

Medtronic MiniMed

REVISED TEST REPORT TO 102337-7

Envision Recorder

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.247
(DTS 2400-2483.5 MHz)

Report No.: 102337-7A

Date of issue: June 17, 2019



Test Certificate # 803.05

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.

TABLE OF CONTENTS

Administrative Information	3
Test Report Information	3
Revision History	3
Report Authorization	3
Test Facility Information	4
Software Versions	4
Site Registration & Accreditation Information	4
Summary of Results	5
Modifications During Testing	5
Conditions During Testing	5
Equipment Under Test	6
General Product Information	6
FCC Part 15 Subpart C	7
15.247(a)(2) 6dB Bandwidth	7
15.247(b)(3) Output Power	13
15.247(e) Power Spectral Density	20
15.247(d) Radiated Emissions & Band Edge	27
Supplemental Information	42
Measurement Uncertainty	42
Emissions Test Details	42

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Medtronic MiniMed
18000 Devonshire Street
Northridge, CA 91325-1219

Representative: Bob Vitti
Customer Reference Number: 4500130929

DATE OF EQUIPMENT RECEIPT:**DATE(S) OF TESTING:****REPORT PREPARED BY:**

Darcy Thompson
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 102337

March 1, 2019

March 1 and 4, 2019

Revision History

Original: Testing of the Envision Recorder to FCC Part 15 Subpart C Section(s) 15.247 (DTS 2400-2483.5 MHz)

Revision A: To correct calculated power level in Section 15.247(b)(3) Output Power.

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.

A handwritten signature in black ink that reads "Steve Behm".

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-0148

*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	NA1
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable

NA1 = Not applicable because the EUT is battery powered only.

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
Spark Test Plug	Medtronic MiniMed	M985454A001	A30064
Envision Recorder	Medtronic MiniMed	MMT-7781	ENV002LJ

Support Equipment:

Device	Manufacturer	Model #	S/N
External Battery Holder	SparkFun Electronics	PRT-09925	NA

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	BLE
Operating Frequency Range:	2402-2480 MHz
Modulation Type(s):	GFSK
Maximum Duty Cycle:	Tested 100% as worst case
Number of TX Chains:	1
Antenna Type(s) and Gain:	PCB Patch / -11.15dBi
Beamforming Type:	NA
Antenna Connection Type:	Integral
Nominal Input Voltage:	3 VDC
Firmware / Software used for Test:	Spark 1.0A Release DVT Mode with Software Debug Off

FCC Part 15 Subpart C

15.247(a)(2) 6dB Bandwidth

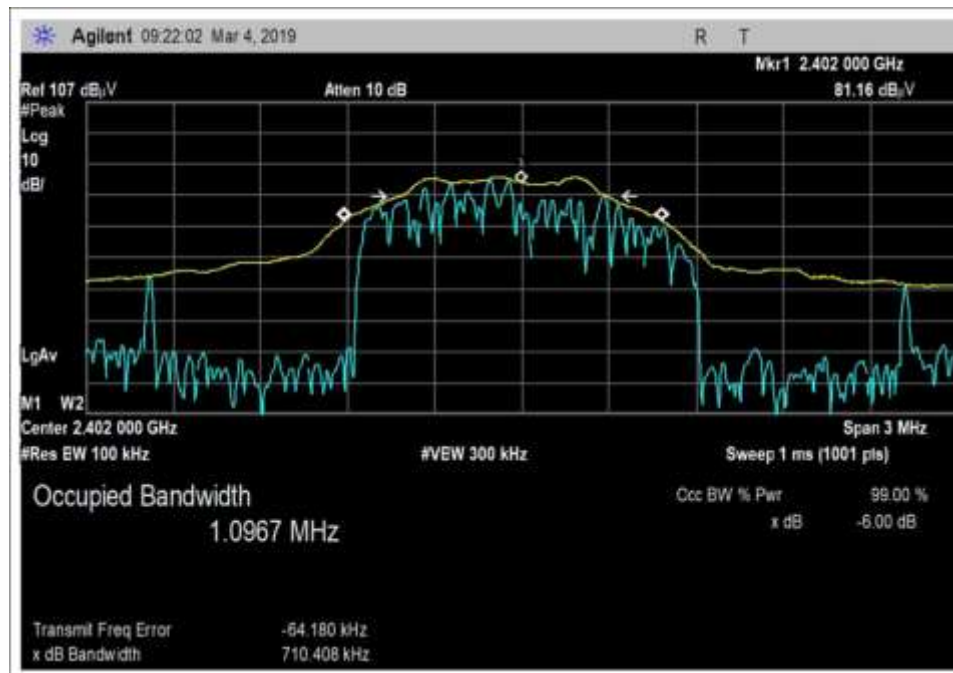
Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Harrison
Test Method:	ANSI C63.10 (2013), KDB 558074 v05r01	Test Date(s):	3/4/2019
Configuration:	1		
Test Setup:	Test Mode: Continuously Modulated The EUT is operating with fresh battery installed. The EUT is set 1.5 meters high on a Styrofoam table. X, Y and Z axis are investigated with the worst case reported.		

Environmental Conditions			
Temperature (°C)	18	Relative Humidity (%):	38

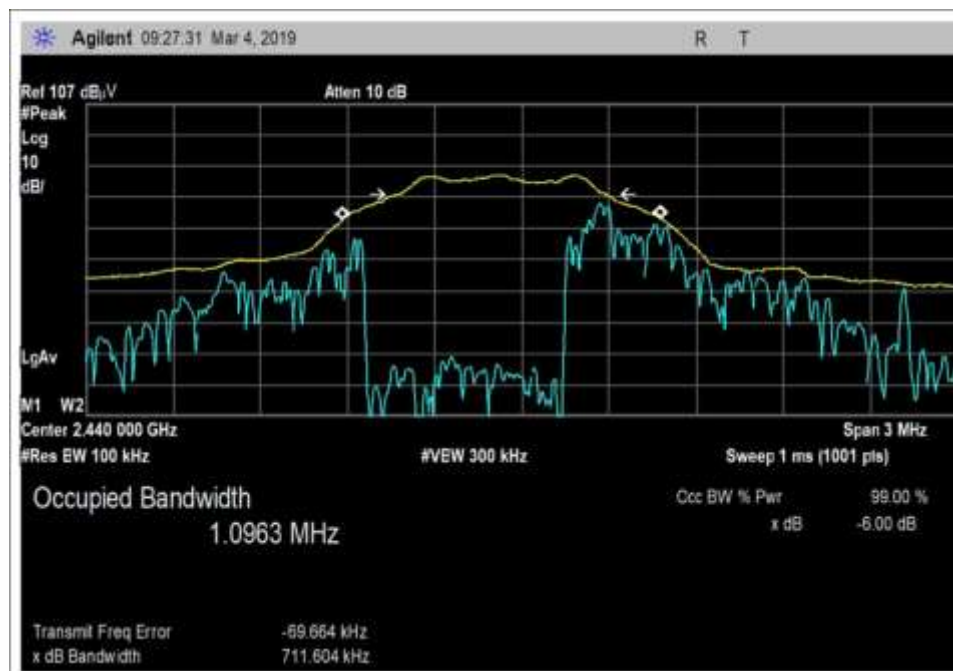
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
01467	Horn Antenna	EMCO	3115	7/21/2017	7/21/2019
02871	Spectrum Analyzer	Agilent	E4440A	1/9/2019	1/9/2021
P06503	Cable	Astrolab	32026-29801-29801-36	3/13/2018	3/13/2020
P06515	Cable	Andrews	Heliast	6/29/2018	6/29/2020
P06540	Cable	Andrews	Heliast	10/30/2017	10/30/2019
03540	Preamplifier	HP	83017A	5/2/2017	5/2/2019

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
2402	1	GFSK	710.408	≥500	Pass
2440	1	GFSK	711.604	≥500	Pass
2480	1	GFSK	707.670	≥500	Pass

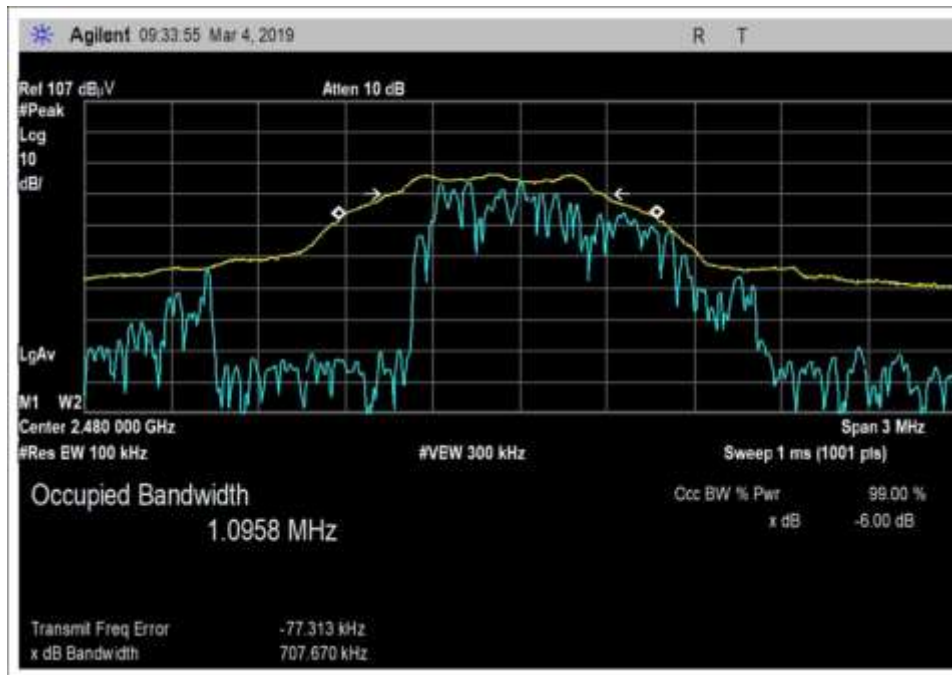
Plot(s)



Low Channel



Middle Channel



High Channel

Test Setup Photo(s)



X-Axis

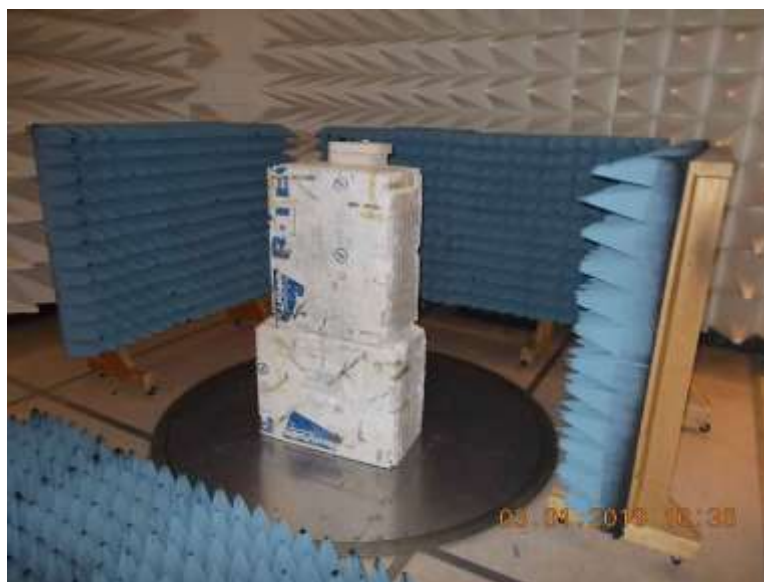


Y-Axis



Z-Axis

Above 1GHz



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	PCB Patch	81.7	-2.37	≤30	Pass
2440	GFSK	PCB Patch	82.5	-1.57	≤30	Pass
2480	GFSK	PCB Patch	83.1	-0.97	≤30	Pass

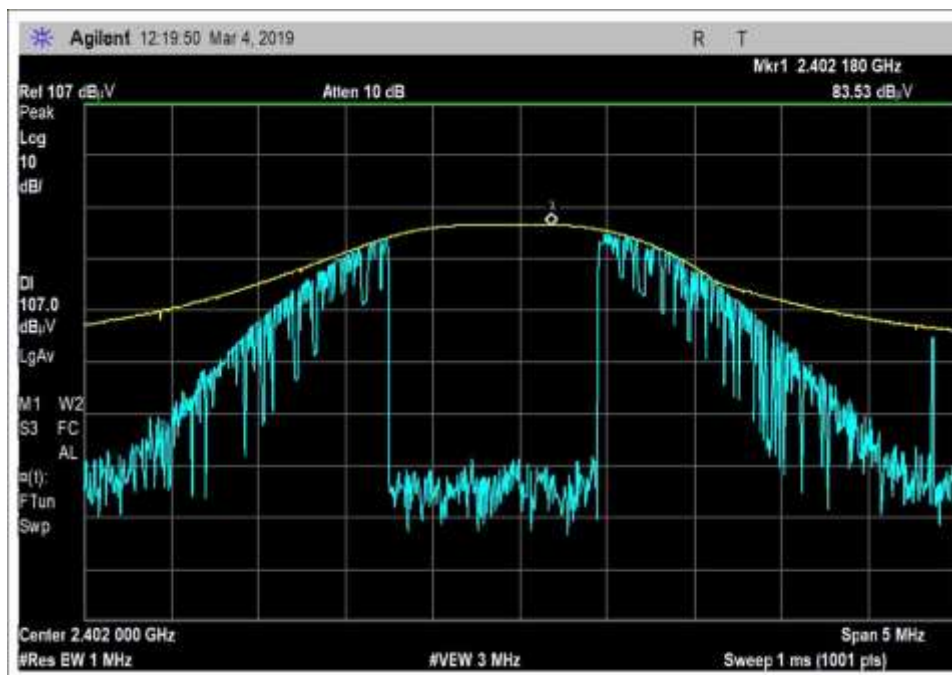
Conducted RF output power calculated in accordance with ANSI C63.10.

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

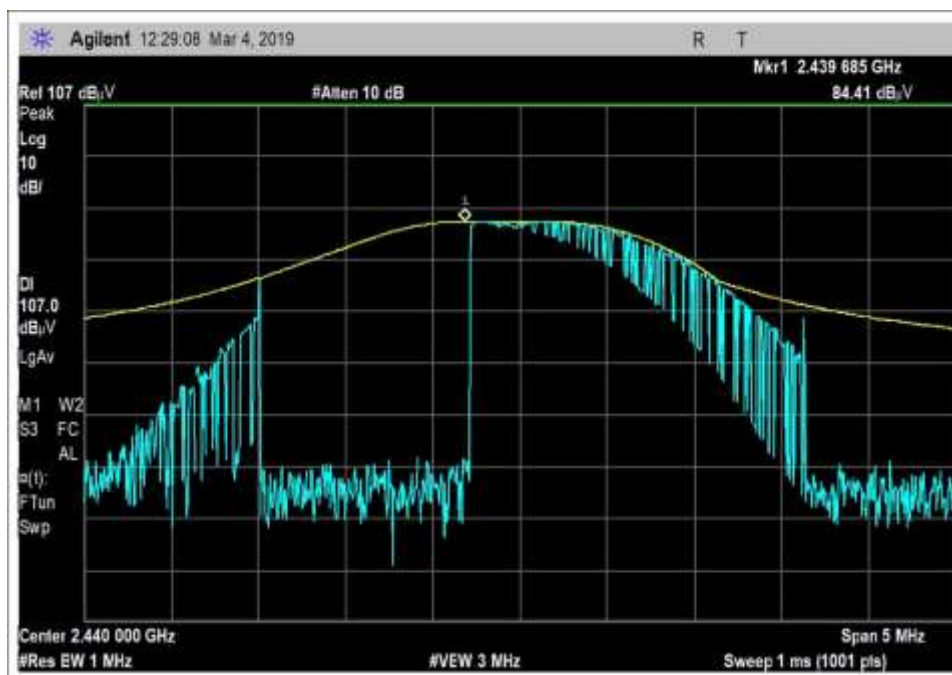
Or equivalently, in logarithmic form:

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

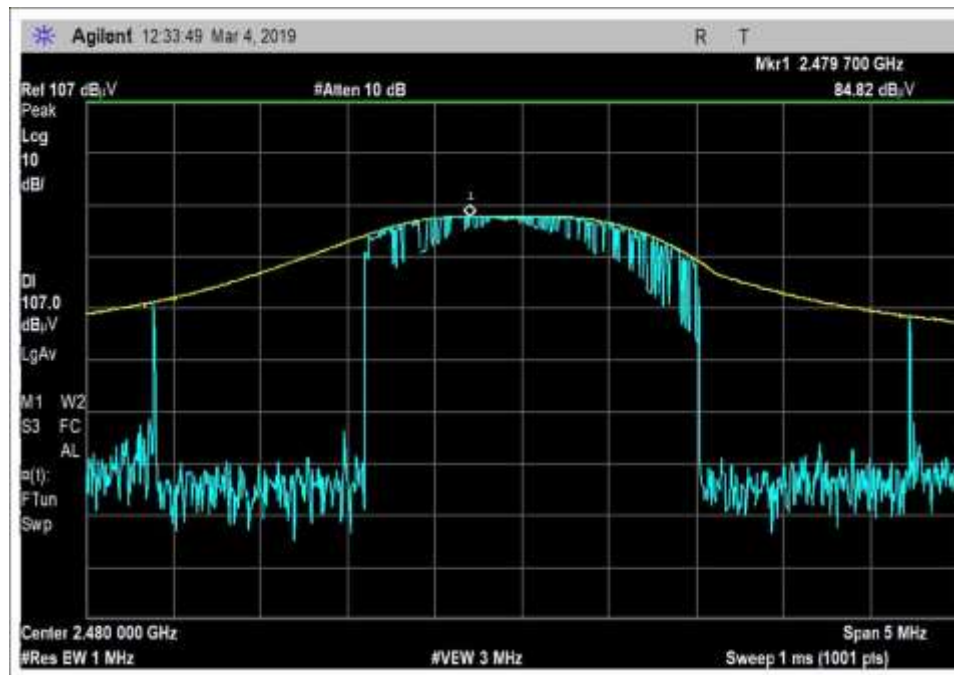
Plots



Low Channel



Middle Channel



High Channel

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC
 Customer: **Medtronic MiniMed**
 Specification: **15.247(b) Power Output (2400-2483.5 MHz DTS)**
 Work Order #: **102337** Date: 3/4/2019
 Test Type: **Maximized Emissions** Time: 08:43:05
 Tested By: Matthew Harrison Sequence#: 12
 Software: EMITest 5.03.12

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

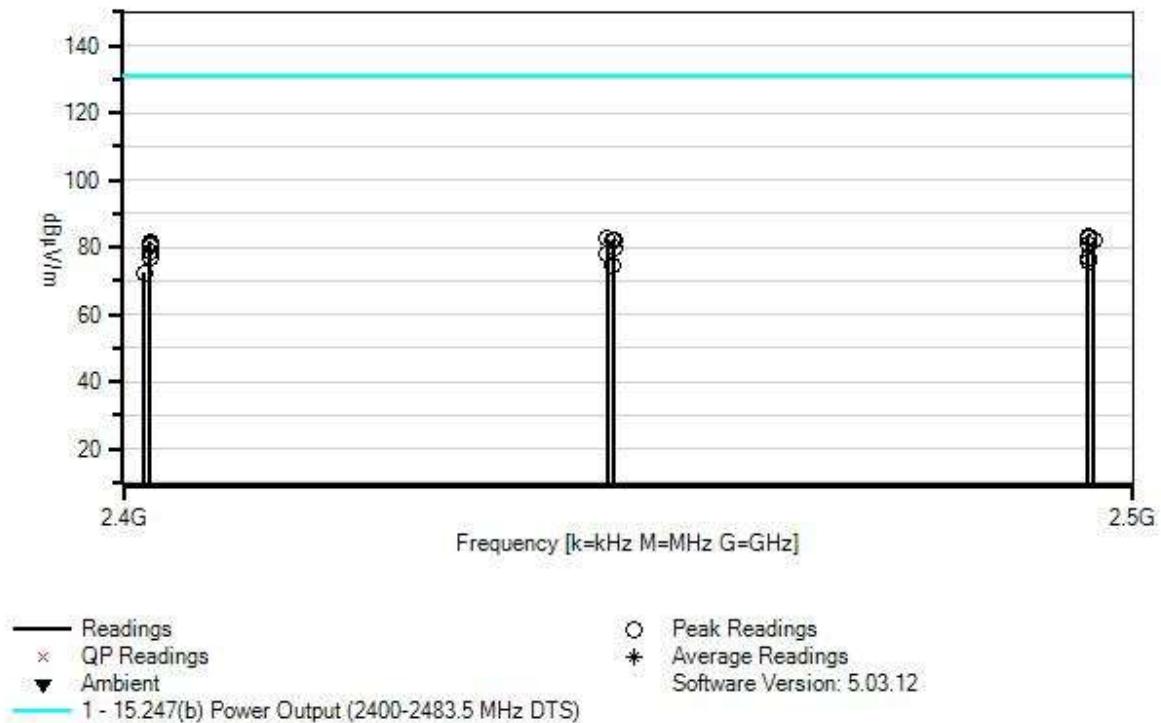
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 20-23°C Humidity: 30-40% Pressure: 101-102kPa Frequency Range: 2402-2480MHz Test Method: ANSI C63.4 2014 Test Setup: Continuously Transmitting 2402, 2440, 2480 MHz Setup: The EUT 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.

Medtronic MiniMed WO#: 102337 Sequence#: 12 Date: 3/4/2019
 15.247(b) Power Output (2400-2483.5 MHz DTS) Test Distance: 3 Meters Vert



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliac	10/30/2017	10/30/2019
T2	AN02871	Spectrum Analyzer	E4440A	1/9/2019	1/9/2021
T3	ANP06515	Cable	Heliac	6/29/2018	6/29/2020
T4	AN03540	Preamp	83017A	5/2/2017	5/2/2019
T5	AN01467	Horn Antenna- ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T6	ANP06503	Cable	32026-29801- 29801-36	3/13/2018	3/13/2020

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 T6 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	2479.680M	84.9	+0.4 +28.1	+0.0 +1.0	+2.7	-34.0	+0.0 180	83.1	131.2 X-Axis	-48.1	Horiz 104
2	2479.670M	84.4	+0.4 +28.1	+0.0 +1.0	+2.7	-34.0	+0.0 160	82.6	131.2 Y-Axis	-48.6	Vert 164
3	2439.685M	84.4	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 249	82.5	131.2 Y-Axis	-48.7	Vert 125
4	2440.190M	84.3	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 171	82.4	131.2 X-Axis	-48.8	Horiz 220
5	2440.180M	84.0	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 150	82.1	131.2 Z-Axis	-49.1	Horiz 106
6	2480.170M	83.8	+0.4 +28.1	+0.0 +1.0	+2.7	-34.0	+0.0 129	82.0	131.2 Y-Axis	-49.2	Horiz 209
7	2402.182M	83.6	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 260	81.7	131.2 Y-Axis	-49.5	Vert 122
8	2479.675M	82.8	+0.4 +28.1	+0.0 +1.0	+2.7	-34.0	+0.0 150	81.0	131.2 Z-Axis	-50.2	Horiz 104
9	2402.185M	82.6	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 180	80.7	131.2 X-Axis	-50.5	Horiz 221
10	2402.195M	82.5	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 343	80.6	131.2 Z-Axis	-50.6	Horiz 219
11	2440.185M	81.8	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 125	79.9	131.2 Y-Axis	-51.3	Horiz 186
12	2402.175M	80.5	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 124	78.6	131.2 Y-Axis	-52.6	Horiz 189
13	2439.700M	80.2	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 240	78.3	131.2 Z-Axis	-52.9	Vert 106

14	2479.675M	78.6	+0.4 +28.1	+0.0 +1.0	+2.7	-34.0	+0.0 279	76.8	131.2 Z-Axis	-54.4	Vert 129
15	2402.180M	78.7	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 300	76.8	131.2 Z-Axis	-54.4	Vert 192
16	2479.685M	77.8	+0.4 +28.1	+0.0 +1.0	+2.7	-34.0	+0.0 233	76.0	131.2 X-Axis	-55.2	Vert 186
17	2440.175M	76.2	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 30	74.3	131.2 X-Axis	-56.9	Vert 150
18	2401.700M	74.4	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 20	72.5	131.2 X-Axis	-58.7	Vert 125

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	PCB Patch	66.6	-17.47	≤8	Pass
2440	GFSK	PCB Patch	67.2	-16.87	≤8	Pass
2480	GFSK	PCB Patch	67.8	-16.27	≤8	Pass

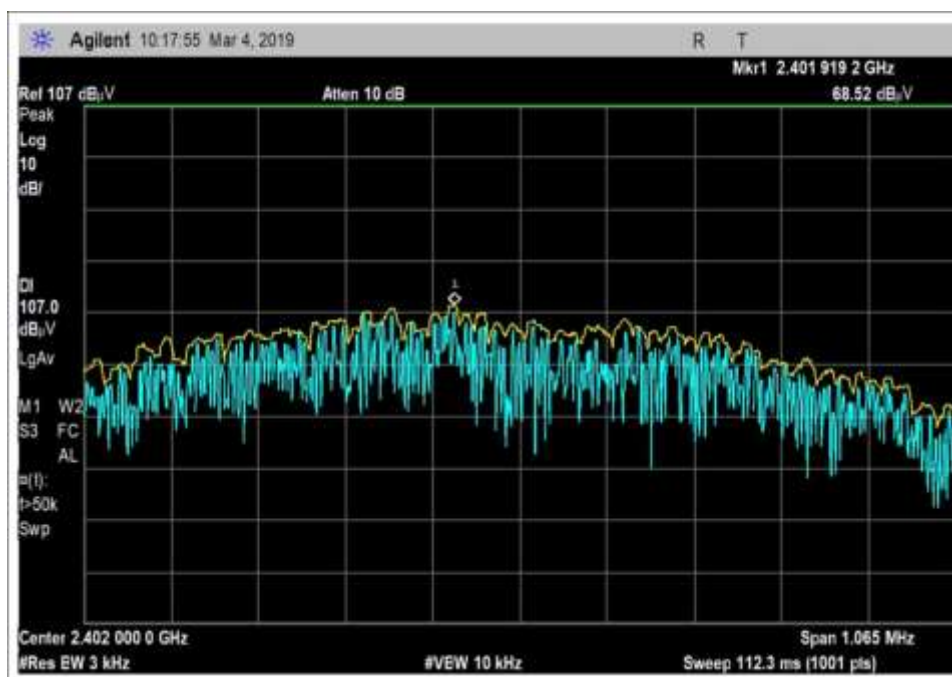
Conducted RF output power calculated in accordance with ANSI C63.10.

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

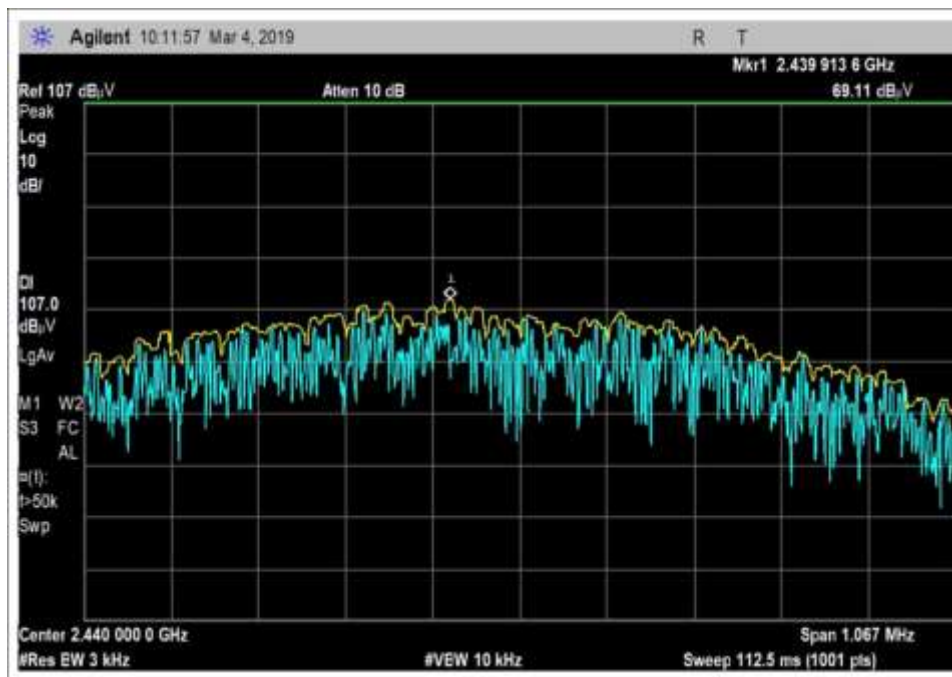
Or equivalently, in logarithmic form:

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

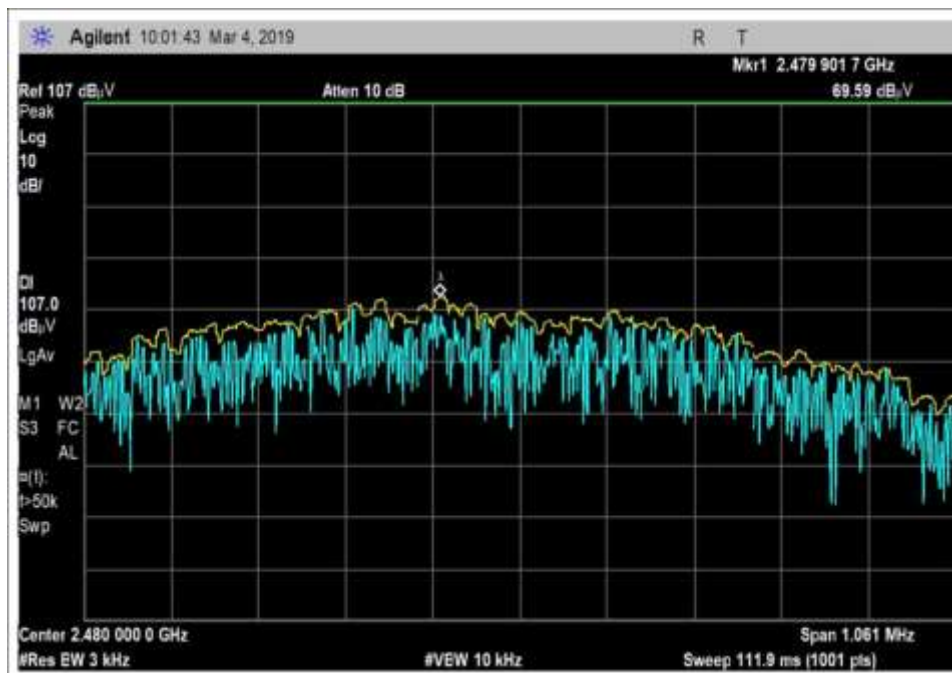
Plots



Low Channel



Middle Channel



High Channel

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC
 Customer: **Medtronic MiniMed**
 Specification: **15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)**
 Work Order #: **102337** Date: 3/4/2019
 Test Type: **Maximized Emissions** Time: 10:16:15
 Tested By: Matthew Harrison Sequence#: 15
 Software: EMITest 5.03.12

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

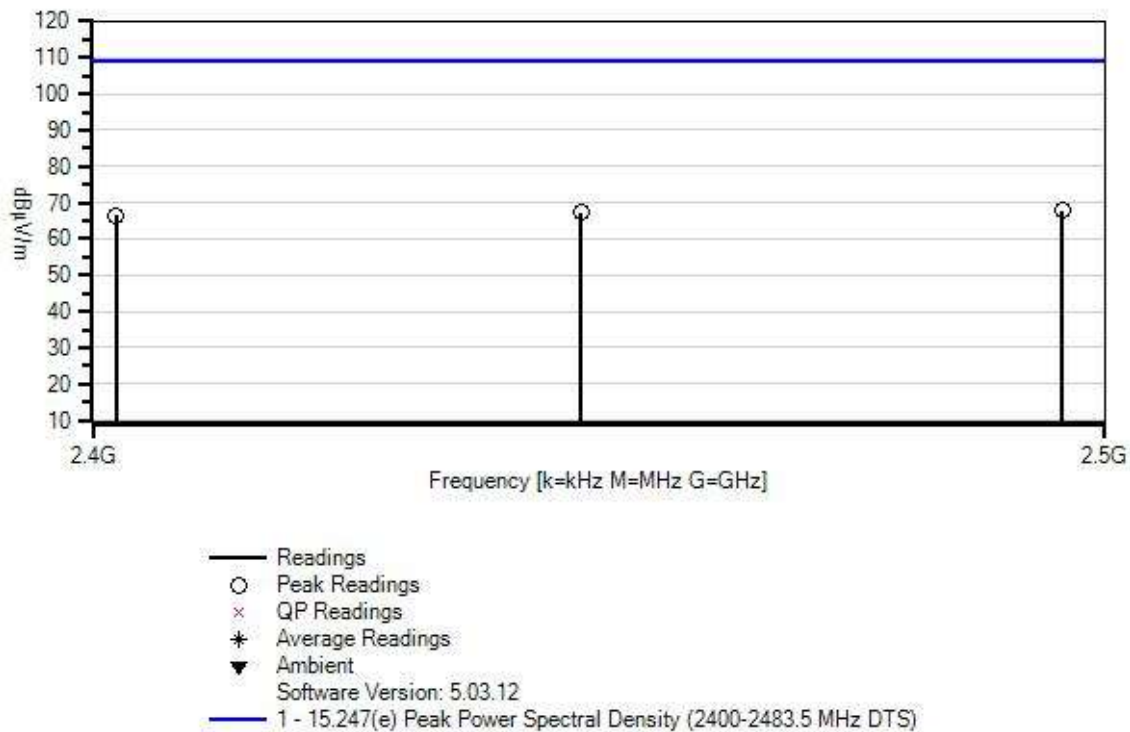
Temperature: 20-23°C
 Humidity: 30-40%
 Pressure: 101-102kPa

 Frequency Range: 2402-2480MHz

 Test Method: ANSI C63.4 2014

 Test Setup: Continuously Transmitting 2402, 2440, and 2480 MHz
 Setup: The EUT 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.

Medtronic MiniMed W/O#: 102337 Sequence#: 15 Date: 3/4/2019
15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS) Test Distance: 3 Meters Vert



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliac	10/30/2017	10/30/2019
T2	AN02871	Spectrum Analyzer	E4440A	1/9/2019	1/9/2021
T3	ANP06515	Cable	Heliac	6/29/2018	6/29/2020
T4	AN03540	Preamp	83017A	5/2/2017	5/2/2019
T5	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T6	ANP06503	Cable	32026-29801- 29801-36	3/13/2018	3/13/2020

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	2479.902M	69.6	+0.4 +28.1	+0.0 +1.0	+2.7	-34.0	+0.0 180	67.8	109.2 X-Axis	-41.4	Horiz 104
2	2439.914M	69.1	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 260	67.2	109.2 Y-Axis	-42.0	Vert 125
3	2401.919M	68.5	+0.4 +28.1	+0.0 +1.0	+2.6	-34.0	+0.0 260	66.6	109.2 Y-Axis	-42.6	Vert 128

Test Setup Photo(s)



X-Axis

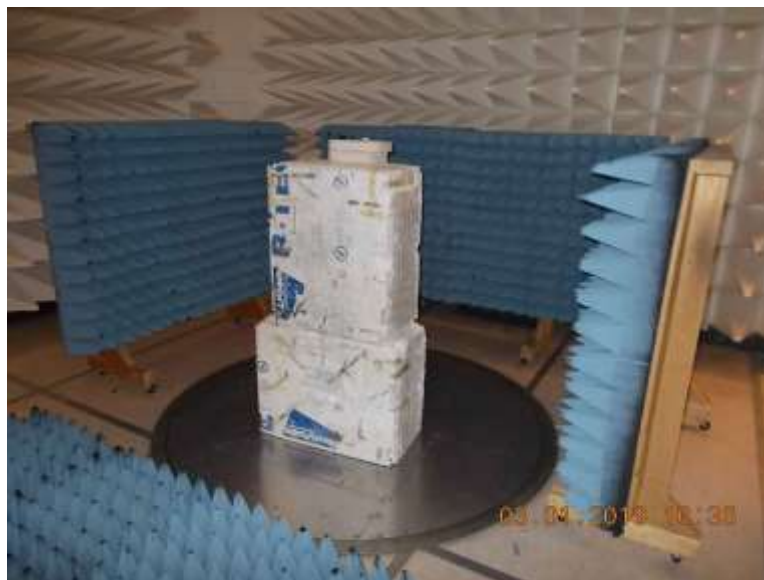


Y-Axis



Z-Axis

Above 1GHz



15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC
 Customer: **Medtronic MiniMed**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **102337** Date: 3/1/2019
 Test Type: **Maximized Emissions** Time: 11:38:16
 Tested By: Matthew Harrison Sequence#: 7
 Software: EMITest 5.03.12

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

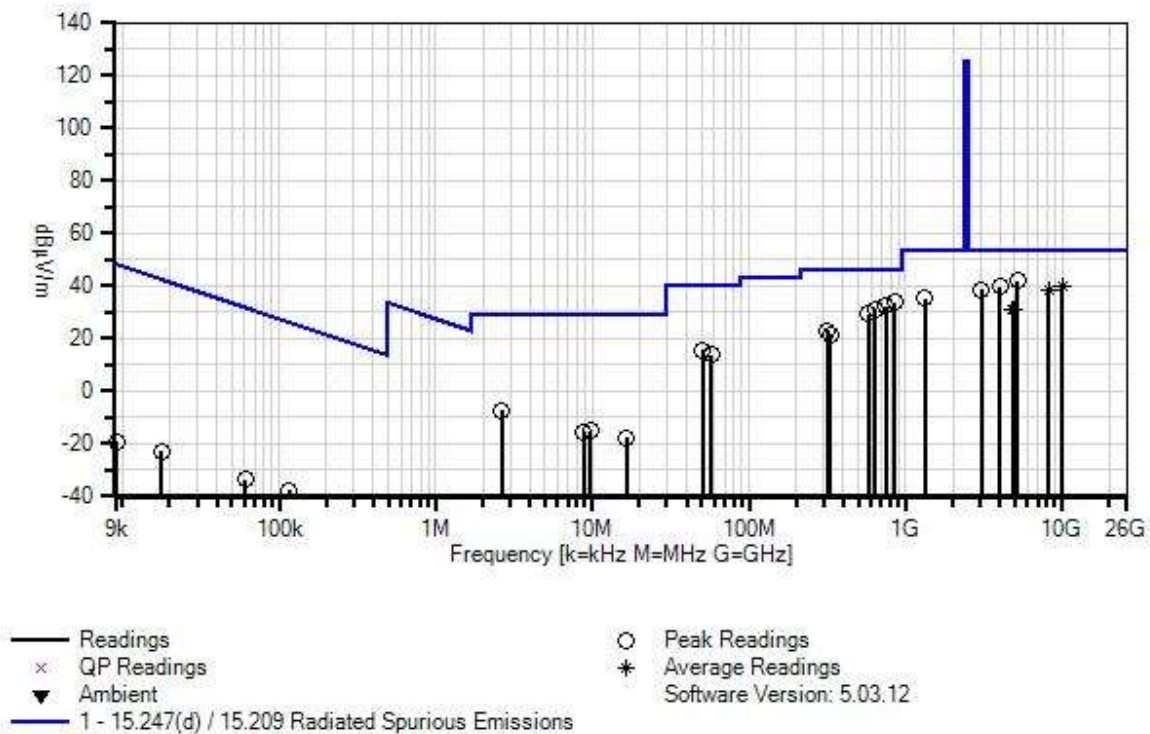
Temperature: 20-23°C
 Humidity: 30-40%
 Pressure: 101-102kPa

 Frequency Range: 9kHz to 26GHz

 Test Method: ANSI C63.4 2014

 Test Setup: Continuously Transmitting 2402, 2440, and 2480 MHz
 Setup: EUT 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.

Medtronic MiniMed WO#: 102337 Sequence#: 7 Date: 3/1/2019
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02307	Preamp	8447D	1/15/2018	1/15/2020
T2	AN03628	Biconilog Antenna	3142E	6/7/2017	6/7/2019
T3	ANP06123	Attenuator	18N-6	5/5/2017	5/5/2019
T4	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
T5	ANP05360	Cable	RG214	1/31/2018	1/31/2020
T6	ANP06540	Cable	Heliac	10/30/2017	10/30/2019
	AN02871	Spectrum Analyzer	E4440A	1/9/2019	1/9/2021
T7	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020
T8	ANP06515	Cable	Heliac	6/29/2018	6/29/2020
T9	AN03540	Preamp	83017A	5/2/2017	5/2/2019
T10	AN01467	Horn Antenna- ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T11	ANP06503	Cable	32026-29801- 29801-36	3/13/2018	3/13/2020

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5	T6	T7	T8					
			T9	T10	T11		Table	dBμV/m	dBμV/m	dB	Ant
1	5157.000M	35.5	+0.0	+0.0	+0.0	+0.0	+0.0	41.9	54.0	-12.1	Vert
			+0.0	+0.5	+0.0	+4.3					
			-33.2	+33.1	+1.7						
2	856.400M	28.8	-27.6	+23.1	+5.9	+1.5	+0.0	33.9	46.0	-12.1	Vert
			+1.9	+0.3	+0.0	+0.0					
			+0.0	+0.0	+0.0						
3	749.700M	28.4	-27.9	+22.5	+5.9	+1.4	+0.0	32.3	46.0	-13.7	Horiz
			+1.7	+0.3	+0.0	+0.0					
			+0.0	+0.0	+0.0						
4	3984.000M	36.6	+0.0	+0.0	+0.0	+0.0	+0.0	39.9	54.0	-14.1	Vert
			+0.0	+0.5	+0.0	+3.6					
			-33.4	+31.2	+1.4						
5	10000.000 M	26.6	+0.0	+0.0	+0.0	+0.0	+0.0	39.9	54.0	-14.1	Vert
			+0.0	+0.3	+0.0	+6.3					
	Ave		-33.7	+37.8	+2.6						
^	10000.000 M	38.4	+0.0	+0.0	+0.0	+0.0	+0.0	51.7	54.0	-2.3	Vert
			+0.0	+0.3	+0.0	+6.3					
			-33.7	+37.8	+2.6						
7	638.200M	28.7	-28.2	+21.7	+5.9	+1.3	+0.0	31.2	46.0	-14.8	Vert
			+1.5	+0.3	+0.0	+0.0					
			+0.0	+0.0	+0.0						
8	3030.000M	38.2	+0.0	+0.0	+0.0	+0.0	+0.0	38.7	54.0	-15.3	Horiz
			+0.0	+0.6	+0.0	+2.9					
			-33.7	+29.6	+1.1						

9	8144.000M Ave	27.4	+0.0 +0.0 -34.7	+0.0 +0.7 +36.8	+0.0 +0.0 +2.3	+0.0 +5.7	+0.0	38.2	54.0	-15.8	Vert
^	8144.000M	37.0	+0.0 +0.0 -34.7	+0.0 +0.7 +36.8	+0.0 +0.0 +2.3	+0.0 +5.7	+0.0	47.8	54.0	-6.2	Vert
11	577.100M	28.8	-28.2 +1.5 +0.0	+19.9 +0.3 +0.0	+5.9 +0.0 +0.0	+1.2 +0.0	+0.0	29.4	46.0	-16.6	Horiz
12	1326.000M	42.7	+0.0 +0.0 -35.4	+0.0 +0.4 +25.1	+0.0 +0.0 +0.6	+0.0 +1.9	+0.0	35.3	54.0	-18.7	Vert
13	318.100M	28.7	-27.1 +1.0 +0.0	+13.4 +0.2 +0.0	+5.9 +0.0 +0.0	+0.9 +0.0	+0.0	23.0	46.0	-23.0	Horiz
14	50.400M	30.1	-27.9 +0.4 +0.0	+6.8 +0.1 +0.0	+5.9 +0.0 +0.0	+0.4 +0.0	+0.0	15.8	40.0	-24.2	Horiz
15	331.700M	26.6	-27.1 +1.1 +0.0	+13.9 +0.2 +0.0	+5.9 +0.0 +0.0	+0.9 +0.0	+0.0	21.5	46.0	-24.5	Vert
16	57.200M	28.4	-27.9 +0.4 +0.0	+6.6 +0.1 +0.0	+5.9 +0.0 +0.0	+0.4 +0.0	+0.0	13.9	40.0	-26.1	Vert
17	2.628M	22.9	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +9.6 +0.0	+0.0 +0.1	-40.0	-7.4	29.5	-36.9	Perp
18	9.732M	15.6	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +9.2 +0.0	+0.0 +0.2	-40.0	-15.0	29.5	-44.5	Perp
19	8.836M	15.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +9.3 +0.0	+0.0 +0.2	-40.0	-15.5	29.5	-45.0	Para
20	16.508M	13.6	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +8.7 +0.0	+0.0 +0.2	-40.0	-17.5	29.5	-47.0	Para
21	116.756k	32.9	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0	-80.0	-37.6	26.3	-63.9	Perp
22	60.845k	36.8	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +9.7 +0.0	+0.0 +0.0	-80.0	-33.5	31.9	-65.4	Para
23	17.815k	44.8	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +12.3 +0.0	+0.0 +0.0	-80.0	-22.9	42.6	-65.5	Para
24	9.169k	44.5	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +16.6 +0.0	+0.0 +0.0	-80.0	-18.9	48.3	-67.2	Perp

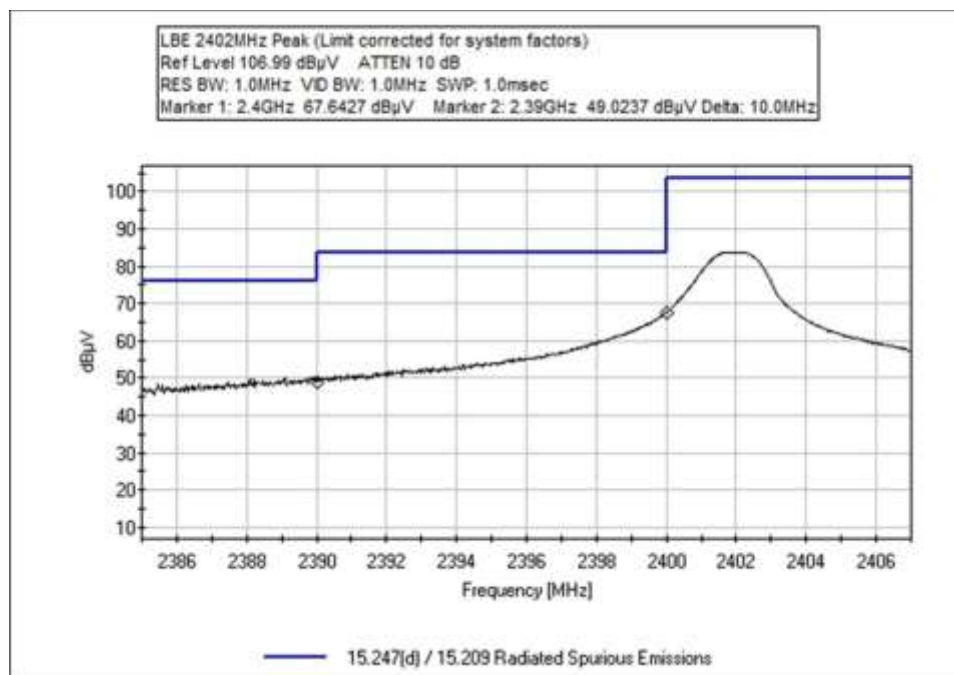
21	8.836M	15.0	+0.0	+0.0	+0.0	+0.0	-40.0	-15.5	29.5	-45.0	Para
			+0.0	+0.0	+9.3	+0.2					
			+0.0	+0.0	+0.0						
22	16.508M	13.6	+0.0	+0.0	+0.0	+0.0	-40.0	-17.5	29.5	-47.0	Para
			+0.0	+0.0	+8.7	+0.2					
			+0.0	+0.0	+0.0						
23	116.756k	32.9	+0.0	+0.0	+0.0	+0.0	-80.0	-37.6	26.3	-63.9	Perp
			+0.0	+0.0	+9.5	+0.0					
			+0.0	+0.0	+0.0						
24	60.845k	36.8	+0.0	+0.0	+0.0	+0.0	-80.0	-33.5	31.9	-65.4	Para
			+0.0	+0.0	+9.7	+0.0					
			+0.0	+0.0	+0.0						
25	17.815k	44.8	+0.0	+0.0	+0.0	+0.0	-80.0	-22.9	42.6	-65.5	Para
			+0.0	+0.0	+12.3	+0.0					
			+0.0	+0.0	+0.0						
26	9.169k	44.5	+0.0	+0.0	+0.0	+0.0	-80.0	-18.9	48.3	-67.2	Perp
			+0.0	+0.0	+16.6	+0.0					
			+0.0	+0.0	+0.0						

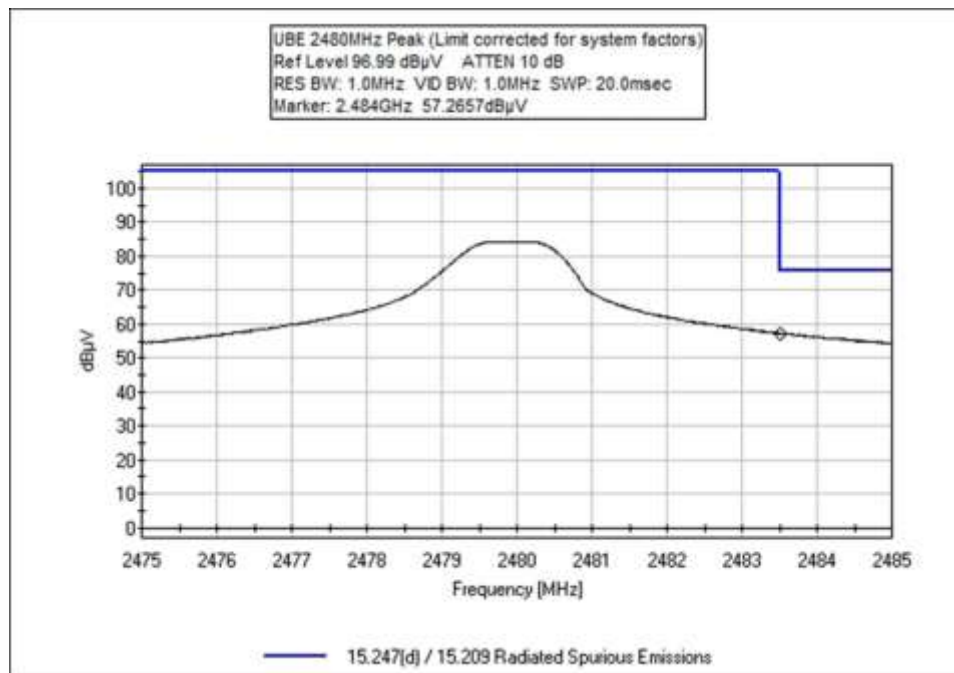
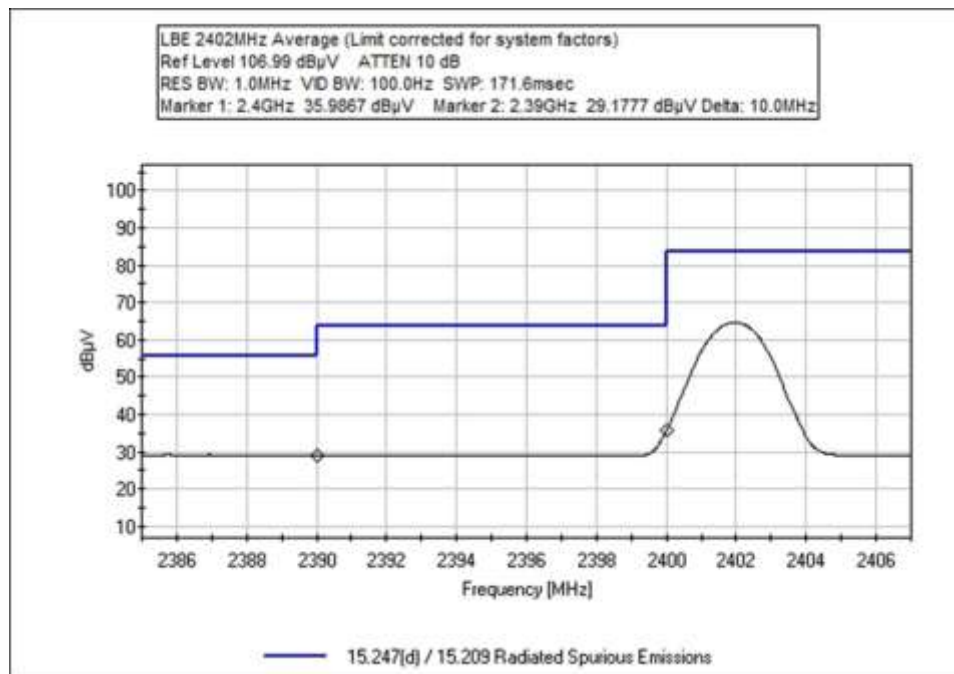
Band Edge

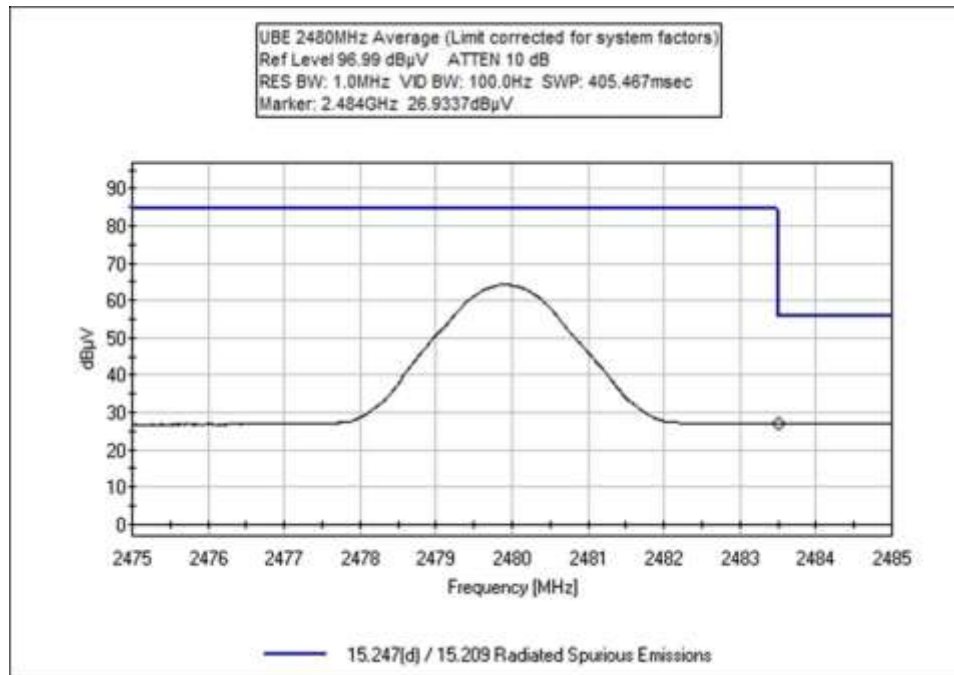
Band Edge Summary

Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	GFSK	PCB Patch	27.3	<54	Pass
2400.0	GFSK	PCB Patch	34.1	<61.7	Pass
2483.5	GFSK	PCB Patch	25.2	<54	Pass

Band Edge Plots







Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC
 Customer: **Medtronic MiniMed**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **102337** Date: 3/4/2019
 Test Type: **Maximized Emissions** Time: 08:53:24
 Tested By: Matthew Harrison Sequence#: 13
 Software: EMITest 5.03.12

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 20-23°C Humidity: 30-40% Pressure: 101-102kPa Frequency Range: 2402-2480MHz Test Method: ANSI C63.4 2014 Test Setup: Continuously Transmitting 2402 and 2480 MHz Setup: The EUT is operating with fresh battery installed. Low 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 Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliac	10/30/2017	10/30/2019
T2	AN02871	Spectrum Analyzer	E4440A	1/9/2019	1/9/2021
T3	ANP06515	Cable	Heliac	6/29/2018	6/29/2020
T4	AN03540	Preamp	83017A	5/2/2017	5/2/2019
T5	AN01467	Horn Antenna- ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T6	ANP06503	Cable	32026-29801- 29801-36	3/13/2018	3/13/2020

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	2390.000M	29.2	+0.4	+0.0	+2.6	-34.0	+0.0	27.3	54.0	-26.7	Vert
	Ave		+28.1	+1.0			260		Y-Axis		122
^	2390.000M	49.0	+0.4	+0.0	+2.6	-34.0	+0.0	47.1	74.0	-26.9	Vert
			+28.1	+1.0			260		Y-Axis		122
3	2400.000M	36.0	+0.4	+0.0	+2.6	-34.0	+0.0	34.1	61.7	-27.6	Vert
	Ave		+28.1	+1.0			260		Y-Axis		122
^	2400.000M	67.6	+0.4	+0.0	+2.6	-34.0	+0.0	65.7	81.7	-16.0	Vert
			+28.1	+1.0			260		Y-Axis		122
5	2483.500M	27.0	+0.4	+0.0	+2.7	-34.0	+0.0	25.2	54.0	-28.8	Vert
	Ave		+28.1	+1.0			180		X-Axis		104
^	2483.500M	57.4	+0.4	+0.0	+2.7	-34.0	+0.0	55.6	74.0	-18.4	Vert
			+28.1	+1.0			180		X-Axis		104

Test Setup Photo(s)



X-Axis



Y-Axis



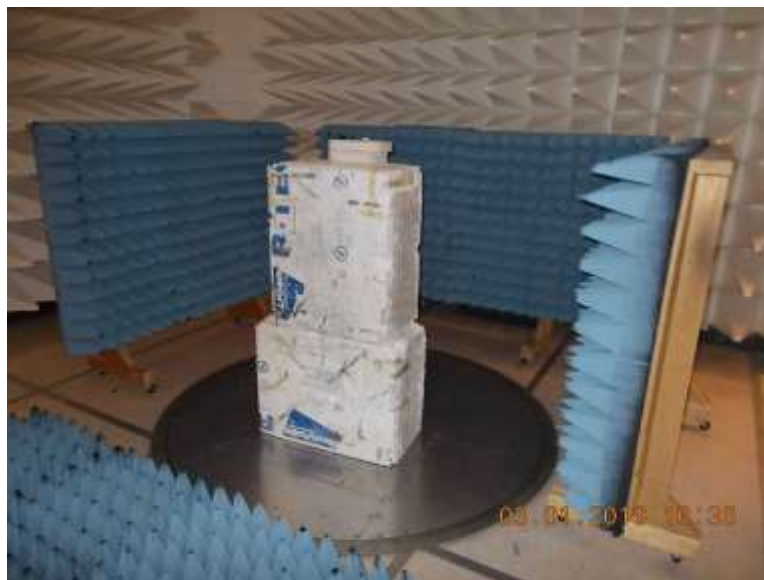
Z-Axis

Below 1GHz





Above 1GHz



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 $\text{dB}\mu\text{V}/\text{m}$, the spectrum analyzer reading in $\text{dB}\mu\text{V}$ 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	($\text{dB}\mu\text{V}$)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	($\text{dB}\mu\text{V}/\text{m}$)

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.