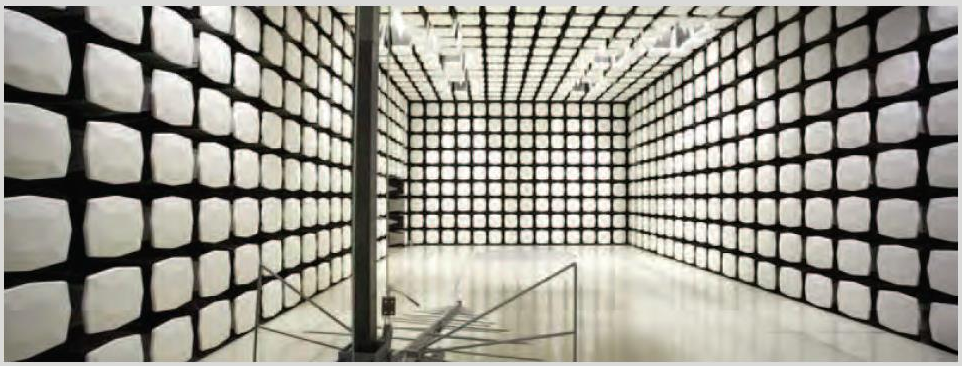
Medtronic, Inc.

EV ICD

FCC 95I:2018
MedRadio

Report # MDTR0743.4 Rev. 1



NVLAP LAB CODE: 200881-0

CERTIFICATE OF TEST

Last Date of Test: December 12, 2018
Medtronic, Inc.
Model: EV ICD

Radio Equipment Testing

Standards

Specification	Method
FCC 95I:2018	ANSI C63.26:2015

Results

Method Clause	Test Description	Applied	Results	Comments
ANSI C63.26 5.4.3	Emission Bandwidth	Yes	Pass	
FCC 95.2579(a)(1)	Emission Mask	Yes	Pass	
ANSI C63.26 5.2.3.3	Conducted Output Power	Yes	Pass	
ANSI C63.26 5.6	Frequency Stability	Yes	Pass	
ANSI C63.26 5.5.4	Spurious Radiated Emissions	Yes	Pass	
ANSI C63.26 5.7	Spurious Conducted Emissions	Yes	Pass	
ANSI C63.26 5.2.3.3, 5.2.7	Radiated Power (EIRP)	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		
01	Removed scans	2019-02-28	26, 27

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

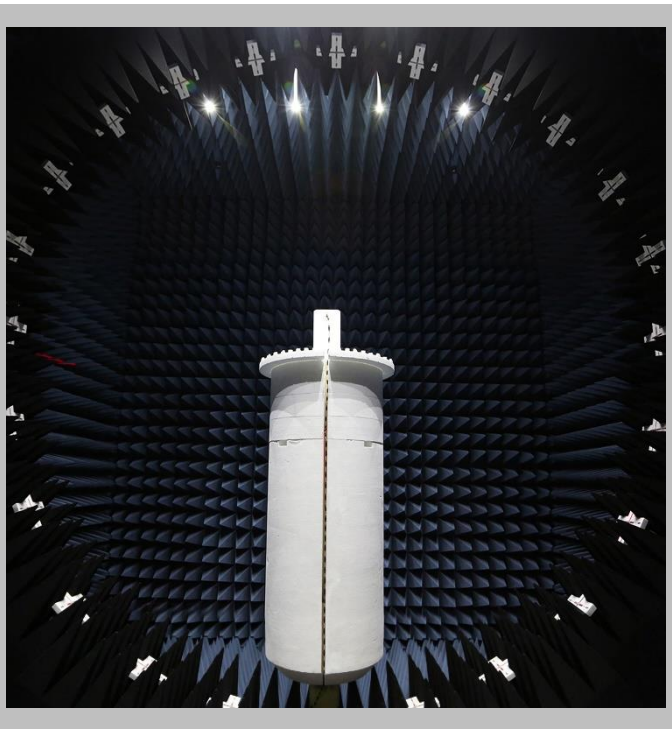
MIC – Recognized by MIC as a CAB for the acceptance of test data.

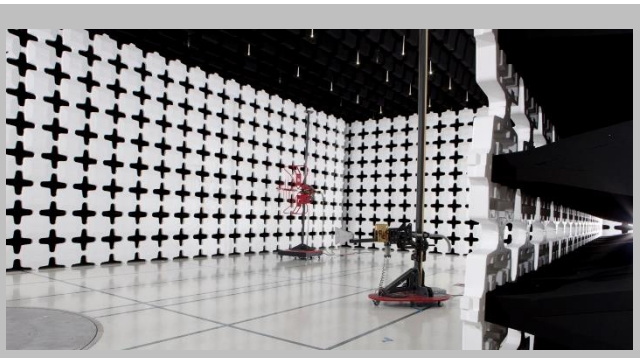
SCOPE

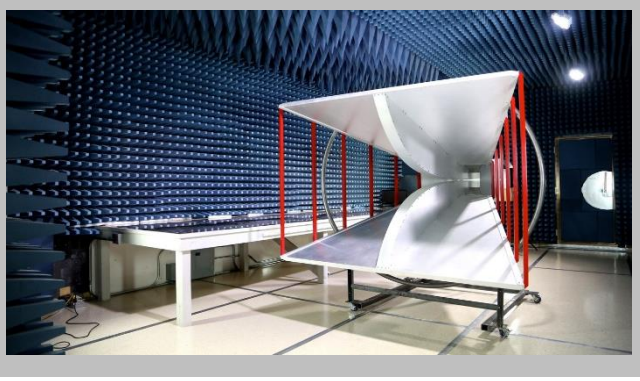
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	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	N/A	2834D-1	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
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







MEASUREMENT UNCERTAINTY

WTD.2016.12.19

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.

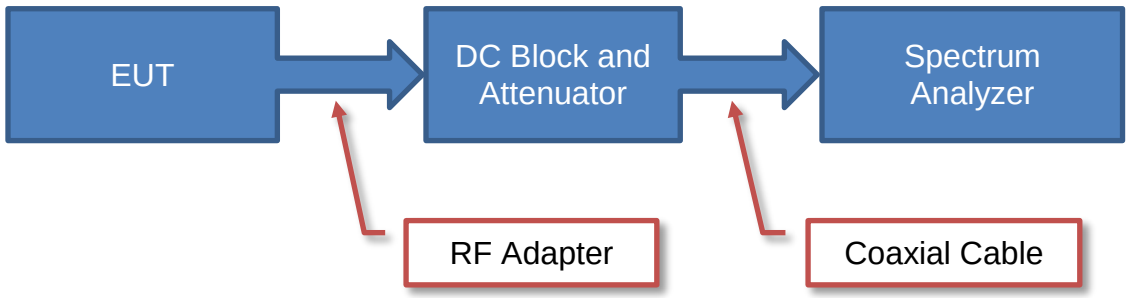
A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is on each data sheet. Our measurement 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.

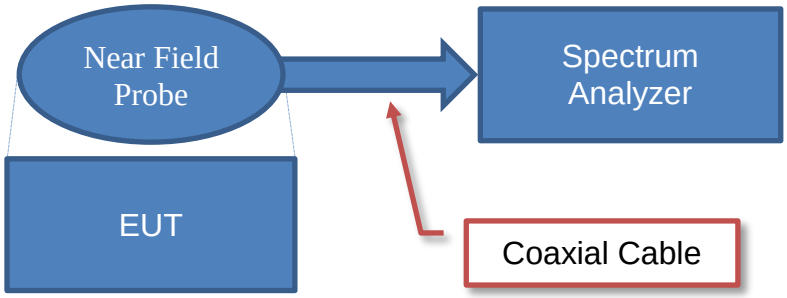
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

Test Setup Block Diagrams

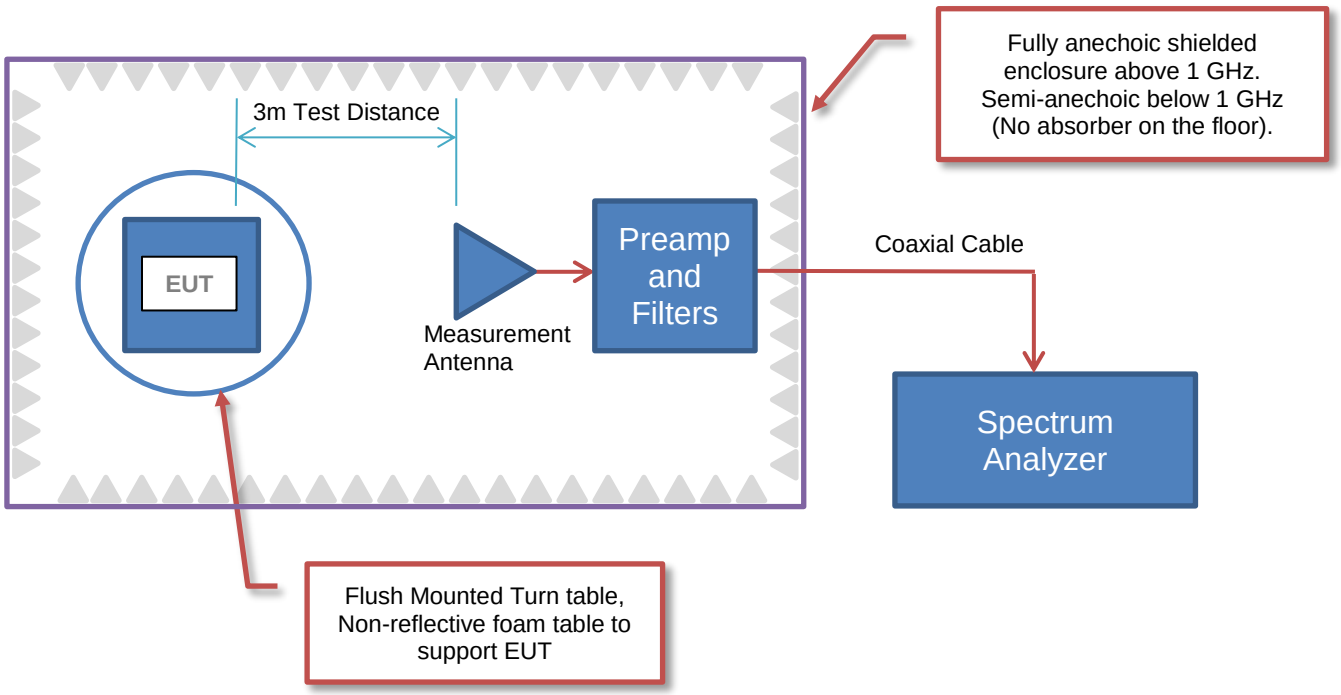
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



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:	Taylor Dowden
Model:	EV ICD
First Date of Test:	December 10, 2018
Last Date of Test:	December 10, 2018
Receipt Date of Samples:	December 10, 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:
EV ICD is an extravascular implantable cardioverter defibrillator that provides fast ventricular tachyarrhythmia/fibrillation detection and defibrillation therapy. The device is based on the Evera MRI platform and has a device volume consistent with transvenous ICDs. The device has a DF4 connector and is compatible with 1.5 and 3 T MRI scanners. EV ICD is programmable and has the capability of wirelessly communicating with an external Medtronic programmer or monitor via 402-405 MHz Medical Implant Communication Service (MICS) telemetry.

Client Provided Information:
Reference Documents MDT30147026: EV ICD Pivotal Study Radio Test Plan MDT30147027: EV ICD Pivotal Study - Equivalency Rationale for Radio Test Samples

Testing Objective:
To demonstrate compliance of the MICS portion of the device to FCC Part 95I specifications.

CONFIGURATIONS

Configuration MDTR0743- 2

Software/Firmware Running during test	
Description	**Version**
Baseline	6.1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EV ICD	Medtronic, Inc.	DVEX2E4	EVR600366S

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EV ICD Lead	Medtronic, Inc.	EV2401	EVL000642V

Configuration MDTR0743- 3

Software/Firmware Running during test	
Description	**Version**
Baseline	6.1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EV ICD	Medtronic, Inc.	DVEX1E4	EVR600121S

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Power Cable	No	1.7m	No	EV ICD	TPZ

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2018-12-11	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.
2	2018-12-11	Spurious Radiated 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.
3	2018-12-12	Emissions 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	2018-12-12	Emission Mask	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	2018-12-12	Conducted 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.
6	2018-12-12	Frequency Stability	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	2018-12-12	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

EMISSIONS BANDWIDTH

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
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Generator - Signal	Keysight	N5182B	TFX	22-Oct-18	22-Oct-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Agilent	E4443A	AAS	27-Feb-18	27-Feb-19

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. Per 47 CFR 95.2573(a), the emission bandwidth was determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 20 dB down relative to the maximum level of the modulated carrier. A spectrum analyzer using a peak detector with no video filtering was used with a resolution bandwidth equal to approximately 1.0 percent of the emission bandwidth of the EUT.

EMISSIONS BANDWIDTH

element

TbtTx 2018.09.13 XMit 2017.12.13

EUT:	EV ICD			**Work Order:**	MDTR0743
Serial Number:	EVR600121S			**Date:**	12-Dec-18
Customer:	Medtronic, Inc.			**Temperature:**	22.5 °C
Attendees:	Taylor Dowden			**Humidity:**	24.5% RH
Project:	None			**Barometric Pres.:**	1011 mbar
Tested by:	Dustin Sparks	**Power:**	3.2VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	**Test Method**
FCC 95I:2018	ANSI C63.26:2015

COMMENTS

None

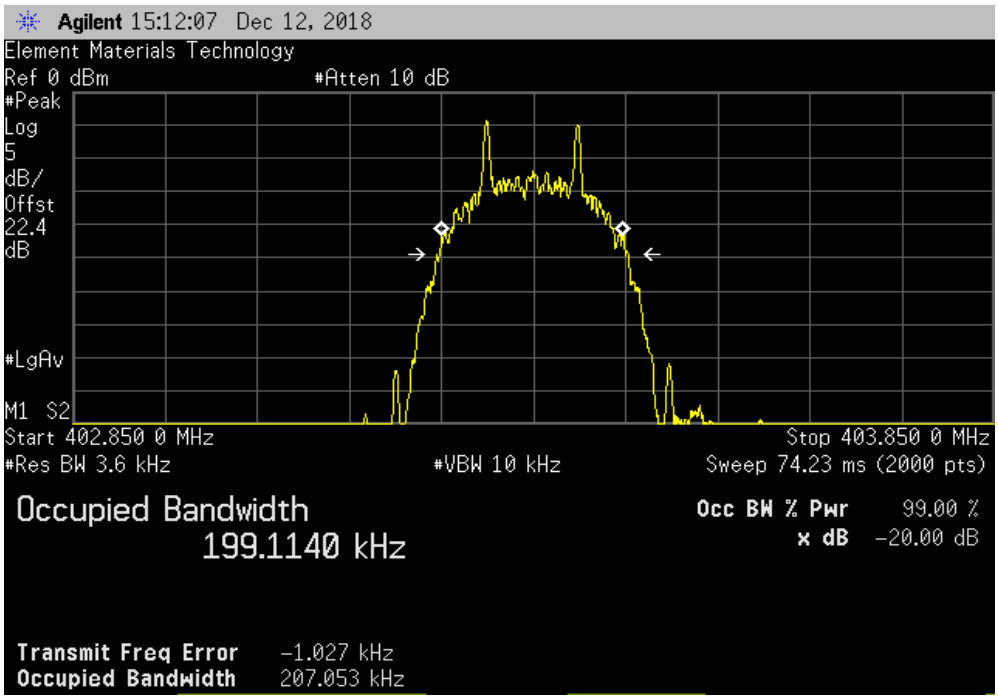
DEVIATIONS FROM TEST STANDARD

None

Configuration #	3	*Signature* Dustin Sparks

	Value	**Limit (≤)**	**Result**
Normal Voltage			
Mid Channel, 403.35 MHz	207.054 kHz	300 kHz	Pass

Normal Voltage, Mid Channel, 403.35 MHz						
				Value	Limit (≤)	Result
				207.054 kHz	300 kHz	Pass



EMISSIONS MASK

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
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Generator - Signal	Keysight	N5182B	TFX	22-Oct-18	22-Oct-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Agilent	E4443A	AAS	27-Feb-18	27-Feb-19

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. Per 47 CFR 95.2579(a)(1) the emission mask was measured. Emissions more than 150 kHz away from the center frequency must be attenuated below the transmitter output power by at least 20 dB. This was evaluated by the Occupied Bandwidth measurement according to 47 CFR 95.2573(a). In addition, emissions 250 kHz or less above and below the MICS band (402-405 MHz) must be attenuated below the maximum permitted output power by at least 20 dB.

A spectrum analyzer was used to measure the emission mask. A spectrum analyzer using a peak detector with no video filtering was used with a resolution bandwidth equal to approximately 1.0 percent of the emission bandwidth of the EUT. However, various plots were made using different frequency spans and resolution bandwidths in an attempt to not only satisfy the measurement criteria, but to also show that all emissions outside of the occupied band are greatly attenuated.

EMISSIONS MASK

element

TbtTx 2018.09.13 XMit 2017.12.13

EUT:	EV ICD			**Work Order:**	MDTR0743
Serial Number:	EVR600121S			**Date:**	12-Dec-18
Customer:	Medtronic, Inc.			**Temperature:**	22.6 °C
Attendees:	Taylor Dowden			**Humidity:**	24.4% RH
Project:	None			**Barometric Pres.:**	1011 mbar
Tested by:	Dustin Sparks	**Power:**	3.2VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	**Test Method**
FCC 95I:2018	ANSI C63.26:2015

COMMENTS

None

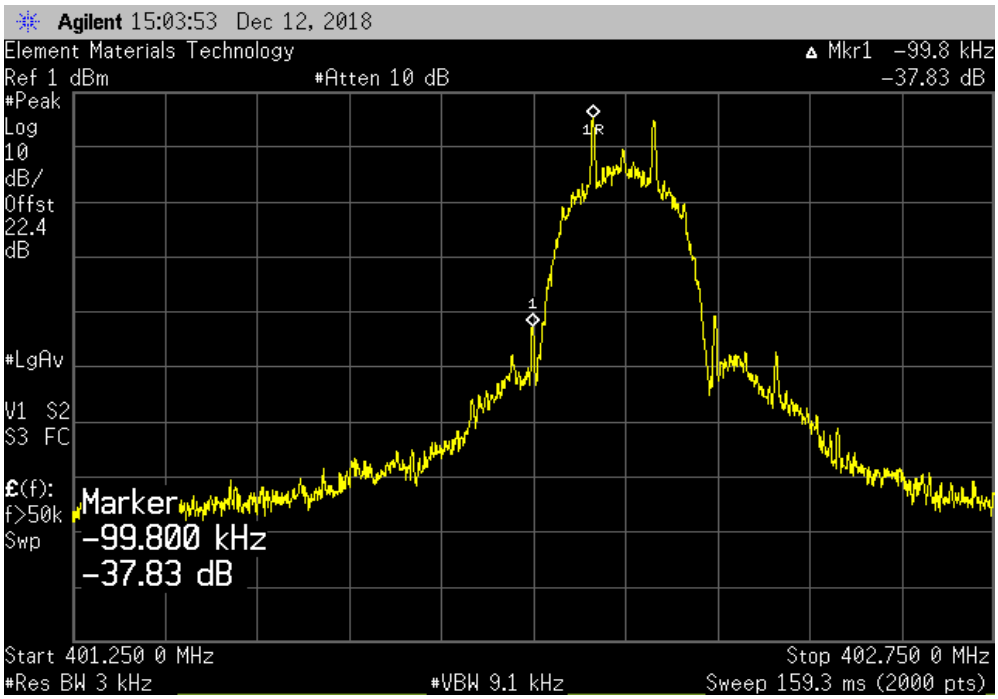
DEVIATIONS FROM TEST STANDARD

None

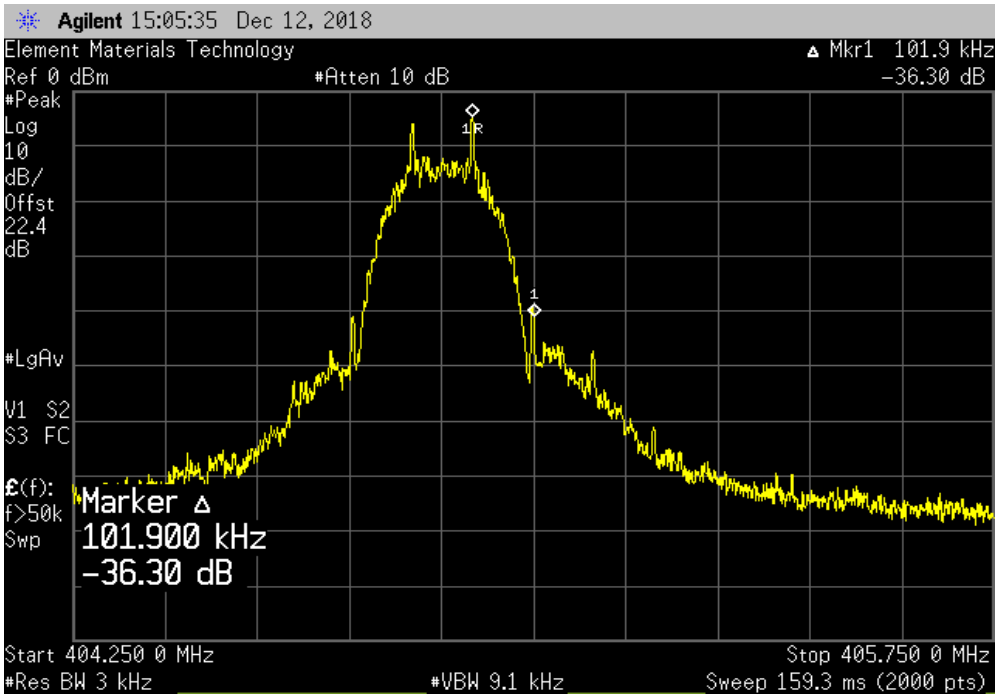
Configuration #	3	*Signature* Dustin Sparks

	Value (dBc)	**Limit ≤ (dBc)**	**Result**
Low Channel, 402.15 MHz	-37.83	-20	Pass
High Channel, 404.85 MHz	-36.3	-20	Pass

Low Channel, 402.15 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-37.83	-20	Pass



High Channel, 404.85 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-36.3	-20	Pass



OUTPUT POWER

XMit 2017.12.13

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TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Generator - Signal	Keysight	N5182B	TFX	22-Oct-18	22-Oct-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Agilent	E4443A	AAS	27-Feb-18	27-Feb-19

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. Per FCC Part 2.1046, RSS-GEN, the output power shall be measured at the RF terminal. The peak output power was measured with the EUT configured in the modes listed in the datasheet. The EUT was transmitting at its maximum data rate.

FCC Part 95 and RSS-243 have no conducted output power limit. It is a requirement to characterize this information and that data is contained within this datasheet.

OUTPUT POWER

TbtTx 2018.09.13 XMit 2017.12.13

EUT:	EV ICD			Work Order:	MDTR0743
Serial Number:	EVR600121S			Date:	12-Dec-18
Customer:	Medtronic, Inc.			Temperature:	22.6 °C
Attendees:	Taylor Dowden			Humidity:	24.4% RH
Project:	None			Barometric Pres.:	1011 mbar
Tested by:	Dustin Sparks	Power:	3.2VDC	Job Site:	MN08

TEST SPECIFICATIONS	Test Method
FCC 95I:2018	ANSI C63.26:2015

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

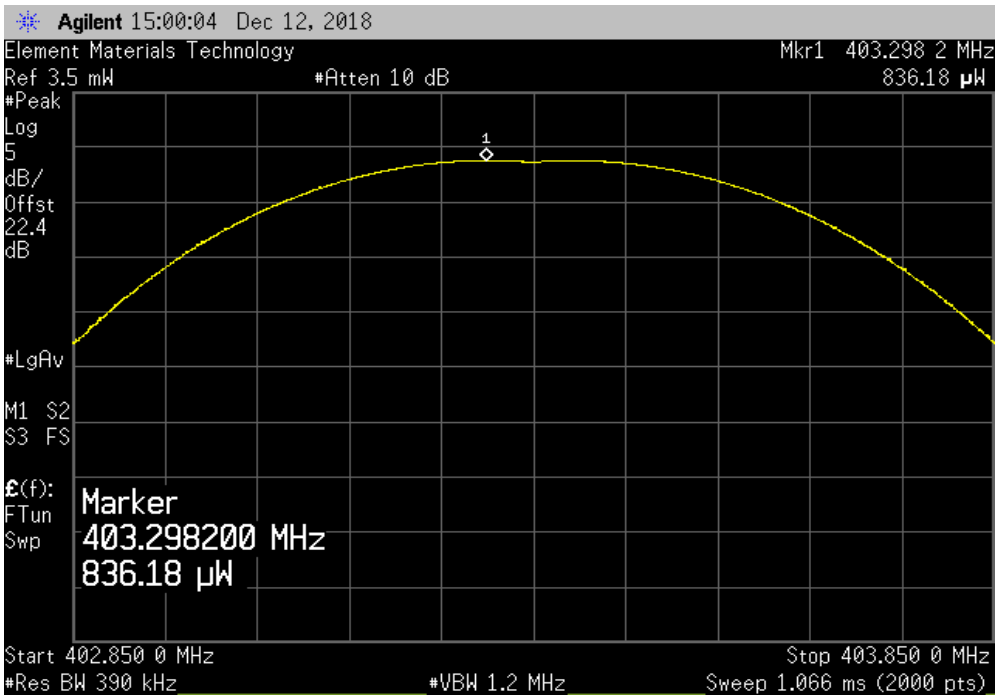
None

Configuration #	3	Signature

	Value	Limit	Result
Normal Voltage			
Mid Channel, 403.35 MHz	836.18 uW	N/A	N/A

OUTPUT POWER

Normal Voltage, Mid Channel, 403.35 MHz						
				Value	Limit	Result
				836.18 uW	N/A	N/A



FREQUENCY STABILITY

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
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPH-32-3.5-SCT/AC	TBF	10-Dec-18	10-Dec-19
Thermometer	Omega Engineering, Inc.	HH311	DUB	10-Nov-17	10-Nov-20
Generator - Signal	Keysight	N5182B	TFX	22-Oct-18	22-Oct-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Agilent	E4443A	AAS	27-Feb-18	27-Feb-19
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-19
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spectrum analyzer is configured with a precision frequency reference that exceeds the stability requirement of the transmitter. The EUT was placed inside a temperature / humidity chamber.

Variation of Supply Voltage
The primary supply voltage was varied from the nominal voltage to the manufacturer declared extreme low voltage. A DC lab supply was used to vary the supply voltage.

Variation of Ambient Temperature
Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range (+25°, 35°C and +45° C).

FREQUENCY STABILITY

element

TbtTx 2018.09.13 XMit 2017.12.13

EUT:	EV ICD			**Work Order:**	MDTR0743
Serial Number:	EVR600121S			**Date:**	12-Dec-18
Customer:	Medtronic, Inc.			**Temperature:**	22.4 °C
Attendees:	Taylor Dowden			**Humidity:**	24.1% RH
Project:	None			**Barometric Pres.:**	1011 mbar
Tested by:	Dustin Sparks, Kyle McMullan	**Power:**	3.2VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	**Test Method**
FCC 95I:2018	ANSI C63.26:2015

COMMENTS

Tested at nominal voltage (3.2VDC) and the extreme low voltage declared by the manufacturer (2.73VDC)

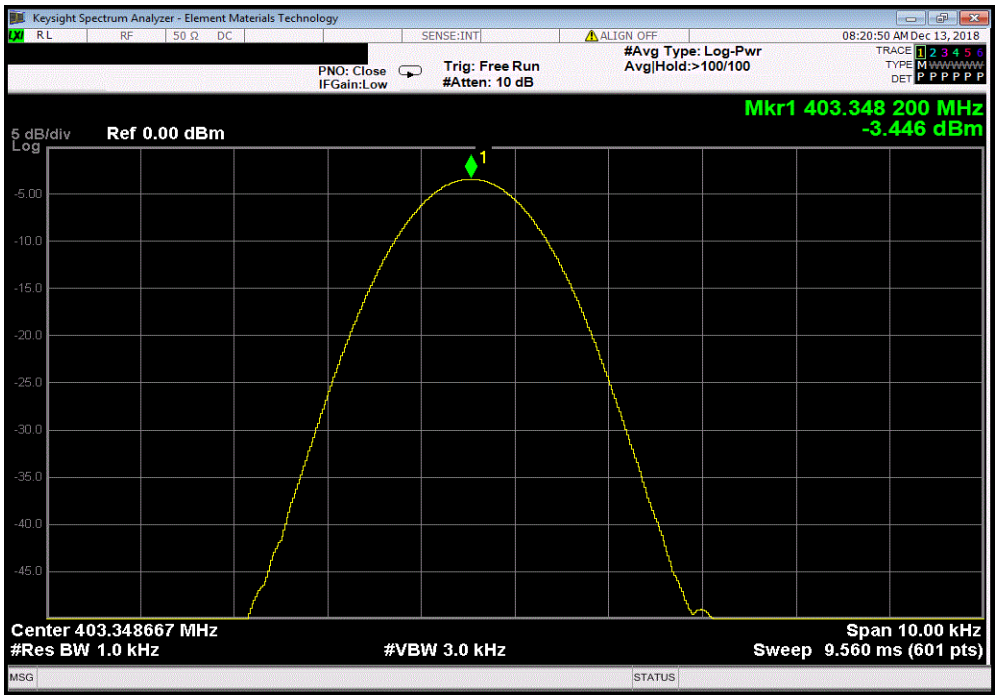
DEVIATIONS FROM TEST STANDARD

None

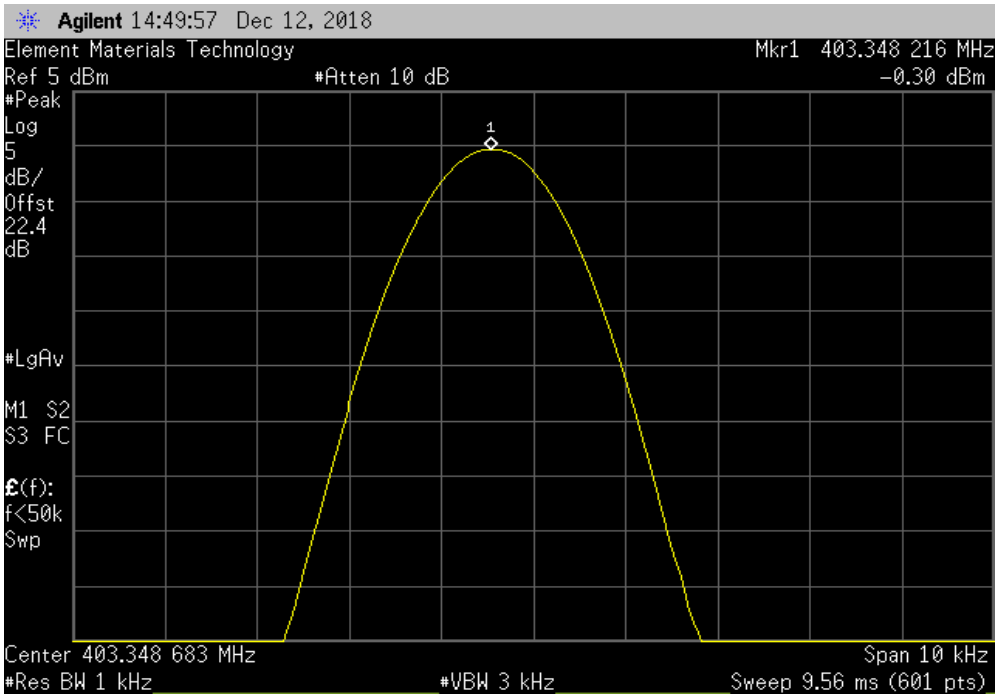
Configuration #	3	*Signature* Dustin Sparks

	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
Normal Voltage					
Mid Channel, 403.35 MHz	403.3482003	403.35	4.5	100	Pass
Extreme Voltage (2.73VDC)					
Mid Channel, 403.35 MHz	403.348216	403.35	4.4	100	Pass
Extreme Temperature +45°C					
Mid Channel, 403.35 MHz	403.3480667	403.35	4.8	100	Pass
Extreme Temperature +35°C					
Mid Channel, 403.35 MHz	403.3480163	403.35	4.9	100	Pass
Extreme Temperature +25°C					
Mid Channel, 403.35 MHz	403.3481837	403.35	4.5	100	Pass

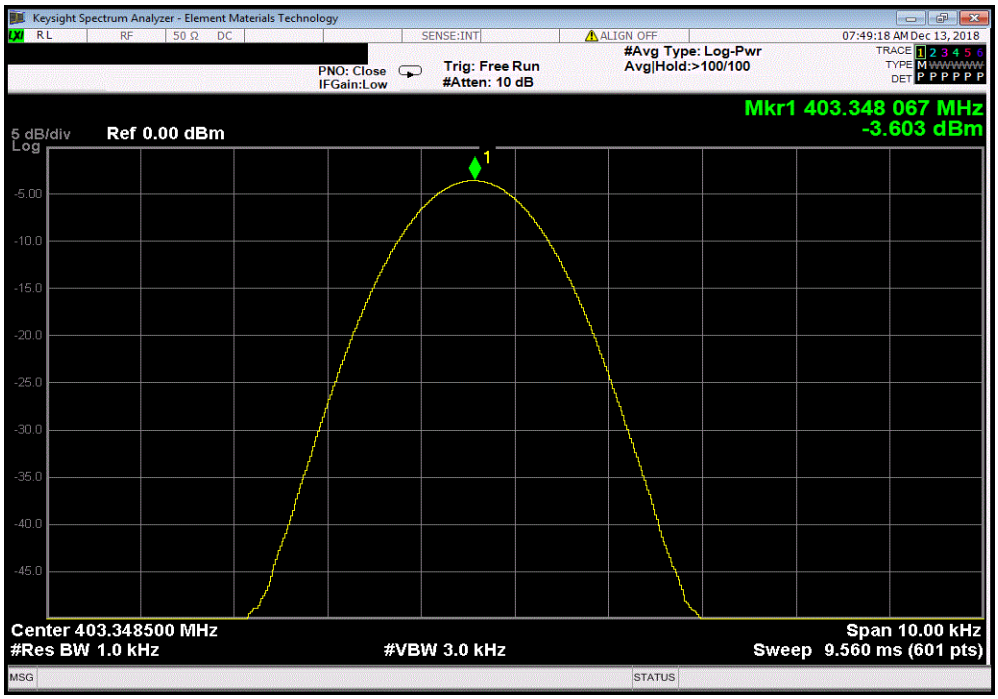
Normal Voltage, Mid Channel, 403.35 MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		403.3482003	403.35	4.5	100	Pass



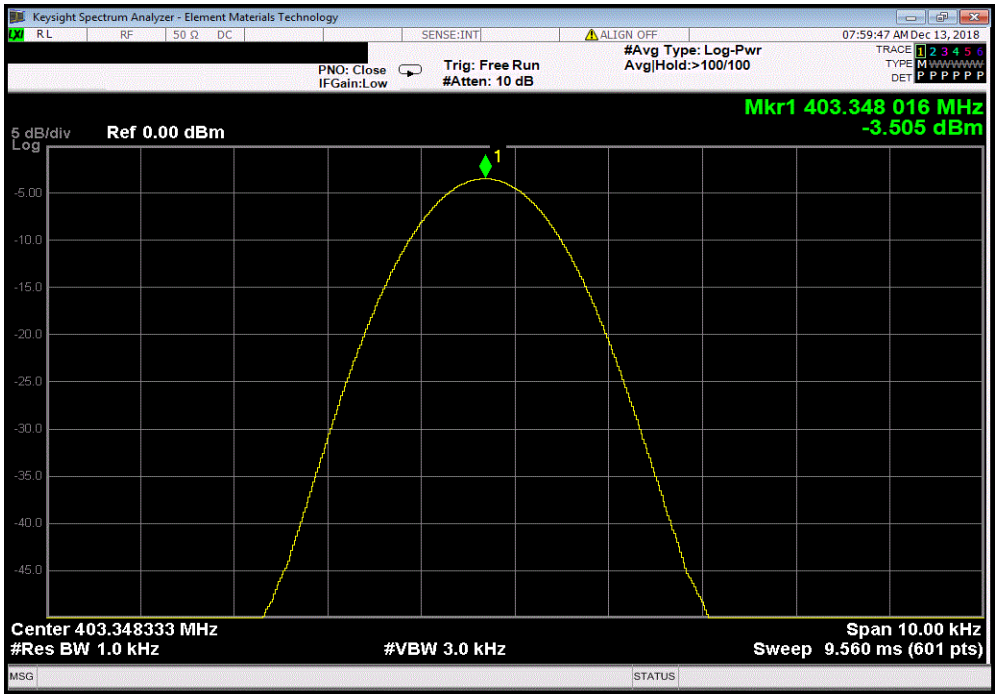
Extreme Voltage (2.73VDC), Mid Channel, 403.35 MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		403.348216	403.35	4.4	100	Pass



Extreme Temperature +45°C, Mid Channel, 403.35 MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		403.3480667	403.35	4.8	100	Pass

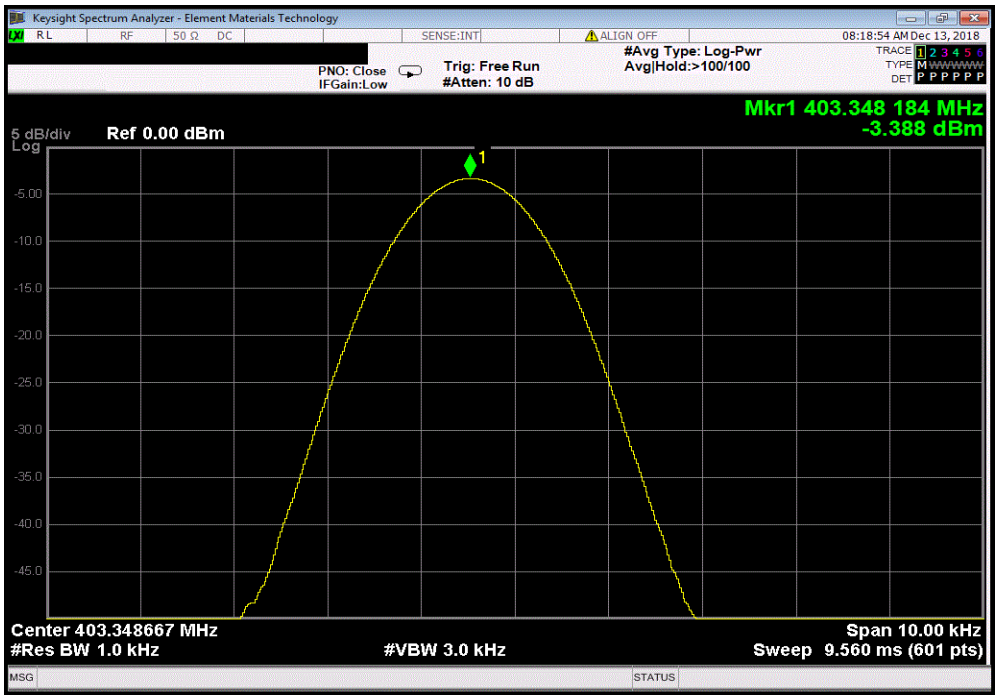


Extreme Temperature +35°C, Mid Channel, 403.35 MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		403.3480163	403.35	4.9	100	Pass



FREQUENCY STABILITY

Extreme Temperature +25°C, Mid Channel, 403.35 MHz						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		403.3481837	403.35	4.5	100	Pass



SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2018.07.27

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 MICS on mid ch at 403.35 MHz.

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

MDTR0743 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	5 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
Tank, Torso Simulator	None	None	PCN	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	2-Nov-2018	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-2018	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 (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

TEST DESCRIPTION

The highest gain of each type of antenna to be used with the EUT was tested. For each configuration, the spectrum was scanned throughout the specified range. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.26). A preamp was used for this test in order to provide sufficient measurement sensitivity.

Per CFR 47 95.2579(a), field strength measurements were performed and compared to the specified limits.

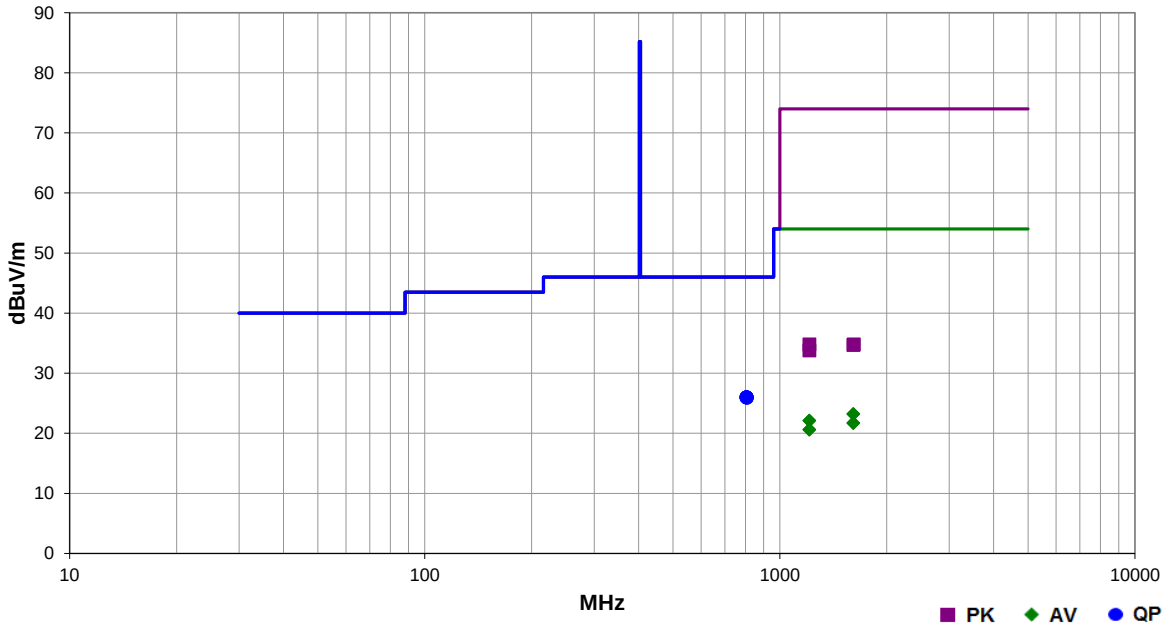
SPURIOUS RADIATED EMISSIONS

EmiR5 2018.09.26 PSA-ESCI 2018.07.27

Work Order:	MDTR0743	**Date:**	11-Dec-2018		
Project:	None	**Temperature:**	21.8 °C		
Job Site:	MN05	**Humidity:**	20.7% RH		
Serial Number:	EVR600366S	**Barometric Pres.:**	1018 mbar	**Tested by:**	Kyle McMullan
EUT:	EV ICD				
Configuration:	2				
Customer:	Medtronic, Inc.				
Attendees:	Taylor Dowden				
EUT Power:	Battery				
Operating Mode:	Transmitting MICS on mid ch at 403.35 MHz.				
Deviations:	None				
Comments:	Permittivity of 56.2 (1.68% below ideal), conductivity of 0.834 S/m (10.3% below ideal).				

Test Specifications	**Test Method**
FCC 95I:2018	ANSI C63.26:2015

Run #	24	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



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
804.818	16.4	9.6	1.0	343.0	3.0	0.0	Horz	QP	0.0	26.0	46.0	-20.0	Mid Ch, Orientation X
805.528	16.4	9.6	1.0	114.9	3.0	0.0	Vert	QP	0.0	26.0	46.0	-20.0	Mid Ch, Orientation X
805.562	16.4	9.6	1.9	116.0	3.0	0.0	Horz	QP	0.0	26.0	46.0	-20.0	Mid Ch, Orientation Y
806.617	16.4	9.6	1.0	358.0	3.0	0.0	Horz	QP	0.0	26.0	46.0	-20.0	Mid Ch, Orientation Z
805.967	16.4	9.6	1.0	63.9	3.0	0.0	Vert	QP	0.0	26.0	46.0	-20.0	Mid Ch, Orientation Z
807.580	16.3	9.6	1.0	288.0	3.0	0.0	Vert	QP	0.0	25.9	46.0	-20.1	Mid Ch, Orientation Y
1611.767	29.6	-6.4	1.0	189.0	3.0	0.0	Horz	AV	0.0	23.2	54.0	-30.8	Mid Ch, Orientation X
1611.567	29.6	-6.4	1.0	141.0	3.0	0.0	Vert	AV	0.0	23.2	54.0	-30.8	Mid Ch, Orientation X
1210.875	30.0	-7.9	2.7	23.0	3.0	0.0	Horz	AV	0.0	22.1	54.0	-31.9	Mid Ch, Orientation X
1211.058	30.0	-7.9	1.0	325.9	3.0	0.0	Vert	AV	0.0	22.1	54.0	-31.9	Mid Ch, Orientation X
1611.125	28.1	-6.4	1.0	189.0	3.0	0.0	Horz	AV	0.0	21.7	54.0	-32.3	Mid Ch, Orientation X
1610.908	28.1	-6.4	1.0	141.0	3.0	0.0	Vert	AV	0.0	21.7	54.0	-32.3	Mid Ch, Orientation X
1211.892	28.5	-7.9	2.7	23.0	3.0	0.0	Horz	AV	0.0	20.6	54.0	-33.4	Mid Ch, Orientation X
1211.733	28.5	-7.9	1.0	325.9	3.0	0.0	Vert	AV	0.0	20.6	54.0	-33.4	Mid Ch, Orientation X
1211.542	42.7	-7.9	2.7	23.0	3.0	0.0	Horz	PK	0.0	34.8	74.0	-39.2	Mid Ch, Orientation X
1614.308	41.2	-6.4	1.0	141.0	3.0	0.0	Vert	PK	0.0	34.8	74.0	-39.2	Mid Ch, Orientation X
1611.842	41.1	-6.4	1.0	189.0	3.0	0.0	Horz	PK	0.0	34.7	74.0	-39.3	Mid Ch, Orientation X
1210.725	41.7	-7.9	1.0	325.9	3.0	0.0	Vert	PK	0.0	33.8	74.0	-40.2	Mid Ch, Orientation X

SPURIOUS CONDUCTED EMISSIONS

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
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Generator - Signal	Keysight	N5182B	TFX	22-Oct-18	22-Oct-21
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Attenuator	S.M. Electronics	SA26B-20	RFW	13-Feb-18	13-Feb-19
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Analyzer - Spectrum Analyzer	Agilent	E4443A	AAS	27-Feb-18	27-Feb-19

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. Per FCC Part 2.1051, the spurious emissions shall be measured at the RF terminal. The peak spurious emissions were measured with the EUT configured to the modes listed in the datasheet. The EUT was transmitting at its maximum data rate.

FCC Part 95 has no conducted spurious emissions limit. It is a requirement to characterize this information and that data is contained within this datasheet.

SPURIOUS CONDUCTED EMISSIONS

XMit 2017.12.13

EUT:	EV ICD			**Work Order:**	MDTR0743
Serial Number:	EVR600121S			**Date:**	12-Dec-18
Customer:	Medtronic, Inc.			**Temperature:**	22.7 °C
Attendees:	Taylor Dowden			**Humidity:**	24.2% RH
Project:	None			**Barometric Pres.:**	1011 mbar
Tested by:	Dustin Sparks	**Power:**	3.2VDC	**Job Site:**	MN08

TEST SPECIFICATIONS	**Test Method**
FCC 95I:2018	ANSI C63.26:2015

COMMENTS

None

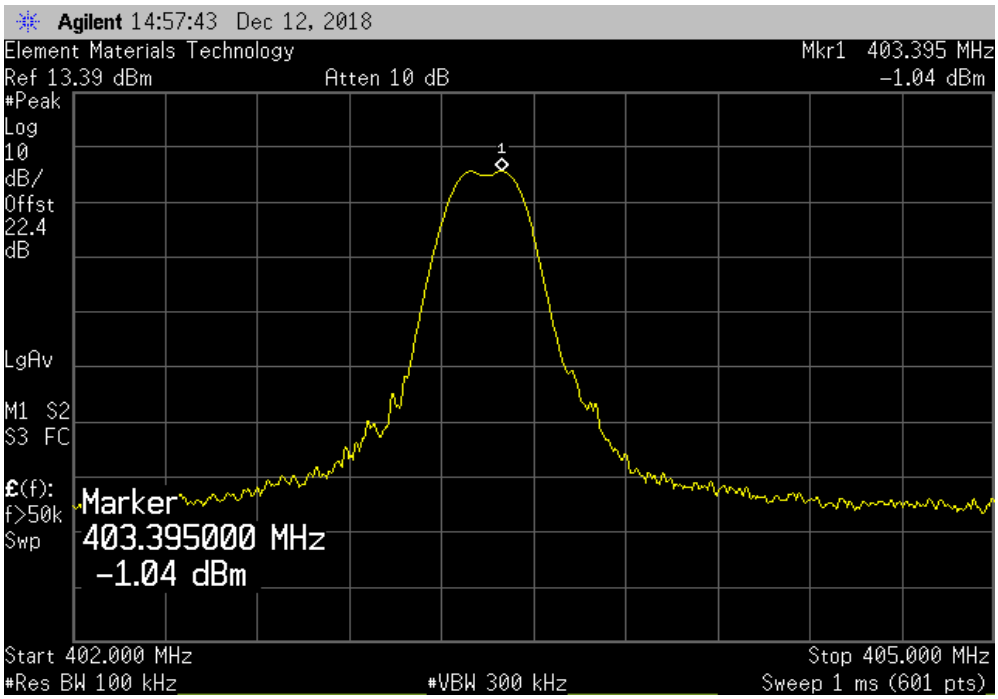
DEVIATIONS FROM TEST STANDARD

None

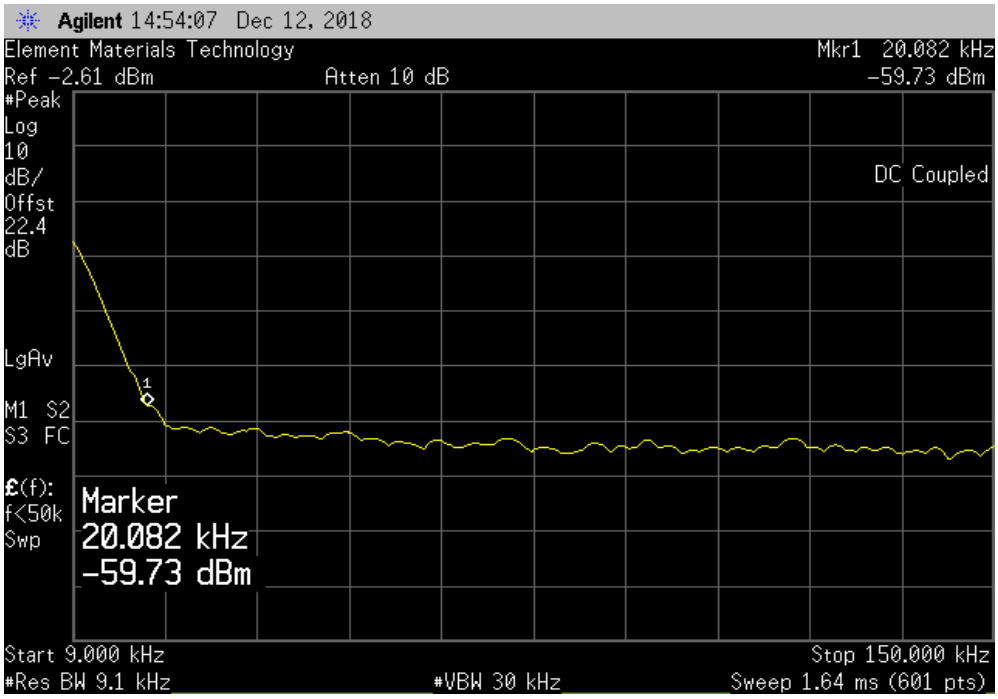
Configuration #	3	*Signature* Dustin Sparks

	Value (dBm)	**Limit**	**Result**
MICS, Mid Channel (403.35 MHz)			
Fundamental	-1.04	N/A	N/A
9 kHz - 150 kHz	-59.73	N/A	N/A
150 kHz - 30 MHz	-59.82	N/A	N/A
30 MHz - 1 GHz	-59.25	N/A	N/A
1 GHz - 5 GHz	-46.01	N/A	N/A

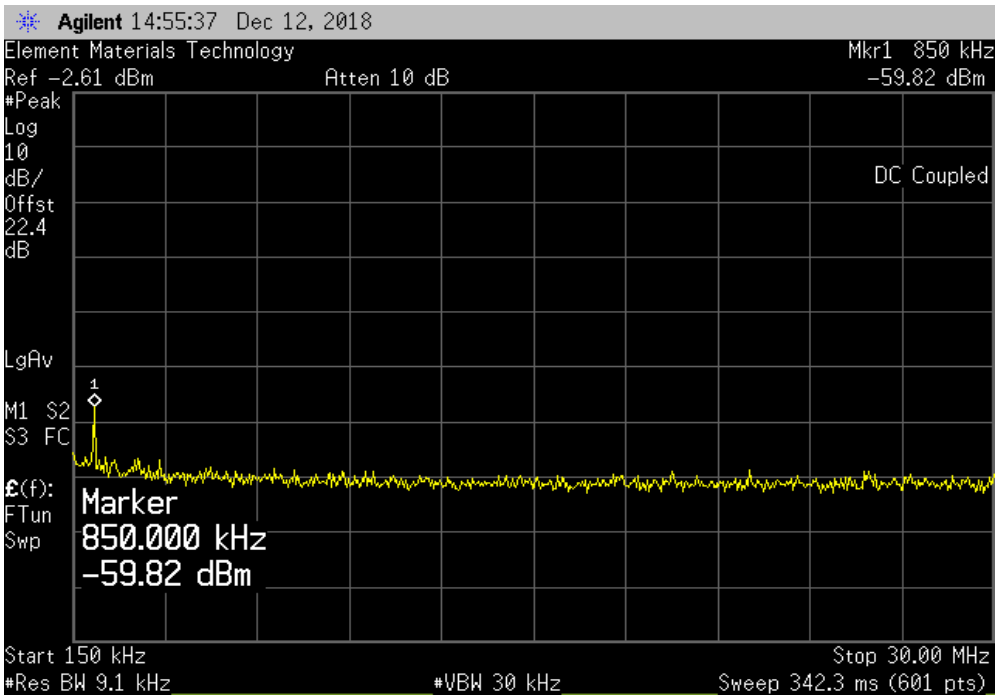
MICS, Mid Channel (403.35 MHz), Fundamental						
				Value (dBm)	Limit	Result
				-1.04	N/A	N/A



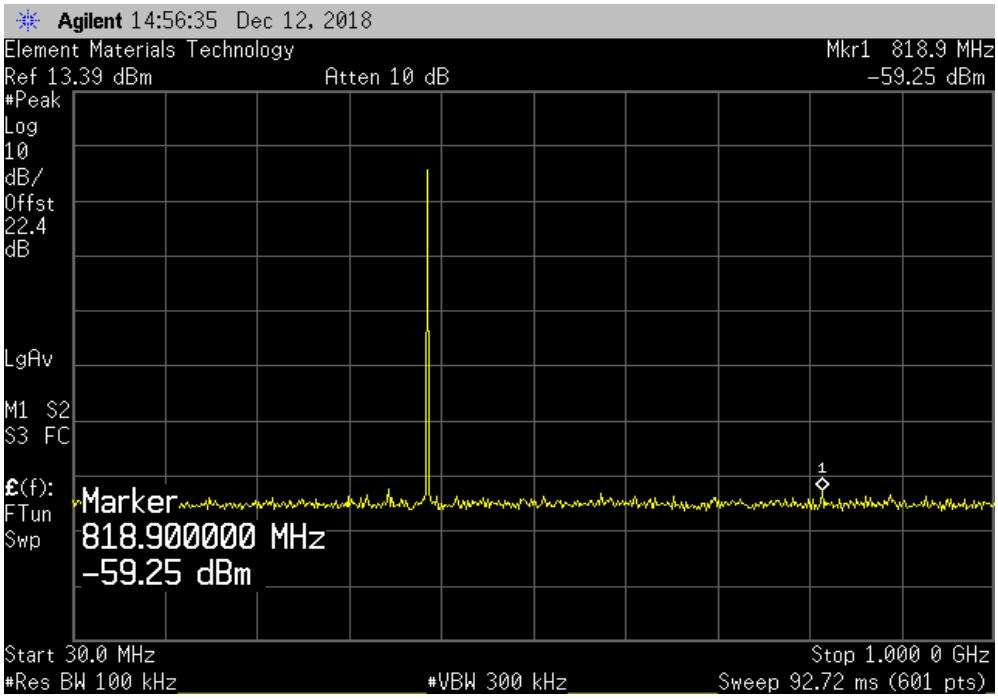
MICS, Mid Channel (403.35 MHz), 9 kHz - 150 kHz						
				Value (dBm)	Limit	Result
				-59.73	N/A	N/A



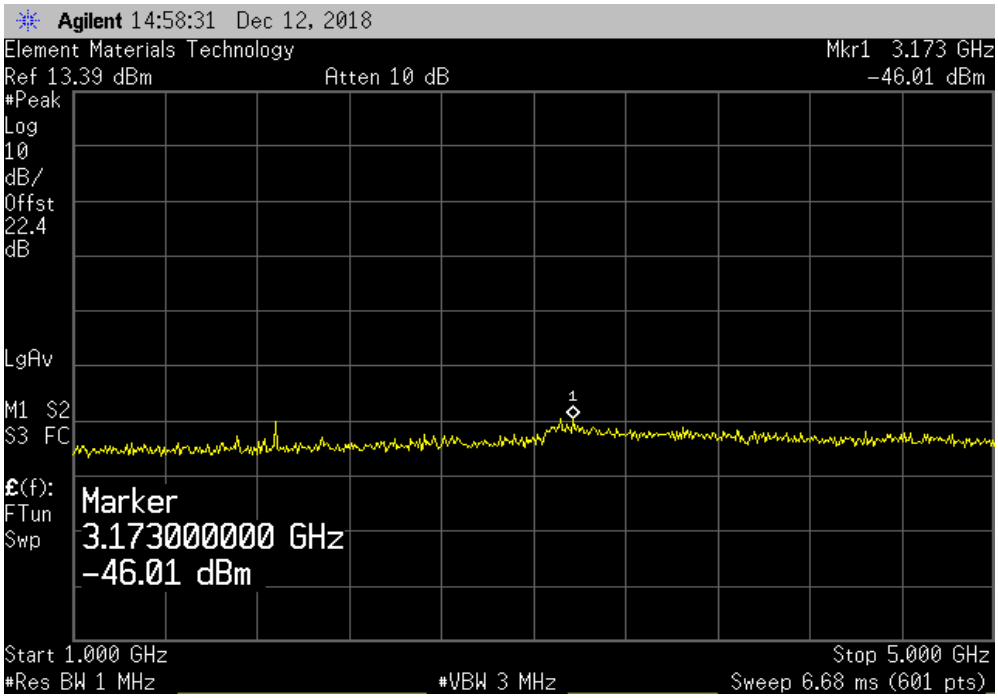
MICS, Mid Channel (403.35 MHz), 150 kHz - 30 MHz						
				Value (dBm)	Limit	Result
				-59.82	N/A	N/A



MICS, Mid Channel (403.35 MHz), 30 MHz - 1 GHz						
				Value (dBm)	Limit	Result
				-59.25	N/A	N/A



MICS, Mid Channel (403.35 MHz), 1 GHz - 5 GHz						
				Value (dBm)	Limit	Result
				-46.01	N/A	N/A



RADIATED POWER (EIRP)

PSA-ESCI 2018.07.27

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 MICS (CW) on mid ch at 403.35 MHz.

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

MDTR0743 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	402 MHz	Stop Frequency	405 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
Tank, Torso Simulator	None	None	PCN	NCR	0 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-2018	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 (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

TEST DESCRIPTION

Per 95.2567(a)(2), the maximum radiated field strength for a MICS transmitter is 25uW EIRP. The Field Strength of the Fundamental data was converted to EIRP with the formula based upon the Friis transmission equation with 6 dB removed due to reflections from the ground plane: EIRP = ((E/2)*d)^2/30 where E is V/m and d = distance = 3m, and EIRP = W (Reference 95.2569(a)).

The Field Strength of the Fundamental was measured in the far-field at an FCC Listed Semi-anechoic Chamber. Spectrum analyzer and linearly polarized antennas were used to measure the radiated field strength of the fundamental.

The orientation of the EUT and measurement antenna were manipulated to maximize the level of emissions. The turntable azimuth was varied to maximize the level of radiated emissions. The height of the measurement antenna was also varied from 1 to 4 meters. The amplitude and frequency of the emissions were noted.

The EUT was configured to transmit in a fixture that simulates the human torso. The dimensions of the test fixture and the characteristics of the tissue substitute material met the requirements 95.2569(c) and FCC KDB 617965. The height of the transmitter was 1.5-meter above the reference ground plane.

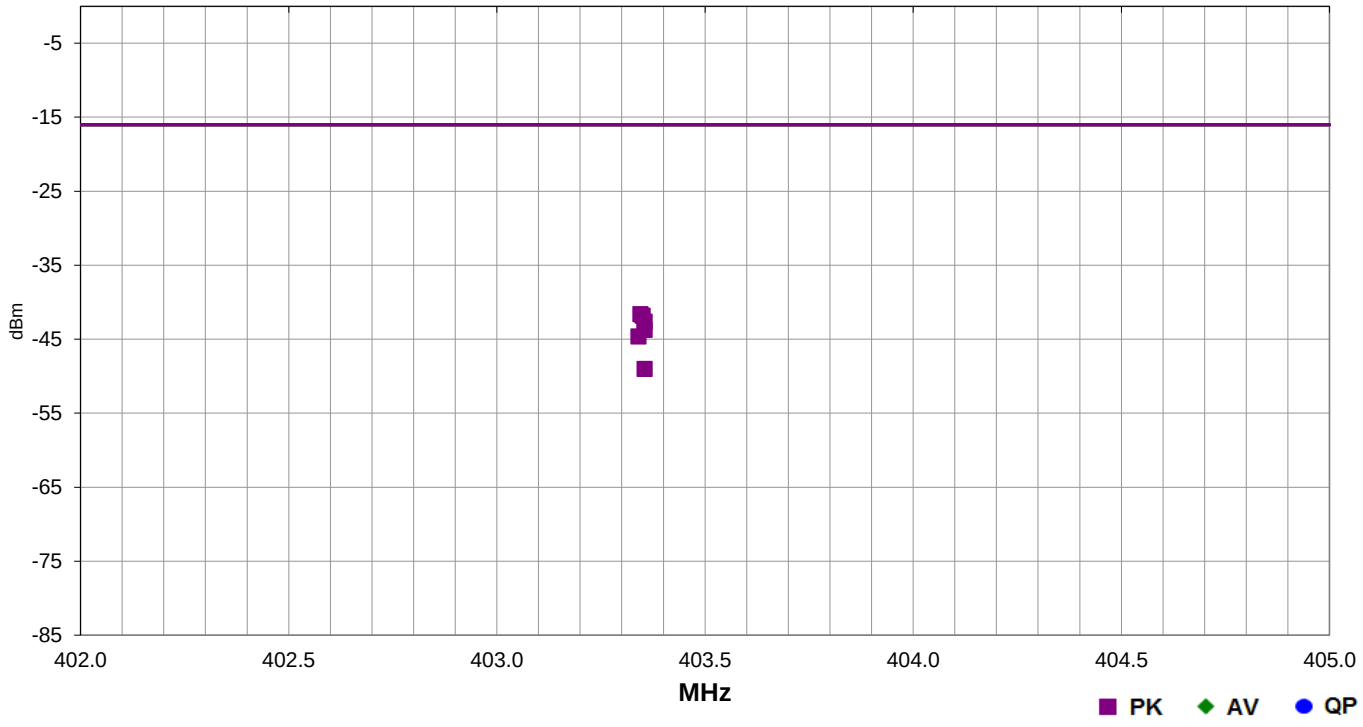
RADIATED POWER (EIRP)

EmiR5 2018.09.26 PSA-ESCI 2018.07.27

Work Order:	MDTR0743	**Date:**	11-Dec-2018		
Project:	None	**Temperature:**	20.3 °C		
Job Site:	MN05	**Humidity:**	20.9% RH		
Serial Number:	EVR600366S	**Barometric Pres.:**	1019 mbar	**Tested by:**	Kyle McMullan
EUT:	EV ICD				
Configuration:	2				
Customer:	Medtronic, Inc.				
Attendees:	Taylor Dowden				
EUT Power:	Battery				
Operating Mode:	Transmitting MICS (CW) on mid ch at 403.35 MHz.				
Deviations:	None				
Comments:	Permittivity of 56.2 (1.68% below ideal), conductivity of 0.834 S/m (10.3% below ideal).				

Test Specifications	**Test Method**
FCC 95I:2018	ANSI C63.26:2015

Run #	20	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



	Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
	403.345	1.1	286.0	Horz	PK	6.87E-08	-41.6	-16.0	-25.6	Mid Ch, Orientation X
	403.350	1.1	314.0	Horz	PK	6.56E-08	-41.8	-16.0	-25.8	Mid Ch, Orientation Y
	403.355	1.1	315.0	Horz	PK	5.46E-08	-42.6	-16.0	-26.6	Mid Ch, Orientation Z
	403.355	1.5	16.9	Vert	PK	4.24E-08	-43.7	-16.0	-27.7	Mid Ch, Orientation Y
	403.340	1.0	239.9	Vert	PK	3.44E-08	-44.6	-16.0	-28.6	Mid Ch, Orientation X
	403.355	1.5	307.9	Vert	PK	1.25E-08	-49.0	-16.0	-33.0	Mid Ch, Orientation Z