىلىمادىلىمىيەتەرىيەتەرىيەتەرىيەتەرىيەتەرىيەتەرىيەتەرىيەتەرىيەتەرىيەتەرىيەتەرىيەتەرىيەتەرىيەتەرىيەتەرىيەتەرىيە		, le hij je beza stil des te stil	والإبار أأذرا فالإزر الحود	
).0									
art 30 MHz Res BW 10			#VB	W 300 kHz			Sweep	Stop 1 40.96 ms	2.500 GH (8192 pt
G						STATUS			



Frequ		K Low Channel, 2 Measured	Max Value	Limit	
Ran		Freq (MHz)	(dBc)	≤ (dBc)	Result
12.5 GHz		24069.1	-46.59	-20	Pass
1210 0112	20 0.12	2100011	10100		1 000
Keysight Spectrum Analyzer - Element Mar XI RL RF 50 Ω DC					
L <mark>X/</mark> RL RF 50 Ω DC	St	NSE:INT	ALIGN OFF #Avg Type	: Log-Pwr	07:01:41 AM Jun 18, 2019 TRACE 1 2 3 4 5
	PNO: Fast 😱 IFGain:Low	Trig: Free Run #Atten: 10 dB			TRACE 1 2 3 4 5 TYPE M WWW DET P P P P P
Ref Offset 22.3 dB				Mkr	1 24.069 1 GH
10 dB/div Ref 10.00 dBm					-49.90 dBn
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0.00					
-10.0					
-20.0					
-30.0					
-40.0					
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-60.0			and the second states of the	al de la desta partes de la del de la desta de la d	and the set of the set
-00.0					
-70.0					
-80.0					
Start 12.500 GHz #Res BW 100 kHz	#VBW	/ 300 kHz		Sweep 4	Stop 25.000 GH 0.96 ms (8192 pts
MSG			STATUS		

BLE/GFSK Mid Channel, 2442 MHz							
Frequency	Frequency Measured Max Value Limit						
Range	Freq (MHz)	(dBc)	≤ (dBc)	Result			
Fundamental	2442.23	N/A	N/A	N/A			

	ENSEITNT	A ALIGN OFF	07:04:38 AM Jun 18, 20
PNO: Wide	Trig: Free Run #Atten: 10 dB		
		N	lkr1 2.442 228 85 GH -3.27 dB
		<b>_</b> 1.	
#VBV	V 300 kHz		Span 1.000 M weep 1.092 ms (8192 p
	PNO: Wide IFGain:Low	PNO: Wide Trig: Free Run	SENSE:INT #ALIGN OFF PNO: Wide Trig: Free Run #Atten: 10 dB M



		SK Mid Channel, 2			
	uency	Measured	Max Value	Limit	
	inge	Freq (MHz)	(dBc)	≤ (dBc)	Result
30 MHz	· 12.5 GHz	4883.42	-47.93	-20	Pass
🔤 Keysight Spectrum Analyzer - Element N					
🗶 RL RF 50Ω DC		SENSE:INT	ALIGN OFF		07:04:58 AM Jun 18, 2019
	PNO: Fast	Trig: Free Run	#Avg Type	Log-Pwr	TRACE 1 2 3 4 5 TYPE M WWWW DET P P P P P
	IFGain:Low	#Atten: 10 dB			DETPPPP
Ref Offset 22.3 dB				M	r1 4.883 4 GH
10 dB/div Ref 10.00 dBm					-51.20 dBm
Log		Y			
0.00					
-10.0					
-20.0					
-30.0					
-40.0					
		1			
-50.0					
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-70.0					
-80.0					
Start 30 MHz					Stop 12.500 GHz
start 30 MHz #Res BW 100 kHz	#VB	W 300 kHz		Sween 4	0.96 ms (8192 pts
	#¥D	A		oweeh a	eree ma (o raz pra

BLE/GFSK Mid Channel, 2442 MHz						
Frequency	Measured	Max Value	Limit			
Range	Freq (MHz)	(dBc)	≤ (dBc)	Result		
12.5 GHz - 25 GHz	23934.81	-45.95	-20	Pass		

RL	RF 50 Ω I	DC	College College	SENSE:INT		ALIGN OFF		07:05:20	AMJun 18, 201
			PNO: Fast G FGain:Low	Trig: Free #Atten: 10	Run	#Avg Type:	Log-Pwr		ACE 1 2 3 4 1 TYPE MWWW DET PPPP
	ef Offset 22.3 ef 10.00 dB						Μ	kr1 23.9 -49	34 8 GH 9.22 dB
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tart 12.500	CH2							Stor	5 000 01
art 12.500 Res BW 10			#V	BW 300 kHz			Sween	40.96 ms	25.000 GI



	Frequency	BLE/GFSK High Channel, : Measured	Max Value	Limit	
	Range	Freq (MHz)	(dBc)	≤ (dBc)	Result
	Fundamental	2480.23	N/A	N/A	N/A
	i undamentai	2400.23	N/A	11/73	19/75
Keysight Spectrum	m Analyzer - Element Materials Technology				
LXI RL	RF 50 Ω DC	SENSE:INT	ALIGN OFF		07:08:04 AM Jun 18, 2019
	PNO: W IFGain:I	ide 🕞 Trig: Free Run	#Avg Type	: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P P
				Mkr1 2 4	80 232 51 GHz
R 10 dB/div R Log	ef Offset 22.3 dB ef 10.00 dBm				-3.36 dBm
Log		Y T			
0.00				<b>1</b>	
0.00					
-10.0					~~~~
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-20.0					
-30.0					
-40.0					
-50.0					
-60.0					
-70.0					
-80.0					
Center 2.480					Span 1.000 MHz
#Res BW 10	0 kHz	#VBW 300 kHz		Sweep 1	.092 ms (8192 pts)
MSG			STATUS		
		BLE/GFSK High Channel,	2480 MHz		
	Frequency	Measured	Max Value	Limit	
	Range	Freq (MHz)	(dBc)	≤ (dBc)	Result
	30 MHz - 12.5 GHz	4959.54	-46.3	-20	Pass

Keysight Spi	ectrum Analyzer - Elemen RF 50 Ω D			SENSE:INT		LIGN OFF		07:00:00	🔲 🕞 💽 AM Jun 18, 2019
A KL	RF   50 Ω U		PNO: Fast 🕞		Run	#Avg Type:	Log-Pwr	TR	AM JUN 18, 2019 ACE 1 2 3 4 5 TYPE M WWW DET P P P P P
0 dB/div	Ref Offset 22.3 c Ref 10.00 dBi						l	Mkr1 4.9 -49	59 5 GH 9.66 dBn
0.00									
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tart 30 N Res BW	/IHz 100 kHz		#VB	W 300 kHz			Sweep	Stop 1 40.96 ms	2.500 GH (8192 pt
SG						STATUS			



BLE/GFSK High Channel, 2480 MHz										
	Freque		Measur		Max Value	Limit				
	Ran		Ereq (MI 24935.9		(dBc)	≤ (dBc)		esult		
	12.5 GHz - 25 GHz					-46.14	-20	P	Pass	
Keysight Spectrum	Analyzer - Element Mat	erials Technology								
LXI RL RF			S	ENSE:INT	4	ALIGN OFF		07:08:47 AM Jun 18, 2019		
				Trig: Free R		#Avg Type	: Log-Pwr	IT	RACE 1 2 3 4 5 6 TYPE M WWWW DET P P P P P P	
		PNO: Fa IFGain:L	ast 🖵	#Atten: 10 d	un B				DET PPPPP	
		II Guille					D/	kr1 24 0	35 9 GHz	
	Offset 22.3 dB								9.50 dBm	
10 dB/div Ref	10.00 dBm								0.00 abiii	
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-60.0		and the second secon	in the local division of	a philosophic first fit in the second s						
-70.0										
-80.0										
Start 12.500 G	Hz			A				Stop 2	25.000 GHz	
#Res BW 100			#VBV	N 300 kHz			s (8192 pts)			

# **SPURIOUS RADIATED EMISSIONS**



Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

#### MODES OF OPERATION

Transmitting BLE - low channel (2402 MHz), mid channel (2442 MHz), and high channel (2480 MHz)

#### POWER SETTINGS INVESTIGATED

110VAC/60Hz

#### **CONFIGURATIONS INVESTIGATED**

MDTR0798 - 5

#### FREQUENCY RANGE INVESTIGATED

Start Frequency 30 MHz

Stop Frequency 26500 MHz

#### SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Interval
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	13-Sep-2018	12 mo
Cable	ESM Cable Corp	TTBJ141 KMKM-72	MNP	12-Sep-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-12001800-30-10P	PAP	23-Feb-2019	12 mo
Cable	Element	Biconilog Cable	MNX	23-Feb-2019	12 mo
Cable	Element	Standard Gain Cable	MNW	23-Feb-2019	12 mo
Cable	Element	Double Ridge Guide Horn Cables	MNV	23-Feb-2019	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	HGG	26-Sep-2018	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	HFM	26-Sep-2018	12 mo
Attenuator	Coaxicom	3910-20	AXY	26-Sep-2018	12 mo
Antenna - Biconilog	ETS Lindgren	3142D	AXO	15-Dec-2017	24 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	23-Feb-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	23-Feb-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	23-Feb-2019	12 mo
Antenna	ETS-Lindgren	3160-08	AJP	NCR	0 mo
Antenna	ETS-Lindgren	3160-07	AJJ	NCR	0 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIB	27-Aug-2018	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	5-Jul-2018	12 mo

#### **MEASUREMENT BANDWIDTHS**

Frequency Range	Peak Data	Quasi-Peak Data	Average Data
(MHz)	(kHz)	(kHz)	(kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

# **SPURIOUS RADIATED EMISSIONS**



PSA-ESCI 2019.05.10

#### **TEST DESCRIPTION**

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These "pre-scans" are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector PK = Peak Detector AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of 10\*LOG(dc).

## SPURIOUS RADIATED EMISSIONS



						EmiR5 2019.05.20	PSA-ESCI 2019.05.10				
	Work Order		Date:	20-Jun-2019	-12 11	$\bigcirc$	0				
	Project		Temperature:	21.9 °C 52.8% RH	Austin Sparts						
	Job Site	: MN09	Humidity:		-(						
Se	rial Number		Barometric Pres.:	Tested by:	Dustin Sparks						
			HeartWare™ HVAD™ Pu	ump							
Co	onfiguration										
		: Medtronic, Inc.									
		: Jeffrey Brown, Aaron	Ledebuhr								
	EUI Power	: 110VAC/60Hz				0 400 MILL )					
Oper	rating Mode	I ransmitting BLE - Io	w channel (2402 MHz), n	nid channel (2442 M	IHz), and high channel (	2480 MHz)					
	Deviations	None									
	Comments	None									
Test Sp	ecifications			Test Meth	hod						
	.247:2019			ANSI C63							
Run	1# 12	Test Distance (m)	) 3 Antenna H	leight(s)	1 to 4(m)	Results	Pass				
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70 60 <b>W/Nngp</b> 40	· · · · · · · · · · · · · · · · · · ·										
70 60 <b>W/NB</b> 40 30											
70 60 <b>W/Nngp</b> 40											
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70 60 <b>W/NBP</b> 40 30 20											
70 60 <b>W/Ngp</b> 40 30 20 10				1000							

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.867	31.6	-4.1	1.5	332.0	3.0	20.0	Horz	AV	0.0	47.5	54.0	-6.5	High ch, EUT horizontal
2484.342	31.4	-4.1	1.5	328.0	3.0	20.0	Vert	AV	0.0	47.3	54.0	-6.7	High ch, EUT horizontal
2483.625	31.3	-4.1	1.5	191.0	3.0	20.0	Horz	AV	0.0	47.2	54.0	-6.8	High ch, EUT on side
2483.925	31.2	-4.1	2.1	249.0	3.0	20.0	Vert	AV	0.0	47.1	54.0	-6.9	High ch, EUT on side
2487.042	31.2	-4.1	2.6	319.0	3.0	20.0	Horz	AV	0.0	47.1	54.0	-6.9	High ch, EUT vertical
2485.108	31.2	-4.1	1.5	28.0	3.0	20.0	Vert	AV	0.0	47.1	54.0	-6.9	High ch, EUT vertical
2385.742	31.1	-4.2	1.5	70.0	3.0	20.0	Horz	AV	0.0	46.9	54.0	-7.1	Low ch, EUT horizontal
2387.817	31.1	-4.2	1.5	303.0	3.0	20.0	Vert	AV	0.0	46.9	54.0	-7.1	Low ch, EUT horizontal
7439.500	28.6	12.8	1.5	239.0	3.0	0.0	Horz	AV	0.0	41.4	54.0	-12.6	High ch, EUT horizontal
7437.958	28.5	12.8	3.5	77.0	3.0	0.0	Vert	AV	0.0	41.3	54.0	-12.7	High ch, EUT horizontal
7429.542	28.4	12.8	1.5	10.0	3.0	0.0	Horz	AV	0.0	41.2	54.0	-12.8	High ch, EUT on side
7428.208	28.4	12.8	3.2	105.0	3.0	0.0	Vert	AV	0.0	41.2	54.0	-12.8	High ch, EUT on side
7435.542	28.4	12.8	1.7	199.0	3.0	0.0	Horz	AV	0.0	41.2	54.0	-12.8	High ch, EUT vertical
7436.208	28.4	12.8	1.5	96.0	3.0	0.0	Vert	AV	0.0	41.2	54.0	-12.8	High ch, EUT vertical
7313.500	28.3	12.7	1.5	138.0	3.0	0.0	Horz	AV	0.0	41.0	54.0	-13.0	Mid ch, EUT horizontal
7326.292	28.3	12.7	3.0	333.0	3.0	0.0	Vert	AV	0.0	41.0	54.0	-13.0	Mid ch, EUT horizontal
2486.333	43.4	-4.1	1.5	332.0	3.0	20.0	Horz	PK	0.0	59.3	74.0	-14.7	High ch, EUT horizontal
2486.017	42.8	-4.1	1.5	328.0	3.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	High ch, EUT horizontal

				_									
						External	Polarity/ Transducer		Distance			Compared to	
Freq	Amplitude	Factor	Antenna Height	Azimuth	Test Distance	Attenuation	Туре	Detector	Adjustment	Adjusted	Spec. Limit	Spec.	
(MHz)	(dBuV)	(dB)	(meters)	(degrees)	(meters)	(dB)			(dB)	(dBuV/m)	(dBuV/m)	(dB)	
													Comments
2485.325	42.8	-4.1	2.1	249.0	3.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	High ch, EUT on side
2386.158	42.9	-4.2	1.5	303.0	3.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	Low ch, EUT horizontal
2487.308	42.7	-4.1	1.5	191.0	3.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	High ch, EUT on side
2487.033	42.7	-4.1	2.6	319.0	3.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	High ch, EUT vertical
2487.833	42.7	-4.1	1.5	28.0	3.0	20.0	Vert	PK	0.0	58.6	74.0	-15.4	High ch, EUT vertical
12403.600	25.6	12.5	3.0	360.0	3.0	0.0	Horz	AV	0.0	38.1	54.0	-15.9	High ch, EUT horizontal
12403.400	25.6	12.5	3.4	54.0	3.0	0.0	Vert	AV	0.0	38.1	54.0	-15.9	High ch, EUT horizontal
2385.858	42.3	-4.2	1.5	70.0	3.0	20.0	Horz	PK	0.0	58.1	74.0	-15.9	Low ch, EUT horizontal
4883.917	30.4	3.5	3.4	232.0	3.0	0.0	Vert	AV	0.0	33.9	54.0	-20.1	Mid ch, EUT horizontal
4884.667	29.8	3.5	1.5	15.0	3.0	0.0	Horz	AV	0.0	33.3	54.0	-20.7	Mid ch, EUT horizontal
4960.250	29.2	3.8	1.9	51.0	3.0	0.0	Vert	AV	0.0	33.0	54.0	-21.0	High ch, EUT horizontal
4957.042	29.2	3.7	1.5	51.0	3.0	0.0	Horz	AV	0.0	32.9	54.0	-21.1	High ch, EUT horizontal
4803.625	29.2	3.5	1.5	207.0	3.0	0.0	Horz	AV	0.0	32.7	54.0	-21.3	Low ch, EUT horizontal
4804.750	29.2	3.5	1.5	44.0	3.0	0.0	Vert	AV	0.0	32.7	54.0	-21.3	Low ch, EUT horizontal
7449.667	39.3	12.8	1.5	239.0	3.0	0.0	Horz	PK	0.0	52.1	74.0	-21.9	High ch, EUT horizontal
7433.292	39.2	12.8	1.5	96.0	3.0	0.0	Vert	PK	0.0	52.0	74.0	-22.0	High ch, EUT vertical
7446.375	38.9	12.8	1.5	10.0	3.0	0.0	Horz	PK	0.0	51.7	74.0	-22.3	High ch, EUT on side
7432.333	38.9	12.8	1.7	199.0	3.0	0.0	Horz	PK	0.0	51.7	74.0	-22.3	High ch, EUT vertical
7442.167	38.9	12.7	3.2	105.0	3.0	0.0	Vert	PK	0.0	51.6	74.0	-22.4	High ch, EUT on side
7325.708	38.9	12.7	1.5	138.0	3.0	0.0	Horz	PK	0.0	51.6	74.0	-22.4	Mid ch, EUT horizontal
7435.875	38.7	12.8	3.5	77.0	3.0	0.0	Vert	PK	0.0	51.5	74.0	-22.5	High ch, EUT horizontal
7313.500	38.5	12.7	3.0	333.0	3.0	0.0	Vert	PK	0.0	51.2	74.0	-22.8	Mid ch, EUT horizontal
12407.650	37.3	12.6	3.4	54.0	3.0	0.0	Vert	PK	0.0	49.9	74.0	-24.1	High ch, EUT horizontal
12017.290	30.7	-1.2	1.5	313.0	3.0	0.0	Horz	AV	0.0	29.5	54.0	-24.5	Low ch, EUT horizontal
12009.040	30.5	-1.2	1.5	159.0	3.0	0.0	Vert	AV	0.0	29.3	54.0	-24.7	Low ch, EUT horizontal
12205.500	29.7	-0.4	1.5	122.0	3.0	0.0	Horz	AV	0.0	29.3	54.0	-24.7	Mid ch, EUT horizontal
12208.290	29.7	-0.4	2.9	338.0	3.0	0.0	Vert	AV	0.0	29.3	54.0	-24.7	Mid ch, EUT horizontal
12397.460	29.5	-0.2	4.0	338.0	3.0	0.0	Horz	AV	0.0	29.3	54.0	-24.7	High ch, EUT horizontal
12392.750	29.2	-0.3	1.5	241.0	3.0	0.0	Vert	AV	0.0	28.9	54.0	-25.1	High ch, EUT horizontal
12408.710	36.3	12.6	3.0	360.0	3.0	0.0	Horz	PK	0.0	48.9	74.0	-25.1	High ch, EUT horizontal
4888.667	40.4	3.5	3.4	232.0	3.0	0.0	Vert	PK	0.0	43.9	74.0	-30.1	Mid ch, EUT horizontal
4955.958	40.1	3.7	1.5	51.0	3.0	0.0	Horz	PK	0.0	43.8	74.0	-30.2	High ch, EUT horizontal
4959.917	39.8	3.8	1.9	51.0	3.0	0.0	Vert	PK	0.0	43.6	74.0	-30.4	High ch, EUT horizontal
4793.167	40.0	3.5	1.5	207.0	3.0	0.0	Horz	PK	0.0	43.5	74.0	-30.5	Low ch, EUT horizontal
4883.125	39.9	3.5	1.5	15.0	3.0	0.0	Horz	PK	0.0	43.4	74.0	-30.6	Mid ch, EUT horizontal
4807.708	39.6	3.5	1.5	44.0	3.0	0.0	Vert	PK	0.0	43.1	74.0	-30.9	Low ch, EUT horizontal
12006.080	41.6	-1.2	1.5	313.0	3.0	0.0	Horz	PK	0.0	40.4	74.0	-33.6	Low ch, EUT horizontal
12205.830	40.2	-0.4	2.9	338.0	3.0	0.0	Vert	PK	0.0	39.8	74.0	-34.2	Mid ch, EUT horizontal
12389.480	39.9	-0.3	4.0	338.0	3.0	0.0	Horz	PK	0.0	39.6	74.0	-34.4	High ch, EUT horizontal
12021.790	40.7	-1.2	1.5	159.0	3.0	0.0	Vert	PK	0.0	39.5	74.0	-34.5	Low ch, EUT horizontal
12204.130	39.8	-0.4	1.5	122.0	3.0	0.0	Horz	PK	0.0	39.4	74.0	-34.6	Mid ch, EUT horizontal
12397.330	39.3	-0.2	1.5	241.0	3.0	0.0	Vert	PK	0.0	39.1	74.0	-34.9	High ch, EUT horizontal
	2010	0.2			210	210			210	2.5.1		2.110	5 - 7