Medtronic MiniMed

TEST REPORT FOR

Synergy
Model: MMT-5100CL

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.247
(DTS 2400-2483.5 MHz)

Report No.: 103746-13

Date of issue: March 31, 2020

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

Test Certificate # 803.01

TABLE OF CONTENTS

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Medtronic MiniMed
18000 Devonshire Street, SS-32
Northridge, CA 91325

Representative: Mahtab Moberg
Customer Reference Number: 4500138796

REPORT PREPARED BY:

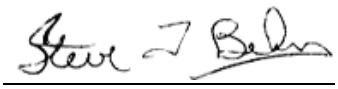
Dianne Dudley
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 103746

DATE OF EQUIPMENT RECEIPT: March 4, 2020
DATE(S) OF TESTING: March 4-5, 2020

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
Canyon Park
22116 23rd Drive S.E., Suite A
Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.12

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Japan
Canyon Park, Bothell, WA	US0081	US1022	A-0136
Brea, CA	US0060	US1025	A-0136
Fremont, CA	US0082	US1023	A-0136
Mariposa, CA	US0103	US1024	A-0136

*CKC's list of NIST designated countries can be found at: https://standards.gov/cabs/designations.html

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C - 15.247 (DTS)

Test Procedure	Description	Modifications	Results
15.247(a)(2)	6dB Bandwidth	NA	Pass
15.247(b)(3)	Output Power	NA	Pass
15.247(e)	Power Spectral Density	NA	Pass
15.247(d)	RF Conducted Emissions & Band Edge	NA	NA[2]
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NA[1]

NA = Not applicable
NA[1] = Not applicable because the EUT is battery powered.
NA[2]= Not applicable because the EUT has an integral antenna.

ISO/IEC 17025 Decision Rule
The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
Synergy	Medtronic MiniMed	MMT-5100CL	A932610756

Support Equipment:

Device	Manufacturer	Model #	S/N
None			

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
Synergy	Medtronic MiniMed	MMT-5100CL	A932623876

Support Equipment:

Device	Manufacturer	Model #	S/N
None			

Configuration 3

Equipment Tested:

Device	Manufacturer	Model #	S/N
Synergy	Medtronic MiniMed	MMT-5100CL	A932687936

Support Equipment:

Device	Manufacturer	Model #	S/N
None			

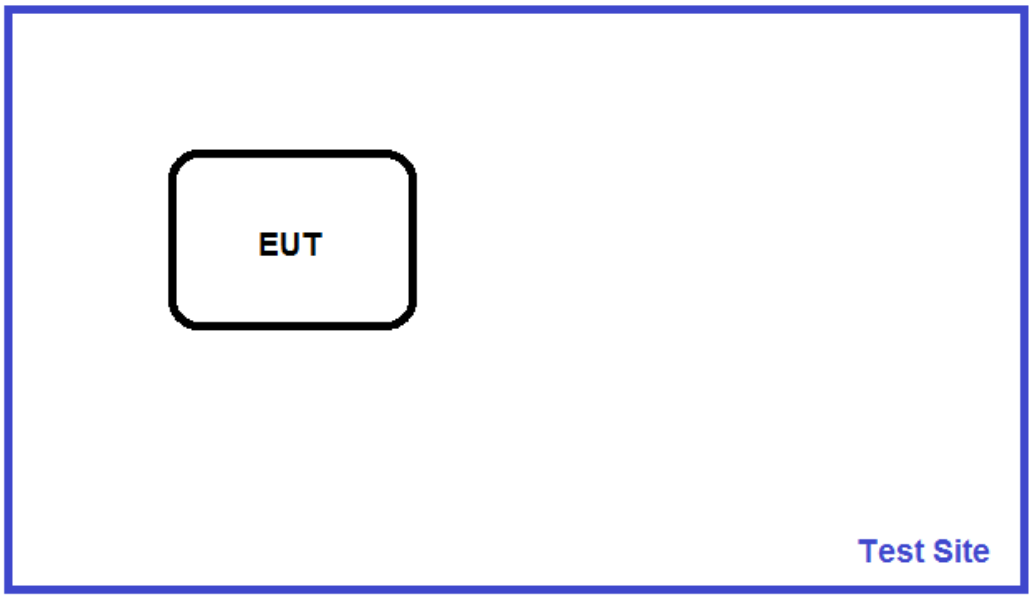
General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	DTS
Operating Frequency Range:	2402-2480
Modulation Type(s):	GFSK
Maximum Duty Cycle:	100% (Tested worst case)
Number of TX Chains:	1
Antenna Type(s) and Gain:	Inverted F / -6dBi
Beamforming Type:	N/A
Antenna Connection Type:	Integral
Nominal Input Voltage:	3V Internal Battery
Firmware / Software used for Test:	Synergy RF Utility Transmitter Firmware/ 1.0A & Synergy RF Utility / 1.0A

EUT Photo

Test Setup Diagram

Test Setup Block Diagram



FCC Part 15 Subpart C

15.247(a)(2) 6dB Bandwidth

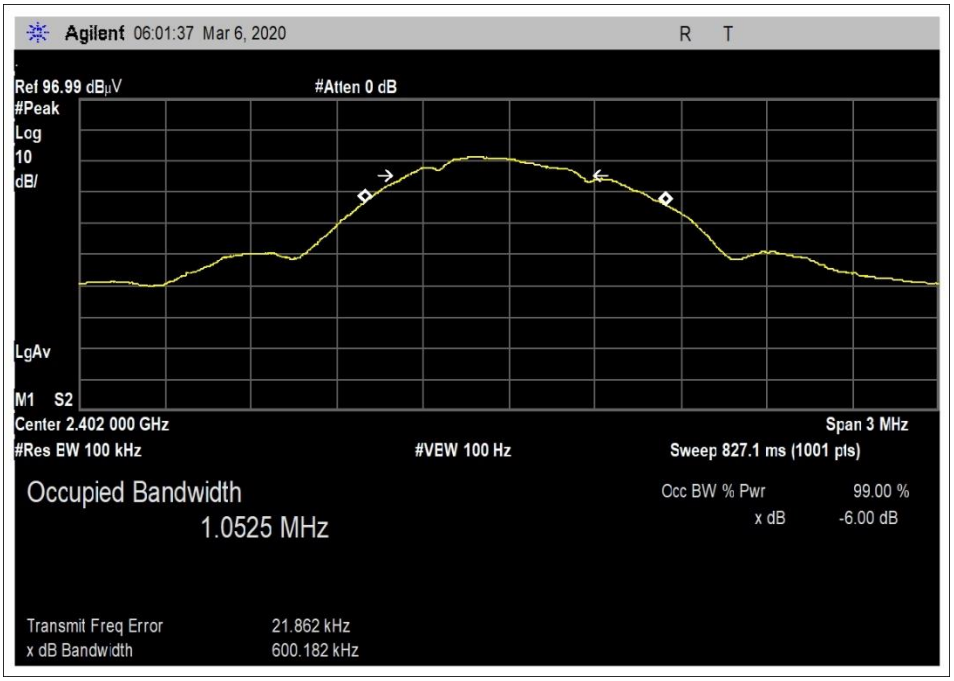
Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Harrison
Test Method:	ANSI C63.10 (2013), KDB 558074 v05r02 04/02/2019	Test Date(s):	3/4/2020
Configuration:	1		
Test Setup:	Test Mode: Continuously Modulated EUT is operating with fresh battery installed. The EUT is set 1.5 meters high on a Styrofoam table. X, Y and Z axis are investigated with the worst case reported.		

Environmental Conditions			
Temperature (ºC)	23	Relative Humidity (%):	32

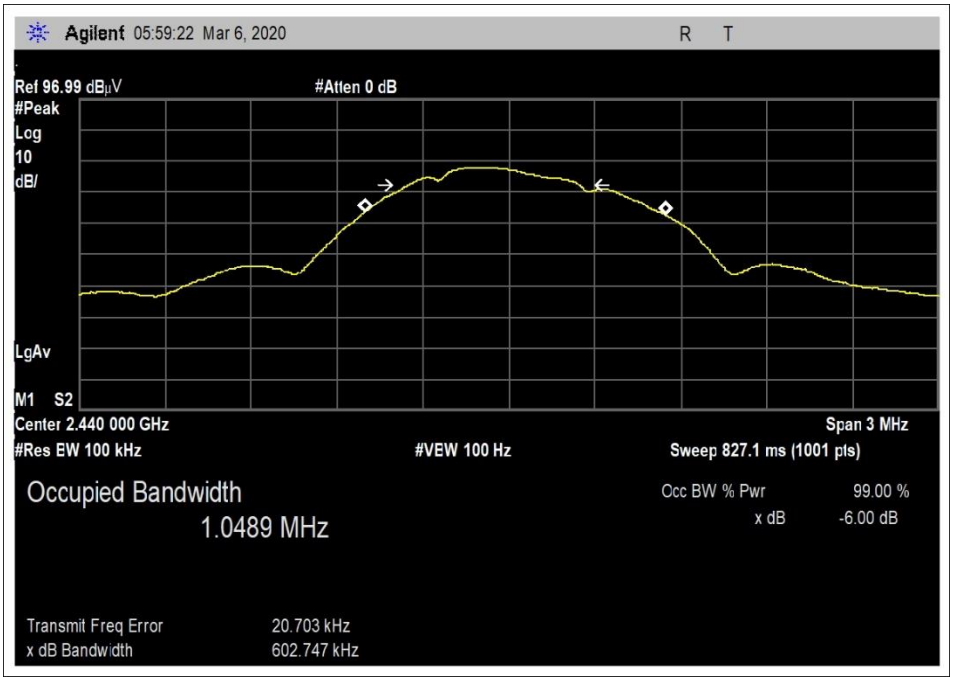
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
01467	Horn Antenna	EMCO	3115	7/5/2019	7/5/2021
02872	Spectrum Analyzer	Agilent	E4440A	11/18/2019	11/18/2021
03540	Preamp	HP	83017A	5/13/2019	5/13/2021

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
2402	1	GFSK	600.2	≥500	Pass
2440	1	GFSK	602.7	≥500	Pass
2480	1	GFSK	616.2	≥500	Pass

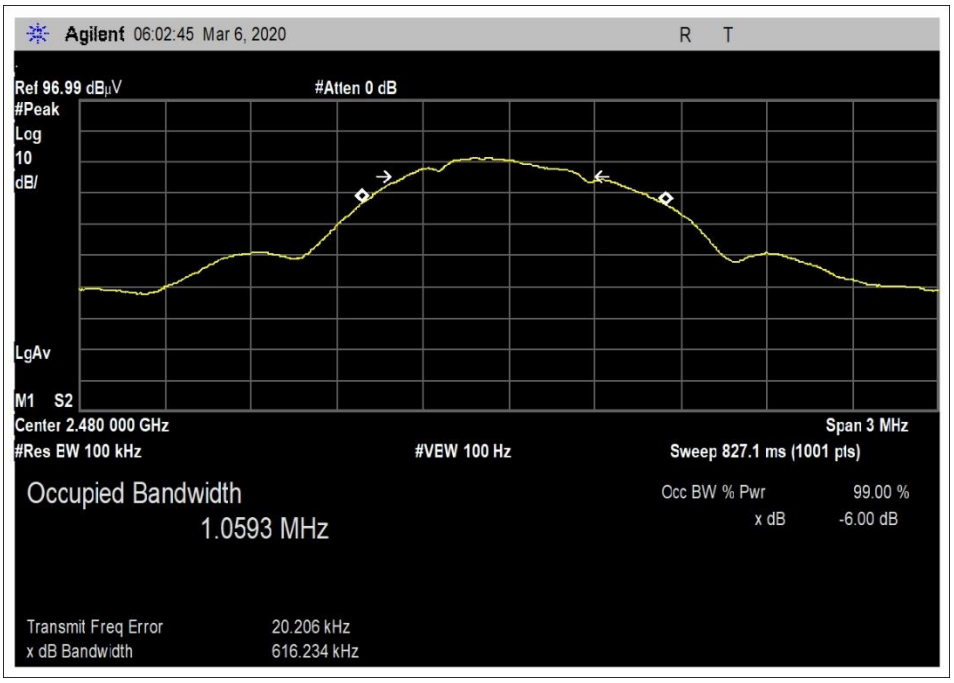
Plot(s)



Low Channel, 2402



Middle Channel, 2440



High Channel, 2480

Test Setup Photo(s)

X Axis

Y Axis

Z Axis

15.247(b)(3) Output Power

Power Output Test Data Summary - Radiated Measurement						
Measurement Option: RBW > DTS Bandwidth						
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Field Strength (dBuV/m @3m)**	**Calculated (dBm)**	**Limit (dBm)**	**Results**
2402	GFSK	Inverted F / -6dBi	88	-1.22	≤30	Pass
2440	GFSK	Inverted F / -6dBi	87.1	-2.12	≤30	Pass
2480	GFSK	Inverted F / -6dBi	88.3	-0.92	≤30	Pass

For fixed point-to-point antennas, the limit is calculated in accordance with 15.247(c)(1): $Limit = 30 - Roundup\left(\frac{G-6}{3}\right)$

For directional beamforming antennas, the limit is calculated in accordance with 15.247(c)(2) and KDB 662911.

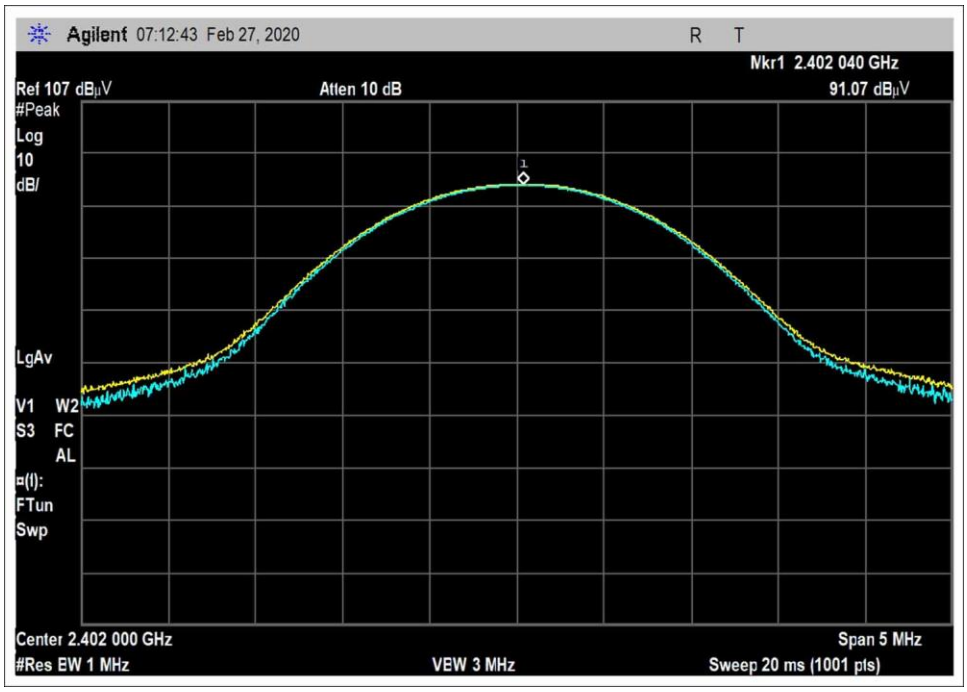
Conducted RF output power calculated in accordance with ANSI C63.10.

$$P(W) = \frac{(E \cdot d)^2}{30\ G}$$

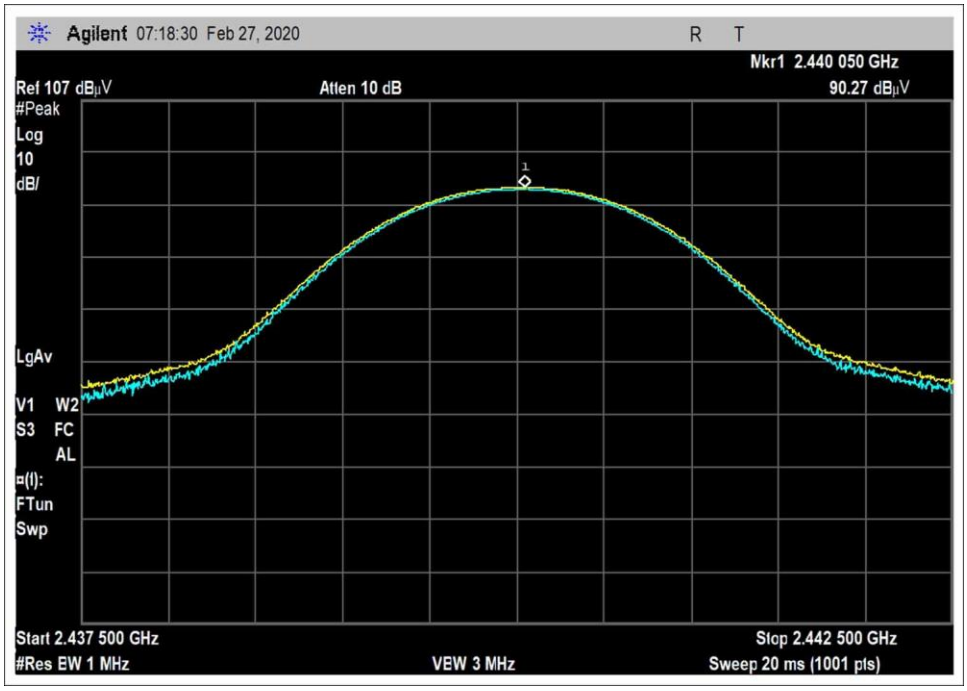
Or equivalently, in logarithmic form:

$$P(dBm) = E(dBuV/m) + 20LOG(d) - G\ - 104.77$$

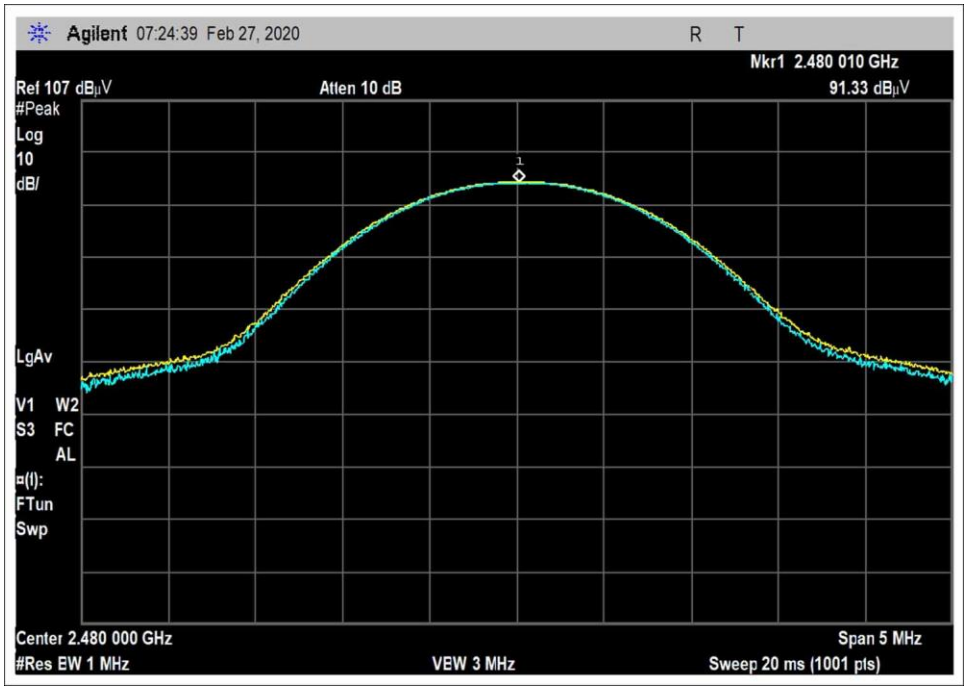
Plots



Low Channel, 2402



Middle Channel, 2440



High Channel, 2480

Test Setup / Conditions / Data

Test Location:	CKC Labs • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Medtronic MiniMed**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**103746**	Date:	3/5/2020
Test Type:	**Maximized Emissions**	Time:	08:45:27
Tested By:	Matthew Harrison	Sequence#:	5
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 22°C
Humidity: 33%
Pressure: 103.0 kPa

Frequency Range: 2402-2480MHz

Power setting: 2 dBm

Antenna: Inverted F / -6dBi

Test Setup: Continuously Transmitting 2402, 2440, 2480 MHz
The
Setup: The EUT is setup 1.5m high on Styrofoam table. It is operating with fresh battery installed. Low, Mid, and High channels investigated. X, Y, and Z EUT axes investigated as well as horizontal and vertical measurement antenna polarities investigated, worst case reported.

Test Location: Bothell Lab C3

Test Method: ANSI C63.10 (2013), KDB 558074 v05r02 04/02/2019

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T2	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T3	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T4	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T5	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T6	ANP07504	Cable	CLU40-KMKM-02.00F	1/17/2019	1/17/2021

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2480.010M	91.3	+0.6 +2.7	+0.0 +0.3	-34.2	+27.6	+0.0 155	88.3	125.2 Z-Axis	-36.9	Horiz 126
2	2402.040M	91.1	+0.6 +2.6	+0.0 +0.3	-34.3	+27.7	+0.0 335	88.0	125.2 Z-Axis	-37.2	Horiz 225
3	2440.050M	90.3	+0.6 +2.6	+0.0 +0.3	-34.3	+27.6	+0.0	87.1	125.2 Z-Axis	-38.1	Horiz 166

Test Setup Photo(s)

X Axis

Y Axis

Z Axis

15.247(e) Power Spectral Density

PSD Test Data Summary - Radiated Measurement						
Measurement Method: PKPSD						
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Field Strength (dBuV/m @3m)**	**Calculated (dBm/3kHz)**	**Limit (dBm/3kHz)**	**Results**
2402	GFSK	Inverted F / -6dBi	72	-17.22	≤8	Pass
2440	GFSK	Inverted F / -6dBi	72.5	-16.72	≤8	Pass
2480	GFSK	Inverted F / -6dBi	72.9	-16.32	≤8	Pass

Conducted RF output power calculated in accordance with ANSI C63.10.

$$P(W) = \frac{(E \cdot d)^2}{30\ G}$$

Or equivalently, in logarithmic form:

$$P(dBm) = E(dBuV/m) + 20LOG(d) - G\ - 104.77$$

Plots

Low Channel, 2402

Middle Channel, 2440

High Channel, 2480

Test Setup / Conditions / Data

Test Location:	CKC Labs • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Medtronic MiniMed**		
Specification:	**15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)**		
Work Order #:	**103746**	Date:	3/5/2020
Test Type:	**Maximized Emissions**	Time:	09:37:59
Tested By:	Matthew Harrison	Sequence#:	6
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 22°C
Humidity: 33%
Pressure: 103.0 kPa

Frequency Range: 2402-2480MHz

Power setting: 2 dBm

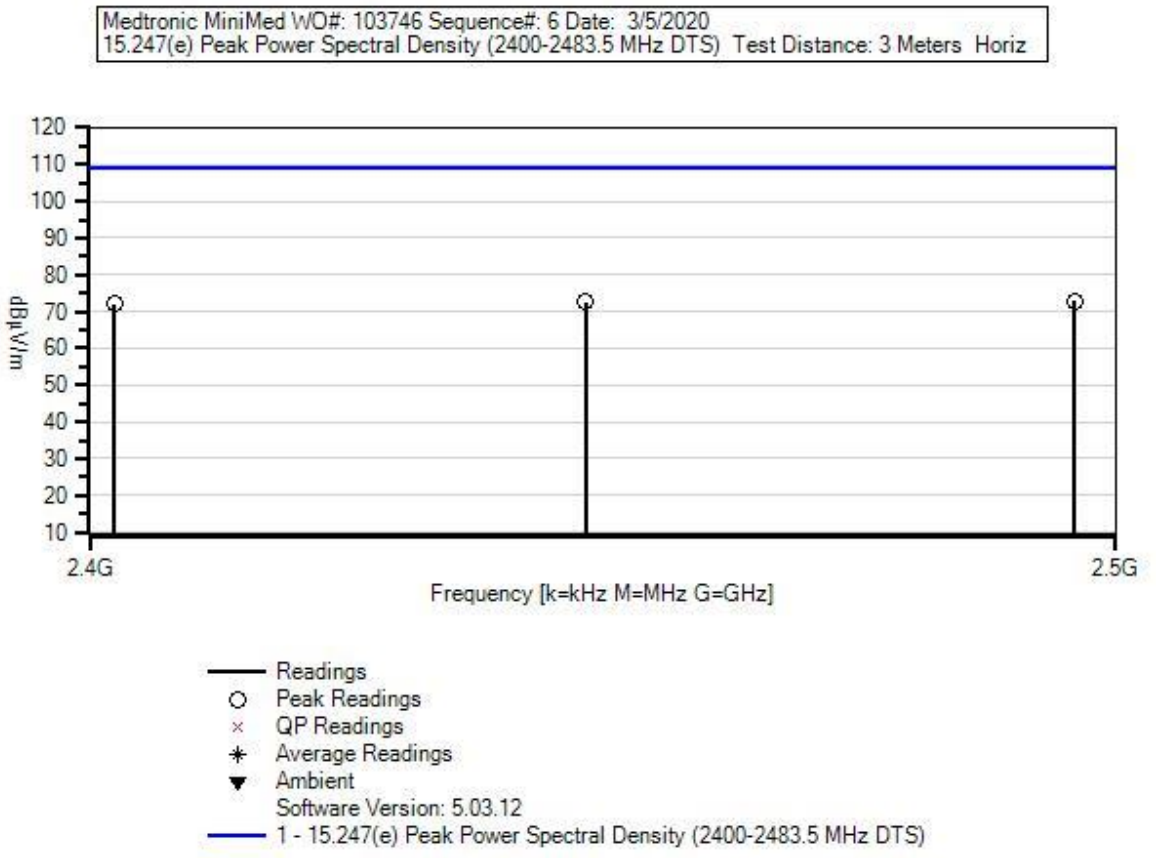
Antenna: Inverted F / -6dBi

Test Setup: Continuously Transmitting 2402, 2440, 2480 MHz

Setup: The EUT is setup 1.5m high on Styrofoam table. It is operating with fresh battery installed. Low, Mid, and High channels investigated. X, Y, and Z EUT axes investigated as well as horizontal and vertical measurement antenna polarities investigated, worst case reported.

Test Location: Bothell Lab C3

Test Method: ANSI C63.10 (2013), KDB 558074 v05r02 04/02/2019



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T2	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T3	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T4	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/17/2019	1/17/2021

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2480.031M	75.9	+0.6 +0.3	-34.2	+27.6	+2.7	+0.0	72.9	109.2	-36.3	Horiz
2	2440.030M	75.7	+0.6 +0.3	-34.3	+27.6	+2.6	+0.0	72.5	109.2	-36.7	Horiz
3	2402.030M	75.1	+0.6 +0.3	-34.3	+27.7	+2.6	+0.0	72.0	109.2	-37.2	Horiz

Test Setup Photo(s)

X Axis

Y Axis

Z Axis

15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Labs • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Medtronic MiniMed**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**103746**	Date:	3/5/2020
Test Type:	**Maximized Emissions**	Time:	14:36:13
Tested By:	Matthew Harrison	Sequence#:	8
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 22°C
Humidity: 33%
Pressure: 103.0 kPa

Frequency Range: 9kHz-25GHz

Power setting: 2 dBm

Antenna: Inverted F / -6dBi

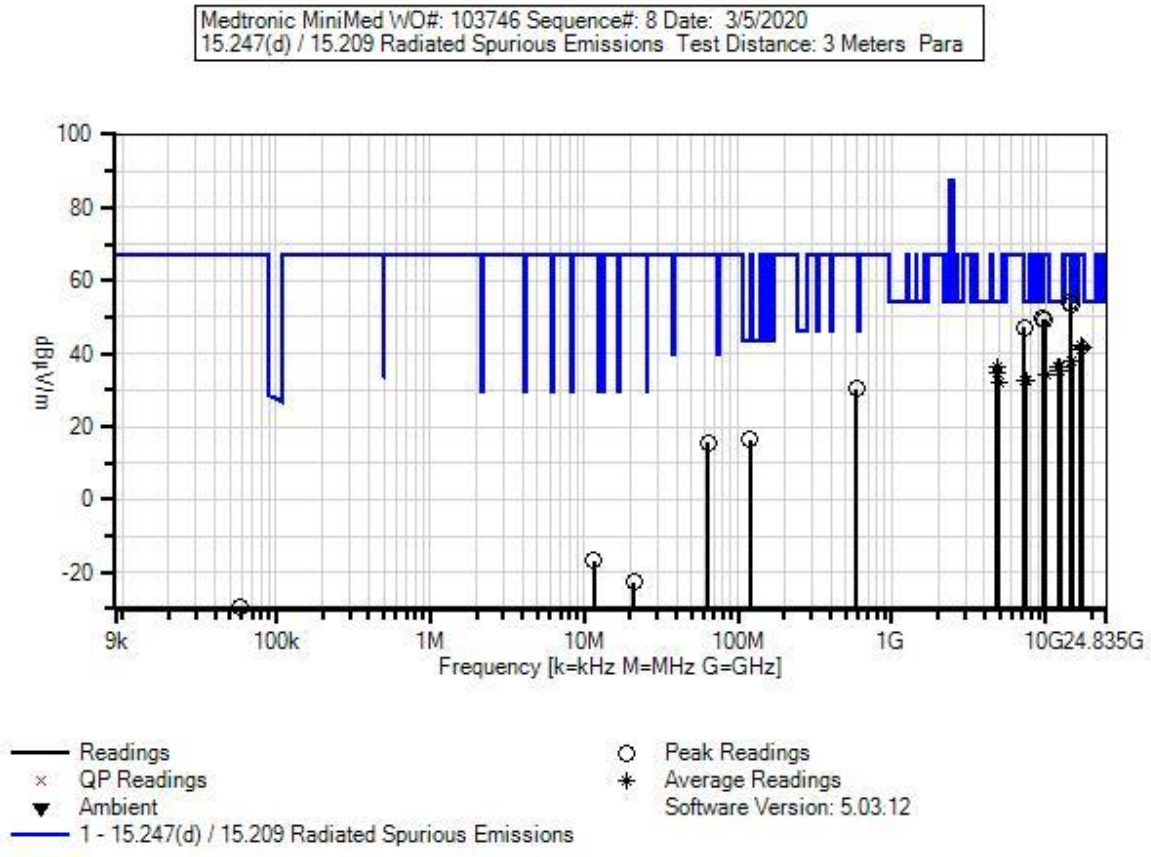
Test Setup: Continuously Transmitting 2402, 2440, 2480 MHz

Setup: The EUT is setup 1.5m high on Styrofoam table for above 1GHz and 0.8m for below 1GHz. It is operating with fresh battery installed. Low, Mid, and High channels investigated. X, Y, and Z EUT axes investigated as well as horizontal and vertical measurement antenna polarities investigated, worst case reported.

Test Location: Bothell Lab C3

Test Method: ANSI C63.10 (2013), KDB 558074 v05r02 04/02/2019

No emissions found above 18GHz.


Medtronic MiniMed WO#: 103746 Sequence#: 8 Date: 3/5/2020
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Para
100
80
60
40
20
0
-20
dBµV/m
9k
100k
1M
10M
100M
1G
10G24.835G
Frequency [k=kHz M=MHz G=GHz]
Readings
QP Readings
Ambient
1 - 15.247(d) / 15.209 Radiated Spurious Emissions
Peak Readings
Average Readings
Software Version: 5.03.12

Test Equipment:

ID	Asset #	Description	Model	Cal Date	Cal Due Date
T1	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T2	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T3	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T4	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T5	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T6	ANP07504	Cable	CLU40-KMKM-02.00F	1/17/2019	1/17/2021
	AN02742	Active Horn Antenna	AMFW-5F-18002650-20-10P	10/16/2018	10/16/2020
	AN02764-70	Waveguide	Multiple	4/23/2018	4/23/2020
	ANP06678	Cable	32026-29801-29801-144	2/20/2020	2/20/2022
	ANP07211	Cable	32026-29801-29801-18	8/7/2019	8/7/2021
	ANP07212	Cable	32026-29801-29801-18	8/7/2019	8/7/2021
T7	AN02307	Preamp	8447D	1/10/2020	1/10/2022
T8	AN03628	Biconilog Antenna	3142E	6/11/2019	6/11/2021
T9	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T10	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T11	ANP05360	Cable	RG214	2/3/2020	2/3/2022
T12	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	14412.500 M	37.1	+1.4 +8.0 +0.0	+0.0 +1.0 +0.0	-33.8 +0.0 +0.0	+40.2 +0.0 +0.0	+0.0	53.9	67.3	-13.4	Vert
2	14639.935 M	36.9	+1.5 +8.2 +0.0	+0.0 +0.9 +0.0	-33.9 +0.0 +0.0	+39.8 +0.0 +0.0	+0.0	53.4	67.3	-13.9	Vert
3	12399.700 M Ave	23.1	+1.5 +7.0 +0.0	+0.0 +0.6 +0.0	-34.6 +0.0 +0.0	+39.0 +0.0 +0.0	+0.0	36.6	54.0	-17.4	Vert
^	12399.700 M	38.3	+1.5 +7.0 +0.0	+0.0 +0.6 +0.0	-34.6 +0.0 +0.0	+39.0 +0.0 +0.0	+0.0	51.8	54.0	-2.2	Vert

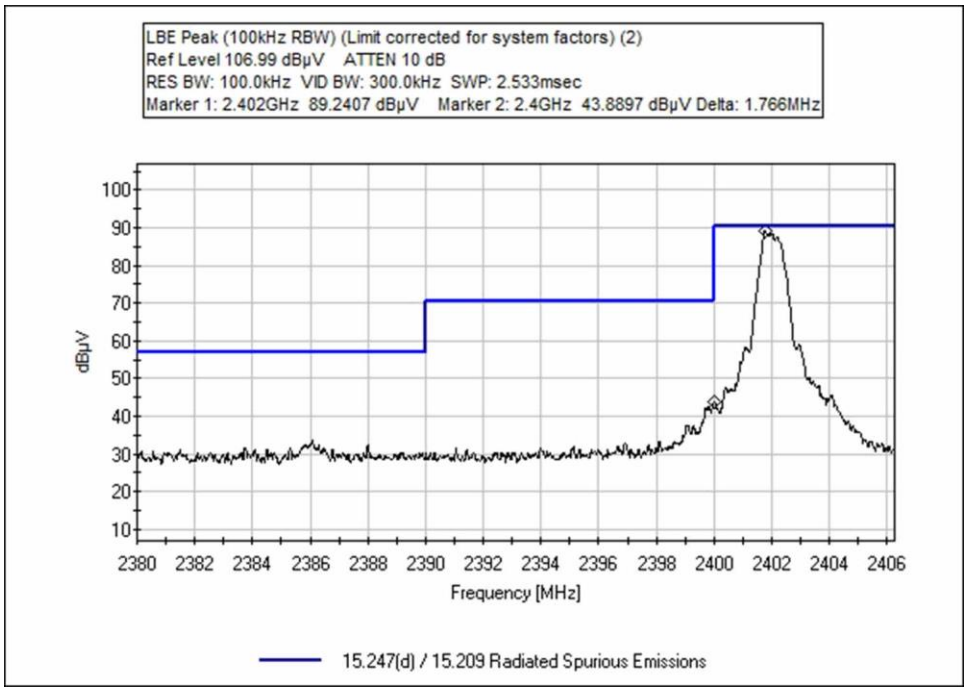
5	12010.500 M Ave	23.8	+1.4 +6.8 +0.0	+0.0 +0.6 +0.0	-34.6 +0.0 +0.0	+38.4 +0.0 +0.0	+0.0	36.4	54.0	-17.6	Horiz
^	12010.500 M	37.8	+1.4 +6.8 +0.0	+0.0 +0.6 +0.0	-34.6 +0.0 +0.0	+38.4 +0.0 +0.0	+0.0	50.4	54.0	-3.6	Horiz
7	9606.700M	37.8	+1.4 +6.2 +0.0	+0.0 +0.5 +0.0	-33.9 +0.0 +0.0	+37.6 +0.0 +0.0	+0.0	49.6	67.3	-17.7	Vert
8	4804.295M Ave	31.9	+0.9 +4.1 +0.0	+0.0 +0.6 +0.0	-33.6 +0.0 +0.0	+32.4 +0.0 +0.0	+0.0	36.3	54.0	-17.7	Vert
^	4804.295M	42.0	+0.9 +4.1 +0.0	+0.0 +0.6 +0.0	-33.6 +0.0 +0.0	+32.4 +0.0 +0.0	+0.0	46.4	54.0	-7.6	Vert
10	9759.935M	37.6	+1.3 +6.3 +0.0	+0.0 +0.4 +0.0	-33.9 +0.0 +0.0	+37.5 +0.0 +0.0	+0.0	49.2	67.3	-18.1	Vert
11	12199.935 M Ave	22.5	+1.4 +6.9 +0.0	+0.0 +0.5 +0.0	-34.7 +0.0 +0.0	+38.7 +0.0 +0.0	+0.0	35.3	54.0	-18.7	Vert
^	12199.935 M	38.5	+1.4 +6.9 +0.0	+0.0 +0.5 +0.0	-34.7 +0.0 +0.0	+38.7 +0.0 +0.0	+0.0	51.3	54.0	-2.7	Vert
13	4879.740M Ave	30.3	+0.9 +4.2 +0.0	+0.0 +0.5 +0.0	-33.6 +0.0 +0.0	+32.5 +0.0 +0.0	+0.0	34.8	54.0	-19.2	Vert
^	4879.740M	40.4	+0.9 +4.2 +0.0	+0.0 +0.5 +0.0	-33.6 +0.0 +0.0	+32.5 +0.0 +0.0	+0.0	44.9	54.0	-9.1	Vert
15	7206.540M	38.4	+1.1 +5.3 +0.0	+0.0 +0.5 +0.0	-34.5 +0.0 +0.0	+36.5 +0.0 +0.0	+0.0	47.3	67.3	-20.0	Vert
16	7320.000M Ave	23.4	+1.3 +5.4 +0.0	+0.0 +0.4 +0.0	-34.6 +0.0 +0.0	+36.8 +0.0 +0.0	+0.0	32.7	54.0	-21.3	Vert
^	7320.000M	38.0	+1.3 +5.4 +0.0	+0.0 +0.4 +0.0	-34.6 +0.0 +0.0	+36.8 +0.0 +0.0	+0.0	47.3	54.0	-6.7	Vert
18	7439.700M Ave	22.9	+1.6 +5.5 +0.0	+0.0 +0.3 +0.0	-34.7 +0.0 +0.0	+37.1 +0.0 +0.0	+0.0	32.7	54.0	-21.3	Vert
^	7439.700M	37.3	+1.6 +5.5 +0.0	+0.0 +0.3 +0.0	-34.7 +0.0 +0.0	+37.1 +0.0 +0.0	+0.0	47.1	54.0	-6.9	Vert
20	4960.565M Ave	27.8	+0.9 +4.2 +0.0	+0.0 +0.4 +0.0	-33.6 +0.0 +0.0	+32.6 +0.0 +0.0	+0.0	32.3	54.0	-21.7	Vert
^	4960.565M	40.7	+0.9 +4.2 +0.0	+0.0 +0.4 +0.0	-33.6 +0.0 +0.0	+32.6 +0.0 +0.0	+0.0	45.2	54.0	-8.8	Vert

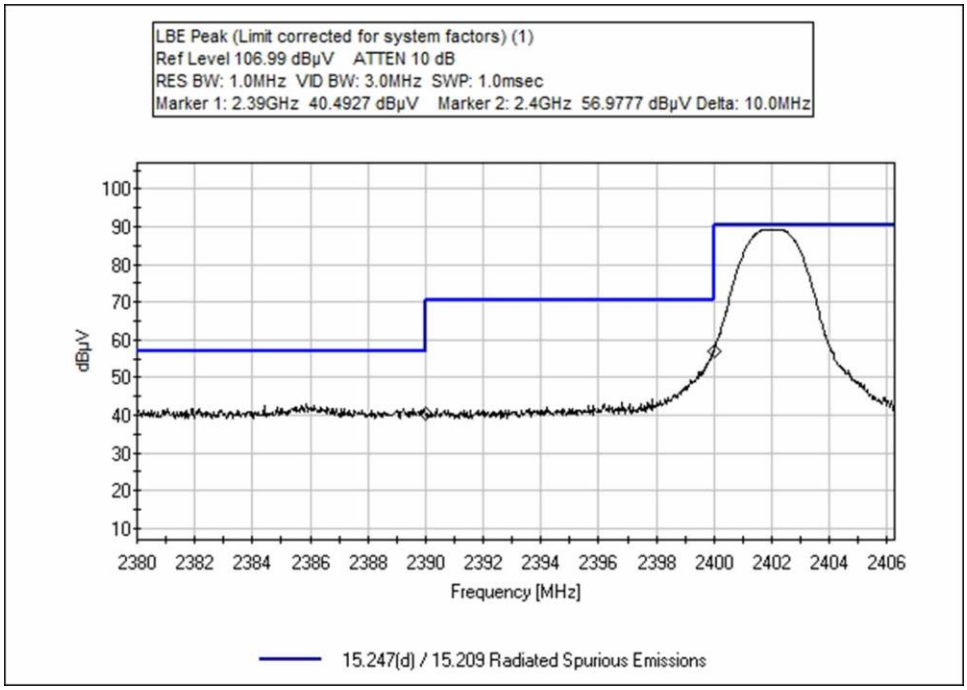
22	17080.000	22.2	+2.0	+0.0	-33.7	+41.8	+0.0	42.0	67.3	-25.3	Vert
	M		+9.0	+0.7	+0.0	+0.0					
	Ave		+0.0	+0.0	+0.0	+0.0					
^	17080.000	38.0	+2.0	+0.0	-33.7	+41.8	+0.0	57.8	67.3	-9.5	Vert
	M		+9.0	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
24	17359.700	22.3	+1.8	+0.0	-33.7	+42.1	+0.0	41.8	67.3	-25.5	Vert
	M		+8.6	+0.7	+0.0	+0.0					
	Ave		+0.0	+0.0	+0.0	+0.0					
^	17359.700	38.0	+1.8	+0.0	-33.7	+42.1	+0.0	57.5	67.3	-9.8	Vert
	M		+8.6	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
26	16814.420	22.3	+1.8	+0.0	-33.8	+41.2	+0.0	41.3	67.3	-26.0	Vert
	M		+9.0	+0.8	+0.0	+0.0					
	Ave		+0.0	+0.0	+0.0	+0.0					
^	16814.420	37.4	+1.8	+0.0	-33.8	+41.2	+0.0	56.4	67.3	-10.9	Vert
	M		+9.0	+0.8	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
28	119.200M	28.9	+0.1	+0.0	+0.0	+0.0	+0.0	16.3	43.5	-27.2	Vert
			+0.0	+0.0	-27.6	+8.0					
			+5.8	+0.5	+0.6	+0.0					
29	14879.700	21.4	+1.7	+0.0	-34.1	+39.3	+0.0	37.7	67.3	-29.6	Vert
	M		+8.5	+0.9	+0.0	+0.0					
	Ave		+0.0	+0.0	+0.0	+0.0					
^	14879.700	36.8	+1.7	+0.0	-34.1	+39.3	+0.0	53.1	67.3	-14.2	Vert
	M		+8.5	+0.9	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
31	9919.700M	22.7	+1.3	+0.0	-33.9	+37.5	+0.0	34.4	67.3	-32.9	Vert
	Ave		+6.3	+0.5	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
^	9919.700M	38.1	+1.3	+0.0	-33.9	+37.5	+0.0	49.8	67.3	-17.5	Vert
			+6.3	+0.5	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
33	590.700M	29.0	+0.3	+0.0	+0.0	+0.0	+0.0	30.4	67.3	-36.9	Vert
			+0.0	+0.0	-28.2	+20.7					
			+5.8	+1.2	+1.6	+0.0					
34	64.000M	28.9	+0.1	+0.0	+0.0	+0.0	+0.0	15.5	67.3	-51.8	Horiz
			+0.0	+0.0	-27.8	+7.6					
			+5.8	+0.4	+0.5	+0.0					
35	11.523M	13.9	+0.0	+0.0	+0.0	+0.0	-40.0	-16.7	67.3	-84.0	Perp
			+0.2	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+9.2					
36	20.985M	9.2	+0.1	+0.0	+0.0	+0.0	-40.0	-22.7	67.3	-90.0	Para
			+0.2	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+7.8					
37	58.068k	40.6	+0.0	+0.0	+0.0	+0.0	-80.0	-29.6	67.3	-96.9	Para
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+9.8					

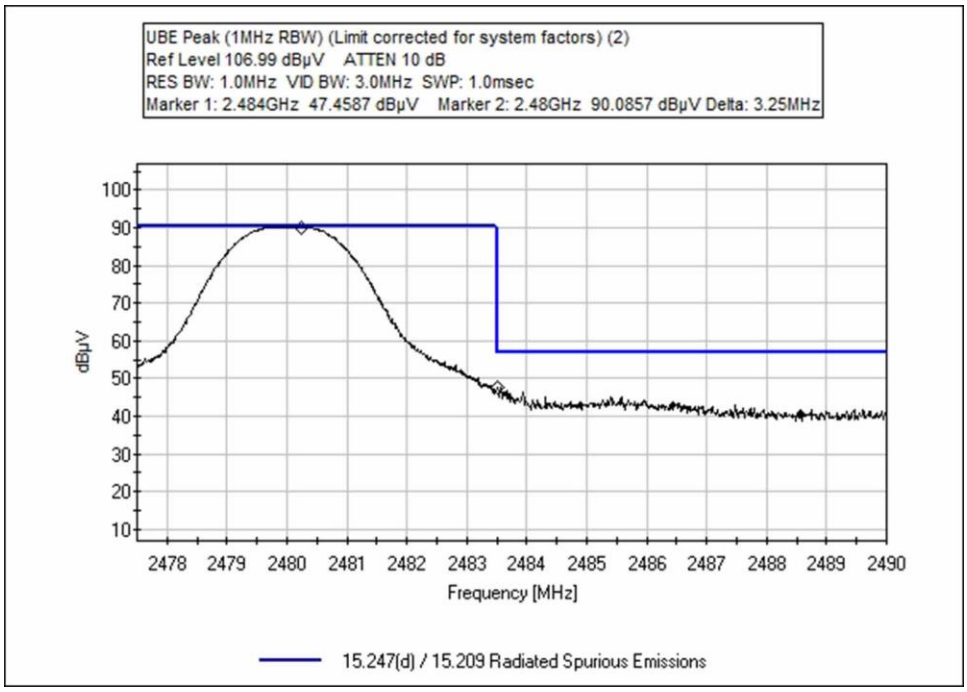
Band Edge

Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
2390.0	GFSK	Inverted F	37.4	<54	Pass
2400.0	GFSK	Inverted F	53.9	<67.3	Pass
2483.5	GFSK	Inverted F	44.5	<54	Pass

Band Edge Plots






UBE Peak (1MHz RBW) (Limit corrected for system factors) (2)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 1.0msec
Marker 1: 2.484GHz 47.4587 dBµV Marker 2: 2.48GHz 90.0857 dBµV Delta: 3.25MHz
dBµV
100
90
80
70
60
50
40
30
20
10
2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Test Setup / Conditions / Data

Test Location:	CKC Labs • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362		
Customer:	**Medtronic MiniMed**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**103746**	Date:	3/5/2020
Test Type:	**Maximized Emissions**	Time:	10:30:15
Tested By:	Matthew Harrison	Sequence#:	7
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 22°C
Humidity: 33%
Pressure: 103.0 kPa

Frequency Range: 2390-2480MHz

Power setting: 2 dBm

Antenna: Inverted F / -6dBi

Test Setup: Continuously Transmitting 2402, 2480 MHz

Setup: The EUT is setup 1.5m high on Styrofoam table. It is operating with fresh battery installed. Low, Mid, and High channels investigated. X, Y, and Z EUT axes investigated as well as horizontal and vertical measurement antenna polarities investigated, worst case reported.

Test Method: ANSI C63.10 (2013), KDB 558074 v05r02 04/02/2019

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T2	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T3	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T4	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T5	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T6	ANP07504	Cable	CLU40-KMKM-02.00F	1/17/2019	1/17/2021

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2479.775M	90.3	+0.6 +2.7	+0.0 +0.3	-34.2	+27.6	+0.0	87.3	87.3 100kHz RBW	+0.0	Horiz
2	2402.291M	89.2	+0.6 +2.6	+0.0 +0.3	-34.3	+27.7	+0.0	86.1	87.3	-1.2	Horiz
3	2401.766M	89.2	+0.6 +2.6	+0.0 +0.3	-34.3	+27.7	+0.0	86.1	87.3 100kHz RBW	-1.2	Horiz
4	2483.500M	47.5	+0.6 +2.7	+0.0 +0.3	-34.2	+27.6	+0.0	44.5	54.0	-9.5	Horiz
5	2400.000M	57.0	+0.6 +2.6	+0.0 +0.3	-34.3	+27.7	+0.0	53.9	67.3	-13.4	Horiz
6	2390.000M	40.5	+0.6 +2.6	+0.0 +0.3	-34.3	+27.7	+0.0	37.4	54.0	-16.6	Horiz
7	2483.500M	33.7	+0.6 +2.7	+0.0 +0.3	-34.2	+27.6	+0.0	30.7	54.0 100kHz RBW	-23.3	Horiz
8	2400.000M	43.9	+0.6 +2.6	+0.0 +0.3	-34.3	+27.7	+0.0	40.8	67.3 100kHz RBW	-26.5	Horiz

Test Setup Photo(s)

Below 1GHz

Below 1GHz

Above 1GHz

Above 1GHz

X Axis

Y Axis

Z Axis

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret (“^”) was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point, the measuring device is set into the linear mode and the scan time is reduced.