

Medtronic, Inc.

LINQ II

FCC 15.247:2018

Report # MDTR0718







CERTIFICATE OF TEST



Last Date of Test: October 11, 2018 Medtronic, Inc. Model: LINQ II

Radio Equipment Testing

Standards	
Specification	Method
FCC 15.247:2018	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for a battery powered EUT.
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 (EIRP)	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:

Matt Nuernberg, Operations 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		

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). Certification chambers and Open Area Test Sites are filed with ISED.

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





(943) 601-8318 (612)-636-5136 (313) 334-6214 (303) 644-4006 (443) 304-3233 (423) 964-6600 NVLAP	California Labs OC01-17 41 Tesla Irvine, CA 92618	Minnesota Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (34) 554 9914	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (E02) 844 Ages	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (09) 2004 5255	Washington Labs NC01-05 19201 120 th Ave NE Bothell, WA 98011	
NVLAPNVLAP Lab Code: 2008760NVLAP Lab Code: 2008810NVLAP Lab Code: 2007610NVLAP Lab Code: 2008300NVLAP Lab Code: 2010490NVLAP Lab Code: 2006290Innovation, Science and Ecorete and Ecoret	(949) 861-8918	(012)-038-5130	(313) 334-8214	(303) 844-4066	(409) 304-3233	(423)984-8600	
NVLAP Lab Code: 200676-0 NVLAP Lab Code: 200881-0 NVLAP Lab Code: 200630-0 NVLAP Lab Code: 200629-0 Innovation, Science and Eco-mic Development Caracter Sease			NV	LAP			
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2834B-1, 2834B-3 2834E-1, 2834E-3 N/A 2834D-1, 2834D-2 2834G-1 2834F-1 SL2-IN-E-1152R SL2-IN-E-1017 SL2-IN-E-1158R SL2-IN-E-1153R SL2-IN-E-1154R SL2-IN-E-1152R N/A SL2-IN-E-1017 SL2-IN-E-1158R SL2-IN-E-1153R A-0029 A-0109 N/A A-0108 A-0201 A-0110 Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA US0158 US0175 N/A US0017 US0191 US0157	Innovation, Science and Economic Development Canada						
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SL2-IN-E-1154R SL2-IN-E-1152R N/A SL2-IN-E-1017 SL2-IN-E-1158R SL2-IN-E-1153R A-0029 A-0109 N/A A-0108 A-0201 A-0110 Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA US0158 US0175 N/A US0017 US0191 US0157			BSI	МІ			
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US0158 US0175 N/A US0017 US0191 US0157	Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA						
	US0158	US0175	N/A	US0017	US0191	US0157	



EMISSIONS MEASUREMENTS



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 QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. 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.

Measurement Bandwidths

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (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

Measurements were made using the bandwidths and detectors specified. No video filter was used.

Sample Calculations

Radiated Emissions:

Field Strength		Measured Level		Antenna Factor		Cable Factor		Amplifier Gain		Distance Adjustment Factor		External Attenuation
33.5	=	42.6	+	28.6	+	3.1	-	40.8	+	0.0	+	0.0

Conducted Emissions:

Adjusted Level		Measured Level		Transducer Factor		Cable Factor		External Attenuation
47.1	=	26.7	+	0.3	+	0.1	+	20.0

Test Setup Block Diagrams





PRODUCT DESCRIPTION



Client and Equipment Under Test (EUT) Information

Company Name:	Medtronic, Inc.
Address:	710 Medtronic Parkway
City, State, Zip:	Minneapolis, MN 55432
Test Requested By:	Jay Axmann
Model:	LINQ II
First Date of Test:	October 8, 2018
Last Date of Test:	October 11, 2018
Receipt Date of Samples:	October 8, 2018
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:

The LINQ II Model LNQ22 Insertable Cardiac Monitor (ICM) is the next generation of Medtronic diagnostic implant devices designed to simplify the user experience from earlier diagnostic implant devices. The LINQ II ICM includes a 2.4 GHz ISM band Bluetooth Low Energy (BLE) radio telemetry module.

Testing Objective:

To demonstrate compliance of the Bluetooth Low Energy (BLE) radio to FCC 15.247 requirements. LINQ II EUT tested per Medtronic Test Plan MDT30138837.

Client Provided Information:

At the time of radio compliance testing, the LINQ II test samples were configured with version 5.1 firmware. Testing unrelated to radio compliance resulted in firmware updates to resolve several anomalies associated with LINQ II's medical functionality. These firmware updates do not affect performance or functionality of the BLE radio, and therefore the results herein remain valid. Details of these firmware updates are documented in Medtronic document MDT30149419.

The LINQ II Insertable Cardiac Monitor (ICM) has been setup in a test fixture for direct connect radio transmitter measurements. The test fixture includes an antenna impedance matching circuit that introduces a fixed 2.36 dB loss to the RF signal. To ensure that measured values are accurate with the actual transmitter output levels, a 2.36 dB correction factor is added to the following measurements:

- Output Power
- Equivalent Isotropic Radiated Power (EIRP)
- Power Spectral Density

This correction factor is included in the data sheets.

POWER SETTINGS



The EUT was tested using the power settings provided by the manufacturer:

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types / Data				
Rates	Туре	Channel	Frequency (MHz)	Power Setting
		0	2402	High Power*
BLE	DTS	20	2442	High Power*
		39	2480	High Power*

*High Power is the only power setting available. See configuration for software version.





Configuration MDTR0718-1

Software/Firmare Running during Test				
Decription	Version			
ULP	8.0.0			

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
LINQ II	Medtronic, Inc.	LNQ22	RLB001885G

Configuration MDTR0718-2

Software/Firmare Running during Test				
Decription	Version			
ULP	8.0.0			

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
LINQ II (Baseline)	Medtronic, Inc.	LNQ22 Hybrid	12345670307

Cables										
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2					
Banana Cables (x2)	No	1.7 m	No	LINQ II (Baseline)	DC Power Supply					

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2018-10-09	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2018-10-09	Equivalent Isotropic Radiated Power (EIRP)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2018-10-09	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2018-10-09	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2018-10-09	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2018-10-09	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2018-10-11	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

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 during test to facilitate radio measurements.

During actual radio operation, the radio worst case Duty Cycle is approximately 44% based on the Bluetooth Low Energy protocol specified in version 4.1 of the BT SIG standard.



XMit 2017.12.13

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	Keysight	N5182B-506	TEU	23-Apr-18	23-Apr-21
Meter - Multimeter	Fluke	117	MLS	23-Jan-17	23-Jan-20
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	12-Jun-18	12-Jun-19
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Attenuator	Fairview Microwave	SA4014-20	AQI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-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 2017.12.13
EUT:	LINQ II				Work Order:	MDTR0718	
Serial Number:	12345670307				Date:	9-Oct-18	
Customer:	Medtronic, Inc.		Temperature:	22 °C			
Attendees:	Nick Blake				Humidity:	45.7% RH	
Project:	None				Barometric Pres.:	1019 mbar	
Tested by:	Kyle McMullan		Power:	2.9VDC	Job Site:	MN05	
TEST SPECIFICAT	ONS			Test Method			
FCC 15.247:2018				ANSI C63.10:2013			
COMMENTS							
None							
DEVIATIONS FROM	I TEST STANDARD						
None							
Configuration #	2	Simpluro	ngh to	attalla			
		Signature				l insit	
					Value		Bocult
						(2)	Result
BLE/GFSK LOW Cha	innei, 2402 MHZ				756.665 KHZ	500 KHZ	Pass
BLE/GFSK Mid Cha	nnei, 2442 MHz				742.794 kHz	500 kHz	Pass
BLE/GFSK High Cha	annel, 2480 MHz				751.014 kHz	500 kHz	Pass













XMit 2017.12.13

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TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B-506	TEU	23-Apr-18	23-Apr-21
Meter - Multimeter	Fluke	117	MLS	23-Jan-17	23-Jan-20
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	12-Jun-18	12-Jun-19
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Attenuator	Fairview Microwave	SA4014-20	AQI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-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.



								TbtTx 2018.09.13	XMit 2017.12.13		
EUT:	LINQ II						Work Order:	MDTR0718			
Serial Number:	12345670307						Date:	9-Oct-18			
Customer:	Medtronic, Inc.			Temperature:	22.1 °C						
Attendees:	Nick Blake			Humidity:	45.7% RH						
Project:	None						Barometric Pres.:	1019 mbar			
Tested by:	Kyle McMullan	yle McMullan Power: 2.9VDC						MN05			
TEST SPECIFICATIONS Test Method											
FCC 15.247:2018				ANSI C63.10:2013							
COMMENTS											
See customer prov	ided information for detail	s on correction factor									
DEVIATIONS FROM	I TEST STANDARD										
None											
Configuration #	2	Signature	ngh	mathela							
				Measured Value (uW)	Correction Factor (dB)	Corrected Value (dBm)	Corrected Value (mW)	Limit (< W)	Result		
BLE/GFSK Low Cha	nnel, 2402 MHz			604.51	2.36	0.17	1.04	1	Pass		
BLE/GFSK Mid Channel, 2442 MHz 583.71 2.36							1.01	1	Pass		
BLE/GFSK High Cha	annel, 2480 MHz			553.19	2.36	-0.21	0.95	1	Pass		



	Measured	Correction	Corrected	Corrected	Limit	
	Value (uW)	Factor (dB)	Value (dBm)	Value (mW)	(< W)	Result
	604.51	2.36	0.17	1.04	1	Pass
🗾 Keysight Spectrum Analyzer -	Element Materials Techno	ogy				
💢 RL RF 50	Ω DC	SE	NSE:INT	ALIGN OFF	Log-Pwr	03:48:40 AM Oct 10, 2018
		PNO: Fast ↔→ IFGain:Low	Trig: Free Run #Atten: 10 dB	Avg Hold: 1	00/100	TYPE MWWWW DET PPPPP
Ref Offset	21.7 dB 0 mW				Mkr	1 2.401 742 GHz 604.51 μW
791 .0.87			<u>1</u>			
13 APA						
250						
200 μ						
70.1.08/						
79.1 µW						
25.0 .0.00						
20.0 µ W						
7.01.087						
7.01 µW						
2.50 .04/						
2.00 μ						
791 n\//						
250 n\/						
79 1 nW						
Center 2.402000 GH	z					Span 3.500 MHz
#Res BW 2.0 MHz		#VBW	6.0 MHz		#Sweep	73.39 ms (1000 pts
MSG				STATUS		

BLE/GFSK Mid Channel, 2442 MHZ									
	Measured	Correction	Corrected	Corrected	Limit				
	Value (uW)	Factor (dB)	Value (dBm)	Value (mW)	(< W)	Result			
	583.71	2.36	0.02	1.01	1	Pass			

L	RF	50 Q DC		S	ENSE:INT	ALIGN OFF		03:56:56 AM Oc	t 10, 201
		50 k 00	PN IFG	O: Fast ↔ ain:Low	Trig: Free Run #Atten: 10 dB	#Avg Type: Avg Hold: 1	Log-Pwr 00/100	TRACE TYPE DET	2345 WWWW PPPP
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			J /				
	Measured	Correction	Corrected	Corrected	Limit		
	Value (uW)	Factor (dB)	Value (dBm)	Value (mW)	(< W)	Result	-
	553.19	2.36	-0.21	0.95	1	Pass	
💓 Keysight Spectrum Analyzer -	Element Materials Tech	nology					8
LXI RL RF 5	DΩ DC	SE	NSE:INT	ALIGN OFF		04:07:50 AM Oct 10, 2	018
			Trig: Free Pup	#Avg Type:	Log-Pwr	TRACE 1 2 3 4	5 6
		PNO: Fast +++	#Atten: 10 dB	Avginoid.	100/100	DET PPP	PPP
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791 uVV			1				
250							
200 pvv							_
70 4 144							
79.1 µvv							
25.0 μW							
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2.50 μW							
791 nVV							
250 nW							
79.1 nW							
	_						
Center 2.480000 GH	Z					Span 3.500 M	IHZ
		-#170147			The Woon 7	72 10 me (1000 r	37.3N

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



XMit 2017.12.13

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

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Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	12-Jun-18	12-Jun-19
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Attenuator	Fairview Microwave	SA4014-20	AQI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-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 gain of the antenna was added to the conducted output power. This value must not exceed 4 Watts, which is the same as 36 dBm.

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



								TbtTx 2018.09.13	XMit 2017.12.13
EUT:	LINQ II						Work Order:	MDTR0718	
Serial Number:	12345670307						Date:	9-Oct-18	
Customer:	Medtronic, Inc.			Temperature:	22.1 °C				
Attendees:	Nick Blake						Humidity:	45.7% RH	
Project:	None						Barometric Pres.:	1019 mbar	
Tested by:	Tested by: Kyle McMullan Power: 2.9VDC							MN05	
TEST SPECIFICATI	ONS			Test Method					
FCC 15.247:2018				ANSI C63.10:2013					
COMMENTS									
See customer provi	ided information for det	ails on correction factor							
DEVIATIONS FROM	I TEST STANDARD								
None									
Configuration #	2	Signature	ngla	mathela					
				Measured Value (uW)	Correction Factor (dB)	Gain (dBi)	EIRP (dBm)	Limit (< dBm)	Result
BLE/GFSK Low Cha	nnel, 2402 MHz			601.51	2.36	-22	-21.8	36	Pass
BLE/GFSK Mid Channel, 2442 MHz 583.71 2.36						-22	-22.0	36	Pass
BLE/GFSK High Cha	nnel, 2480 MHz			553.19	2.36	-22	-22.2	36	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



		BI E/GES	K Low Channel	2402 MHz		
	Measured	Correction	Gain	FIRP	Limit	
	Value (uW)	Factor (dB)	(dBi)	(dBm)	(< dBm)	Result
	601.51	2.36	-22	-21.8	36	Pass
ł						
📕 Keysight Spec	trum Analyzer - Element Materials Tec	hnology				
LXI RL	RF 50 Ω DC	SE	NSE:INT	ALIGN OFF		03:48:40 AM Oct 10, 2018
			Trig: Free Run	#Avg Type Avg Hold:	:: Log-Pwr 100/100	TYPE MWWWWW
		IFGain:Low	#Atten: 10 dB			DET PPPPP
5 dB/div	Ref Offset 21.7 dB Ref 2.500 mW				Mkr1	2.401 742 GHz 604.51 μW
704.007			1			
791 µw						
250 .044						
200 µ00						
79.1 .00/						
73.1 µw						
25 O JW						
23.0 µ**						
7 91 08/						
2.50 uW						
791 nW						
250 nW						
79.1 nW						
Conton 2 d						0
#Res BW/2		#VBM	6.0 MHz		#Sweep 71	Span 3.500 WHZ 39 ms (1000 pts)
MSG		<i>"</i> • B•• •		STATUS	"encep re	
DOM .				STATUS		
		BLE/GFS	K Mid Channel,	2442 MHz		
	Measured	Correction	Gain	EIRP	Limit	
	Value (uW)	Factor (dB)	(dBi)	(dBm)	(< dBm)	Result
		0.00	00	22.0	26	Deee

Keysigne Sp	RF 50.0	DC	599	ENSE:INT	ALIGN OFF	03:56:56 AM Oct 10, 2018
			PNO: Fast ↔ FGain:Low	Trig: Free Run #Atten: 10 dB	#Avg Type: Log- Avg Hold: 100/10	Pwr TRACE 2 3 4 5 6 00 TYPE MWWWWW DET P P P P P P
5 dB/div	Ref Offset 21.7 Ref 2.500 m	′dB W				Mkr1 2.441 886 GHz 583.71 μW
791 µW				1		
250 μW						
79.1 μW						
25.0 μW						
7.91 µW						
2.50 μW						
791 nW						
250 nW						
79.1 nW						
Center 2. #Res BW	442000 GHz 2.0 MHz		#VBW	6.0 MHz		Span 3.500 MHz #Sweep 73.39 ms (1000 pts)
MSG					STATUS	

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



		,	a chingin onianni	, <u>2 100 mil 12</u>			
	Measured	Correction	Gain	EIRP	Limit		
	Value (uW)	Factor (dB)	(dBi)	(dBm)	(< dBm)	Re	sult
	553.19	2.36	-22	-22.2	36	Pa	ass
Keysight Spectrum Analyzer	Element Materials Techr	nology					
XI RL RF 5	0 Ω DC	SE	NSE:INT	ALIGN OFF		04:07:50	AM Oct 10, 2018
				#Avg Type:	Log-Pwr	TR	ACE 1 2 3 4 5 6
		PNO: Fast	#Atten: 10 dB	Avg Hold: 1	100/100		DET P P P P P
		IFGalli.LOw	"Attent To up		Nuc	4 0 470	705 CIL
Ref Offset	21.7 dB				IVIKI	1 2.4/9	720 GHZ
5 dB/div Ref 2.50	0 mW						55. 19 µw
791 .00			1				
701 µW							
0.50							
250 μW							
79.1 µVV							
25.0 µW							
7.91 µW							
2.50 µW							
791 n\8/							
250 w//							
200-1144							
70 4 141							
79.1 nW							
Center 2 480000 G	17					Snan	3 500 MHz
#Res BW 2.0 MHz	12	#VBW	6.0 MHz		#Sweep	73.39 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	Keysight	N5182B-506	TEU	23-Apr-18	23-Apr-21
Meter - Multimeter	Fluke	117	MLS	23-Jan-17	23-Jan-20
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	12-Jun-18	12-Jun-19
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Attenuator	Fairview Microwave	SA4014-20	AQI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-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.



								10(1x 2018.05.13	AMIL 2017.12.13
EUT:	LINQ II						Work Order:	MDTR0718	
Serial Number:	12345670307						Date:	9-Oct-18	
Customer:	Medtronic, Inc.				Temperature:	22.2 °C			
Attendees:	Nick Blake				Humidity:	45.5% RH			
Project:	None				Barometric Pres.:	1019 mbar			
Tested by:	Kyle McMullan			Job Site:	MN05				
TEST SPECIFICATION	ONS								
FCC 15.247:2018				ANSI C63.10:2013					
COMMENTS									
See oustomor provi	ided information for details	on correction factor							
See customer provi	ded information for details	s on conection factor							
See customer provi		on conection factor							
		son contection factor							
DEVIATIONS FROM	TEST STANDARD								
DEVIATIONS FROM	I TEST STANDARD								
DEVIATIONS FROM	I TEST STANDARD		V- 2	In the bla					
DEVIATIONS FROM None Configuration #	1 TEST STANDARD		Vayla	Mathalla					
DEVIATIONS FROM None Configuration #	1 TEST STANDARD	Signature	Vayla	mmillen					
DEVIATIONS FROM None Configuration #	1 TEST STANDARD	Signature	Hyli	mmillen	Measured	Correction	Corrected Val	Limit	
DEVIATIONS FROM None Configuration #	1 TEST STANDARD	Signature	Vayla	Mathalla	Measured Val (dBm/3kHz)	Correction Factor (dB)	Corrected Val dBm/3kHz	Limit < dBm/3kHz	Results
DEVIATIONS FROM None Configuration # BLE/GFSK Low Char	1 TEST STANDARD 2 nnel, 2402 MHz	Signature	Kuzli	Mathalla	Measured Val (dBm/3kHz) -18.793	Correction Factor (dB) 2.36	Corrected Val dBm/3kHz -16.43	Limit < dBm/3kHz 8	Results Pass
DEVIATIONS FROM None Configuration # BLE/GFSK Low Chai BLE/GFSK Mid Char	1 TEST STANDARD 2 nnel, 2402 MHz nnel, 2442 MHz	Signature	Huyli	mmillen	Measured Val (dBm/3kHz) -18.793 -18.974	Correction Factor (dB) 2.36 2.36	Corrected Val dBm/3kHz -16.43 -16.61	Limit < dBm/3kHz 8 8	Results Pass Pass
DEVIATIONS FROM None Configuration # BLE/GFSK Low Chai BLE/GFSK Mid Char BLE/GFSK Mid Char	2 nnel, 2402 MHz nnel, 2402 MHz nnel, 2440 MHz	Signature	Vayle	Malla	Measured Val (dBm/3kHz) -18.974 -19.084	Correction Factor (dB) 2.36 2.36 2.36	Corrected Val dBm/3kHz -16.43 -16.61 -16.72	Limit < dBm/3kHz 8 8 8	Results Pass Pass Pass













BAND EDGE COMPLIANCE



XMit 2017.12.13

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

Manufacturer	Model	ID	Last Cal.	Cal. Due
Keysight	N5182B-506	TEU	23-Apr-18	23-Apr-21
Fluke	117	MLS	23-Jan-17	23-Jan-20
Agilent	U8002A	TPZ	NCR	NCR
ESM Cable Corp.	TTBJ141 KMKM-72	MNO	12-Jun-18	12-Jun-19
Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Fairview Microwave	SA4014-20	AQI	7-Sep-18	7-Sep-19
Keysight	N9010A	AFN	27-Apr-18	27-Apr-19
	Manufacturer Keysight Fluke Agilent ESM Cable Corp. Fairview Microwave Fairview Microwave Keysight	ManufacturerModelKeysightN5182B-506Fluke117AgilentU8002AESM Cable Corp.TTBJ141 KMKM-72Fairview MicrowaveSD3379Fairview MicrowaveSA4014-20KeysightN9010A	ManufacturerModelIDKeysightN5182B-506TEUFluke117MLSAgilentU8002ATPZESM Cable Corp.TTBJ141 KMKM-72MNOFairview MicrowaveSD3379AMIFairview MicrowaveSA4014-20AQIKeysightN9010AAFN	ManufacturerModelIDLast Cal.KeysightN5182B-506TEU23-Apr-18Fluke117MLS23-Jan-17AgilentU8002ATPZNCRESM Cable Corp.TTBJ141 KMKM-72MNO12-Jun-18Fairview MicrowaveSD3379AMI7-Sep-18Fairview MicrowaveSA4014-20AQI7-Sep-18KeysightN9010AAFN27-Apr-18

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 2017.12.13
EUT:	LINQ II					Work Order:	MDTR0718	
Serial Number:	12345670307					Date: 9	9-Oct-18	
Customer:	Medtronic, Inc.					Temperature: 2	22 °C	
Attendees:	Nick Blake					Humidity:	44.9% RH	
Project:	None				Ba	rometric Pres.: 1	1019 mbar	
Tested by:	Kyle McMullan		Pow	er: 2.9VDC		Job Site:	MN05	
TEST SPECIFICAT	IONS			Test Method				
FCC 15.247:2018				ANSI C63.10:2013				
COMMENTS								
None								
DEVIATIONS FROM	M TEST STANDARD							
None								
		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		mar 16. OF.				
Configuration #	2	K	zyta	randera				
		Signature						
						Value	Limit	
						(dBc)	≤ (dBc)	Result
BLE/GFSK Low Cha	annel, 2402 MHz					-48.1	-20	Pass
BLE/GFSK High Ch	annel. 2480 MHz					-51.9	-20	Pass

High Channel, 2

### **BAND EDGE COMPLIANCE**









XMit 2017.12.13

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	Keysight	N5182B-506	TEU	23-Apr-18	23-Apr-21
Meter - Multimeter	Fluke	117	MLS	23-Jan-17	23-Jan-20
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	12-Jun-18	12-Jun-19
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Attenuator	Fairview Microwave	SA4014-20	AQI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-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.



							TbtTx 2018.09.13	XMit 2017.12.1
EUT: LIN	QII					Work Order:	MDTR0718	
Serial Number: 123	45670307					Date:	9-Oct-18	
Customer: Med	dtronic, Inc.					Temperature:	22.3 °C	
Attendees: Nic	k Blake					Humidity:	45.5% RH	
Project: Nor	ne			<b>Barometric Pres.:</b>	1019 mbar			
Tested by: Kyl	e McMullan			Job Site:	MN05			
TEST SPECIFICATIONS	6			Test Method				
FCC 15.247:2018				ANSI C63.10:2013				
								,
COMMENTS				•				
None								
DEVIATIONS EDOM TE								
None	ST STANDARD							
None								
Configuration #	2		Kuli	mathelan				
<b>J N N N</b>		Signature	1					
		<u>-</u>		Frequency	Measured	Max Value	Limit	
				Range	Freq (MHz)	(dBc)	≤ (dBc)	Result
BLE/GFSK Low Channel	, 2402 MHz			Fundamental	2402.25	N/A	N/A	N/A
BLE/GFSK Low Channel	, 2402 MHz			30 MHz - 12.5 GHz	8977.16	-49.29	-20	Pass
BLE/GFSK Low Channel	, 2402 MHz			12.5 GHz - 25 GHz	24307.17	-47.95	-20	Pass
BLE/GFSK Mid Channel,	2442 MHz			Fundamental	2442.25	N/A	N/A	N/A
BLE/GFSK Mid Channel,	2442 MHz			30 MHz - 12.5 GHz	3834.48	-49.27	-20	Pass
BLE/GFSK Mid Channel, 2442 MHz 12.5 GHz - 25 GHz						-48.03	-20	Pass
BLE/GFSK High Channe	l, 2480 MHz			Fundamental	2480.25	N/A	N/A	N/A
BLE/GFSK High Channe	l, 2480 MHz			30 MHz - 12.5 GHz	3864.93	-48.31	-20	Pass
BLE/GFSK High Channe	l, 2480 MHz			12.5 GHz - 25 GHz	24105.73	-47.48	-20	Pass



	Frequency		Measured	Max Value	Limit		
	Range		Freq (MHz)	(dBc)	≤ (dBc)	Result	_
	Fundamental		2402.25	N/A	N/A	N/A	
The Manufacture Constant	A						672
Keysight Spectrur	RF 50 Ω DC	SE	NSE:INT	ALIGN OFF		03:49:23 AM Oct 10, 2	018
	la di	PNO: Wide 🖵 FGain:Low	Trig: Free Run #Atten: 10 dB	#Avg Type:	Log-Pwr	TRACE 1 2 3 4 TYPE MWWW DET P P P	56 WWW PPP
10 dB/div R	ef Offset 21.7 dB ef 10.00 dBm				Mkr1 2.4	02 254 73 G -3.06 dE	Hz 3m
0.00					1		
-10.0							
-20.0							
20.0							
-30.0							
-40.0							
-50.0							
-60.0							
-70.0							
-80.0							
Center 2.402	0000 GHz		I	1	I	Span 1.000 N	IHz
#Res BW 10	0 kHz	#VBW	/ 300 kHz		Sweep 1	.092 ms (8192 p	ots)
MSG				STATUS			
		BLE/GFS	K Low Channel, 2	2402 MHz			
	Frequency		Measured	Max Value	Limit		
·	Range		Freq (MHz)	(dBc)	<u>≤ (dBc)</u>	Result	1
	30 MHz - 12.5 GHz		8977.16	-49.29	-20	Pass	

P Rey	signt spectrum	Analyzer - Element	materiais rechnolo	gy	CENCENNE				02:50:43	AMOct 10, 2018
		- 30 12 Di	-       	PNO: Fast G	Trig: Free #Atten: 10	Run dB	#Avg Type:	Log-Pwr	03.30.47 TF	ACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P P
10 dE	Ref 3/div <b>Re</b>	f Offset 21.7 d f 10.00 dBn	B n						Mkr1 8.9 -52	77 2 GHz 2.35 dBm
0.00										
-10.0										
-20.0										
-30.0										
-40.0								4		
-50.0		والمراجع المراجع الم	فبجراء والمطاومة ومعاومة	a and the second second	An contraction	and the second	والمتحاط المتحاد المتحاط		nu fisial birga tikeket	an birth most through the state
-60.0										
-80.0										
Star	t 30 MHz								Stop_1	2.500 GHz
#Res	s BW 100	kHz		#VB	W 300 kHz			Swe	ep 1.192 s	(8192 pts)
MSG							STATUS			



Fragues		Moocurod	Max Value	Limit		
Frequer	icy				Decult	
Rang	8	Freq (MHZ)	(aBC)	≥ (aBC)	Result	1
12.5 GHz - 2	25 GHz	24307.17	-47.95	-20	Pass	
🗾 Keysight Spectrum Analyzer - Element Materi	als Technology					x
LX RL RF 50Ω DC	S	ENSE:INT	ALIGN OFF		03:51:49 AM Oct 10, 20	018
		Trig: Free Run	#Avg Type:	Log-Pwr	TRACE 1 2 3 4	5 6
	IFGain:Low	#Atten: 10 dB			DET PPPP	ΡΡ
				Mkr	1 24 307 2 GI	17
Ref Offset 21.7 dB				- Million	-51.01 dB	m
Log						
0.00						
10.0						
- 10.0						
-20.0						
-30.0						
-40.0						-
					▲1	
-50.0						
and the second	لى الشار مى المربع المانيا. المالية المربع المانيا، المربع المانية الم	A dise i also col destinados al facilitado	واللغان والمعروبالالال والمعالفات	And the second		
-60.0	a sufficient of the surface surface of the second states of the surface of the su					
-70.0						
-80.0						
Start 12.500 GHz					Stop 25.000 GI	Hz
#Res BW 100 kHz	#VBV	V 300 kHz		Sweep	1.195 s (8192 p)	ts)
			STATUS			

BLE/GFSK Mid Channel, 2442 MHz									
Frequency Measured Max Value Limit									
Range Freq (MHz) (dBc) ≤ (dBc) Result									
Fundamental 2442.25 N/A N/A N/A									

ceysigne spe	curum Analyzer - Element Materials	rechnology					
KL	RF   50 Ω DC	5	SENSE:INT	ALIGN OFF		03:57:24	AM Oct 10, 2
		PNO: Wide 🖵	Trig: Free Run #Atten: 10 dB	#Avg Type	: Log-Pwr	TF	ACE 1 2 3 TYPE MWW DET PPP
lB/div	Ref Offset 21.7 dB Ref 10.00 dBm				Mkr1 2	2.442 24	9 60 G 3.22 d
						•••	
	and the second s					The second second	
iter 2.4 s BW	420000 GHz 100 kHz	#VB\	W 300 kHz		Sweep	Span 1.092 ms	1.000 I (819 <u>2</u> )
				STATUS			





BLE/GFSK Mid Channel, 2442 MHz									
Frequency	Measured	Max Value	Limit						
Range	Freq (MHz)	(dBc)	≤ (dBc)	Result					
12.5 GHz - 25 GHz 24516.24 -48.03 -20 Pass									

	Curum Analyzer + Elemen	ne wiatenais recri	nology	CONCE ANT			02:50:10	
KL	KF   50 Ω		PNO: Fast 🖵 IFGain:Low	Trig: Free Run #Atten: 10 dB	#Avg Type	: Log-Pwr	03:59:19 TF	AM OCT 10, 20 AACE 1 2 3 4 TYPE M WWW DET P P P P
dB/div	Ref Offset 21.7 Ref 10.00 dB	dB m				N	lkr1 24.5 -51	16 2 GH I.25 dB
00								
o								
	And an a state of the	hi i al til hajgedom			n an	معملين والجافير فريداده	deter turiste	adardari dip <mark>i</mark> t
J								
art 12.5	00 GHz						Stop 2	25.000 G
es BW	100 KHZ		#VB	W 300 KHZ		Swe	ep 1.195 s	s (8192 p



	B	LE/GFSK High Channel,	2480 MHz		
	Frequency	Measured	Max Value	Limit	Bassili
	Range	Freq (MHz)	(dBc)	≤ (dBc)	Result
	Fundamental	2480.25	N/A	N/A	N/A
🌉 Keysight Spec	trum Analyzer - Element Materials Technology				
LXI RL	RF 50 Ω DC	SENSE:INT	ALIGN OFF		04:08:13 AM Oct 10, 2018
	PNO: Wid IFGain:Lo	le 🖵 Trig: Free Run w #Atten: 10 dB	#Avg Type:	Log-Pwr	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P
10 dB/div	Ref Offset 21.7 dB Ref 10.00 dBm			Mkr1 2.4	80 251 68 GHz -3.46 dBm
L09					
0.00				1	
-10.0	and the second sec				and a second
-20.0					
-30.0					
-40.0					
-50.0					
60.0					
-60.0					
-70.0					
-80.0					
Center 2.4 #Res BW 1	800000 GHz 100 kHz	#VBW 300 kHz		Sweep 1.	Span 1.000 MHz 092 ms (8192 pts)
MSG			STATUS		····· (···· /····
	Erequency	LE/GFSK High Channel, Measured	2480 MHz Max Value	Limit	
	Range	Freq (MHz)	(dBc)	<u>≤ (dBc)</u>	Result
	30 MHz - 12.5 GHz	3864.93	-48.31	-20	Pass

🊺 Keysig	ht Spectrum Analyzer - Element I	Materials Technolog	gy						
LXI RL	RF 50 Ω DC			SENSE:INT	<u>^</u> A	LIGN OFF		04:09:12	AM Oct 10, 2018
		F IF	PNO: Fast 🖵 Gain:Low	Trig: Free #Atten: 10	Run dB	#Avg Type:	Log-Pwr	I I	
10 dB/d	Ref Offset 21.7 dE liv <b>Ref 10.00 dBm</b>	3						Mkr1 3.8 -51	64 9 GHz I.77 dBm
Log									
0.00									
-10.0									
-20.0									
-30.0									
10.0									
-40.0			<u>, 1</u>						
-50.0		المراجعة والمراجعة	·	eller in kaak	ر بىللەردى		. يىلىدىپ ، ئالاستىس	and have also	
-60.0				a state of the second		and the second second second		states and the loss of firsts	
-70.0									
-80 0									
Start 3 #Res	BO MHZ BW 100 kHz		#VB	W 300 kHz			Swe	Stop 1	2.500 GHz
MSG						STATUS			



				BLE/GF	SK High Ch	annel, 248	80 MHz			
		Free	quency		Measu	ıred	Max Value	Limit		
		Ra	ange		Freq (M	/Hz)	(dBc)	≤ (dBc)	R	esult
		12.5 GH	lz - 25 GHz		24105	5.73	-47.48	-20	F	Pass
Ke	vsight Spectrum	Analyzer - Element I	Materials Technolo	yav						
LXI R	L RF	50 Ω DC		.50	SENSE:INT	4	ALIGN OFF		04:10:2	24 AM Oct 10, 201
					T	_	#Avg Type	: Log-Pwr	1	TRACE 1 2 3 4
				PNO: Fast 🕞	#Atten: 10	dB				DET PPPP
								N	Akr1 24 1	105 7 CH
40	Ref	Offset 21.7 dl	3							0 94 dB
Log	Salv Rel	10.00 UBN								
0.00										
-10.0										
-10:0										
-20.0										
-30.0										
-40.0										
										<b>1</b>
-50.0										
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-60.0	And a state of the	A ALASSANDI TALLAND	and the second state of th	and the following sound						
-70.0										
-80.0										
00.0										
Star	t 12.500 G	Hz							Stop	25.000 GH
#Re	s BW 100	kHz		#VB	W 300 kHz			Swe	ep 1.195	s (8192 pt
							STATUS			

# 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 (2402 MHz), mid (2442 MHz), or high channel (2480 MHz)

#### POWER SETTINGS INVESTIGATED

Battery

#### **CONFIGURATIONS INVESTIGATED**

MDTR0718 - 1

#### FREQUENCY RANGE INVESTIGATED

Start Frequency 30 MHz

Stop Frequency 25 GHz

#### 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
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
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
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	13-Feb-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	13-Feb-2018	12 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	12-Jul-2018	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	13-Feb-2018	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	24-Sep-2018	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJA	27-Jun-2018	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	9-Nov-2017	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	9-Nov-2017	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	24 mo
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-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**



SA-ESCI 2018.07.27

#### 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).

To mimic the patient use condition, the EUT was tested in tissue substitute solution of 3g/L saline concentration which is representative of the subcutaneous tissue surrounding the implanted device. This provides a representative impedance match for the device's integral antenna compare with antenna-to-air measurements and allows the results to be consistent with implantable devices using MedRadio which are tested in tissue simulant per 95.2569 (c). A KDB inquiry was sent to the FCC and they approved the alternative test configuration. A copy of the inquiry will be submitted with the application as a confidential document.

# SPURIOUS RADIATED EMISSIONS



Work C						EmiR5 2018.09.26	PSA-ESCI 2018.0
	Order:	MDTR0718	Date:	11-Oct-2	2018	· Ano	1 10
Pr	oject:	None	Temperature:	22 °(	My My	la man	nerm
Job	Site:	MN05	Humidity:	29.2%	RH		
Serial Nu	mber:	RLB001885G	Barometric Pres.:	1032 m	bar Tes	ted by: Kyle McMullar	า
	EUT:	LINQ II					
Configura	ation:	1					
Cust	omer:	Medtronic, Inc.					
Atten	dees:	Nick Blake					
EUT P	ower:	Battery					
Operating I	/lode:	Transmitting BLE lov	v (2402 MHz), mid (244)	2 MHz), or hi	gh channel (2480 MHz)		
Devia	tions:	None					
Comm	ients:	None					
est Specifica	tions			Т	est Method		
CC 15.247.20	18			A	NSI C63.10:2013		
Run #	49	Test Distance (m	) 3 Antenna	I Height(s)	1 to 4(m)	Results	Pass
80							
80							
70							
60							
_ 50							
۳ ۳							
⁵⁰ 40		<b>F</b>				•	
40 30							
<b>W/Ngp</b> 40							
<b>W/Ngp</b> 40 30 20 10							
<b>a</b> 50 40 30 20 10 0							

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
7324.867	30.9	11.4	2.5	65.1	3.0	0.0	Horz	AV	0.0	42.3	54.0	-11.7	Mid Ch, EUT Vert
7323.833	30.8	11.4	3.9	279.0	3.0	0.0	Vert	AV	0.0	42.2	54.0	-11.8	Mid Ch, EUT Vert
7439.358	29.5	11.7	1.3	253.9	3.0	0.0	Horz	AV	0.0	41.2	54.0	-12.8	High Ch, EUT Vert
7438.400	29.3	11.7	1.0	156.1	3.0	0.0	Vert	AV	0.0	41.0	54.0	-13.0	High Ch, EUT Vert
4881.525	31.9	4.1	3.5	282.9	3.0	0.0	Horz	AV	0.0	36.0	54.0	-18.0	Mid Ch, EUT Vert
4881.642	31.9	4.1	3.6	202.1	3.0	0.0	Vert	AV	0.0	36.0	54.0	-18.0	Mid Ch, EUT Vert
4881.608	31.6	4.1	1.1	351.0	3.0	0.0	Horz	AV	0.0	35.7	54.0	-18.3	Mid Ch, EUT On Side
4881.833	31.6	4.1	2.0	224.1	3.0	0.0	Vert	AV	0.0	35.7	54.0	-18.3	Mid Ch, EUT On Side
4882.233	31.6	4.1	1.0	325.0	3.0	0.0	Horz	AV	0.0	35.7	54.0	-18.3	Mid Ch, EUT Horz
4882.158	31.5	4.1	1.7	322.9	3.0	0.0	Vert	AV	0.0	35.6	54.0	-18.4	Mid Ch, EUT Horz
7327.142	43.7	11.4	3.9	279.0	3.0	0.0	Vert	PK	0.0	55.1	74.0	-18.9	Mid Ch, EUT Vert
4957.508	29.9	4.3	1.0	223.0	3.0	0.0	Horz	AV	0.0	34.2	54.0	-19.8	High Ch, EUT Vert
4804.442	30.3	3.9	1.0	66.1	3.0	0.0	Horz	AV	0.0	34.2	54.0	-19.8	Low Ch, EUT Vert
4804.550	30.3	3.9	1.0	343.0	3.0	0.0	Vert	AV	0.0	34.2	54.0	-19.8	Low Ch, EUT Vert
4957.942	29.8	4.3	1.7	81.0	3.0	0.0	Vert	AV	0.0	34.1	54.0	-19.9	High Ch, EUT Vert
7326.533	42.6	11.4	2.5	65.1	3.0	0.0	Horz	PK	0.0	54.0	74.0	-20.0	Mid Ch, EUT Vert
7440.183	41.3	11.7	1.0	156.1	3.0	0.0	Vert	PK	0.0	53.0	74.0	-21.0	High Ch, EUT Vert

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
7438.250	40.7	11.7	1.3	253.9	3.0	0.0	Horz	PK	0.0	52.4	74.0	-21.6	High Ch, EUT Vert
12399.000	27.5	0.9	1.0	268.9	3.0	0.0	Horz	AV	0.0	28.4	54.0	-25.6	High Ch. EUT Vert
12399.980	27.5	0.9	1.0	83.1	3.0	0.0	Vert	AV	0.0	28.4	54.0	-25.6	High Ch, EUT Vert
2388.977	32.1	-3.9	1.8	257.9	3.0	0.0	Horz	AV	0.0	28.2	54.0	-25.8	Low Ch, EUT Horz
2483.867	32.2	-4.1	1.0	95.1	3.0	0.0	Horz	AV	0.0	28.1	54.0	-25.9	High Ch, EUT Vert
2483.917	32.2	-4.1	1.1	358.0	3.0	0.0	Horz	AV	0.0	28.1	54.0	-25.9	High Ch, EUT Horz
2484.810	32.2	-4.1	1.0	195.1	3.0	0.0	Vert	AV	0.0	28.1	54.0	-25.9	High Ch, EUT Horz
2389.293	32.0	-3.9	2.9	344.9	3.0	0.0	Vert	AV	0.0	28.1	54.0	-25.9	Low Ch, EUT Horz
2484.827	32.1	-4.1	1.0	50.0	3.0	0.0	Vert	AV	0.0	28.0	54.0	-26.0	High Ch, EUT Vert
2484.823	32.1	-4.1	2.4	340.0	3.0	0.0	Horz	AV	0.0	28.0	54.0	-26.0	High Ch, EUT On Side
2483.553	32.1	-4.1	3.5	72.0	3.0	0.0	Vert	AV	0.0	28.0	54.0	-26.0	High Ch, EUT On Side
12207.880	28.2	-0.3	1.0	219.0	3.0	0.0	Vert	AV	0.0	27.9	54.0	-26.1	Mid Ch, EUT Vert
12207.790	28.0	-0.3	1.1	199.1	3.0	0.0	Horz	AV	0.0	27.7	54.0	-26.3	Mid Ch, EUT Vert
4884.700	43.5	4.1	3.6	202.1	3.0	0.0	Vert	PK	0.0	47.6	74.0	-26.4	Mid Ch, EUT Vert
4885.925	43.5	4.1	2.0	224.1	3.0	0.0	Vert	PK	0.0	47.6	74.0	-26.4	Mid Ch, EUT On Side
4883.842	43.3	4.1	3.5	282.9	3.0	0.0	Horz	PK	0.0	47.4	74.0	-26.6	Mid Ch, EUT Vert
4883.042	43.2	4.1	1.0	325.0	3.0	0.0	Horz	PK	0.0	47.3	74.0	-26.7	Mid Ch, EUT Horz
4883.333	43.1	4.1	1.1	351.0	3.0	0.0	Horz	PK	0.0	47.2	74.0	-26.8	Mid Ch, EUT On Side
4884.500	43.1	4.1	1.7	322.9	3.0	0.0	Vert	PK	0.0	47.2	74.0	-26.8	Mid Ch, EUT Horz
12008,160	28.1	-0.9	1.0	59.1	3.0	0.0	Horz	AV	0.0	27.2	54.0	-26.8	Low Ch, EUT Vert
12008.220	28.0	-0.9	1.0	274.0	3.0	0.0	Vert	AV	0.0	27.1	54.0	-26.9	Low Ch, EUT Vert
4804.817	42.2	3.9	1.0	66.1	3.0	0.0	Horz	PK	0.0	46.1	74.0	-27.9	Low Ch, EUT Vert
4957.650	41.5	4.3	1.0	223.0	3.0	0.0	Horz	PK	0.0	45.8	74.0	-28.2	High Ch, EUT Vert
4960.633	41.2	4.3	1.7	81.0	3.0	0.0	Vert	PK	0.0	45.5	74.0	-28.5	High Ch, EUT Vert
4804.283	41.6	3.9	1.0	343.0	3.0	0.0	Vert	PK	0.0	45.5	74.0	-28.5	Low Ch, EUT Vert
12210.070	41.5	-0.2	1.1	199.1	3.0	0.0	Horz	PK	0.0	41.3	74.0	-32.7	Mid Ch, EUT Vert
12399.350	39.4	0.9	1.0	268.9	3.0	0.0	Horz	PK	0.0	40.3	74.0	-33.7	High Ch, EUT Vert
2485.483	44.0	-4.1	2.4	340.0	3.0	0.0	Horz	PK	0.0	39.9	74.0	-34.1	High Ch, EUT On Side
2483.923	44.0	-4.1	1.0	195.1	3.0	0.0	Vert	PK	0.0	39.9	74.0	-34.1	High Ch, EUT Horz
2483.593	43.9	-4.1	1.0	95.1	3.0	0.0	Horz	PK	0.0	39.8	74.0	-34.2	High Ch, EUT Vert
2485.487	43.7	-4.1	1.0	50.0	3.0	0.0	Vert	PK	0.0	39.6	74.0	-34.4	High Ch, EUT Vert
2484.747	43.7	-4.1	3.5	72.0	3.0	0.0	Vert	PK	0.0	39.6	74.0	-34.4	High Ch, EUT On Side
2389.667	43.5	-3.9	1.8	257.9	3.0	0.0	Horz	PK	0.0	39.6	74.0	-34.4	Low Ch, EUT Horz
12398.360	38.6	0.9	1.0	83.1	3.0	0.0	Vert	PK	0.0	39.5	74.0	-34.5	High Ch, EUT Vert
12007.620	40.4	-0.9	1.0	59.1	3.0	0.0	Horz	PK	0.0	39.5	74.0	-34.5	Low Ch, EUT Vert
2483.837	43.6	-4.1	1.1	358.0	3.0	0.0	Horz	PK	0.0	39.5	74.0	-34.5	High Ch, EUT Horz
2389.950	43.3	-3.9	2.9	344.9	3.0	0.0	Vert	PK	0.0	39.4	74.0	-34.6	Low Ch, EUT Horz
12208.870	39.3	-0.2	1.0	219.0	3.0	0.0	Vert	PK	0.0	39.1	74.0	-34.9	Mid Ch, EUT Vert
12011.040	39.9	-0.9	1.0	274.0	3.0	0.0	Vert	PK	0.0	39.0	74.0	-35.0	Low Ch, EUT Vert