

Medtronic MiniMed

REVISED TEST REPORT FOR

**NGP Insulin Pump
Model: MMT-1781KQ**

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

**15.247
(DTS 2400-2483.5 MHz)**

Report No.: 99536-88A

Date of issue: October 17, 2017



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 EMC 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.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Medtronic MiniMed
18000 Devonshire Street
Northridge, CA 91325-1219

Representative: Greg Bowden
Customer Reference Number: 4500117074

REPORT PREPARED BY:

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Mariposa, CA 95338

Project Number: 99536

DATE OF EQUIPMENT RECEIPT:

February 8, 2017

DATE(S) OF TESTING:

February 8-11, 2017

Revision History

Original: Testing of the NGP Insulin Pump, Model: MMT-1781KQ to FCC Part 15 Subpart C Section(s) 15.247 (DTS 2400-2483.5 MHz).

Revision A: To replace the data in section 15.247(d) Radiated Emissions 1-26GHz due to incorrect transducer noted.

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment 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	5.03.02

Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Canyon Park Bothell, WA	US0081	SL2-IN-E- 1145R	3082C-1	US1022	A-0148

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C - 15.247 (DTS) (2400-2483.5 MHz)

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	NA2
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 only battery powered.

NA2 = Not applicable because the EUT does not have an antenna port.

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
NGP Insulin Pump (Jabil)	Medtronic MiniMed	MMT-1781KQ	NG0011690X

Support Equipment:

Device	Manufacturer	Model #	S/N
None			

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
NGP Insulin Pump (Jabil)	Medtronic MiniMed	MMT-1781KQ	NG0011688X

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:	802.15.4
Operating Frequency Range:	2420MHz-2480MHz
Modulation Type(s):	O-QPSK
Maximum Duty Cycle:	23%
Number of TX Chains:	1
Antenna Type(s) and Gain:	Integral 0dBi
Beamforming Type:	None
Antenna Connection Type:	Integral
Nominal Input Voltage:	1.5V battery
Firmware / Software used for Test:	6x0G XTest PRM 2.5A (M969745DOC)

FCC Part 15 Subpart C

15.247(a)(2) 6dB Bandwidth

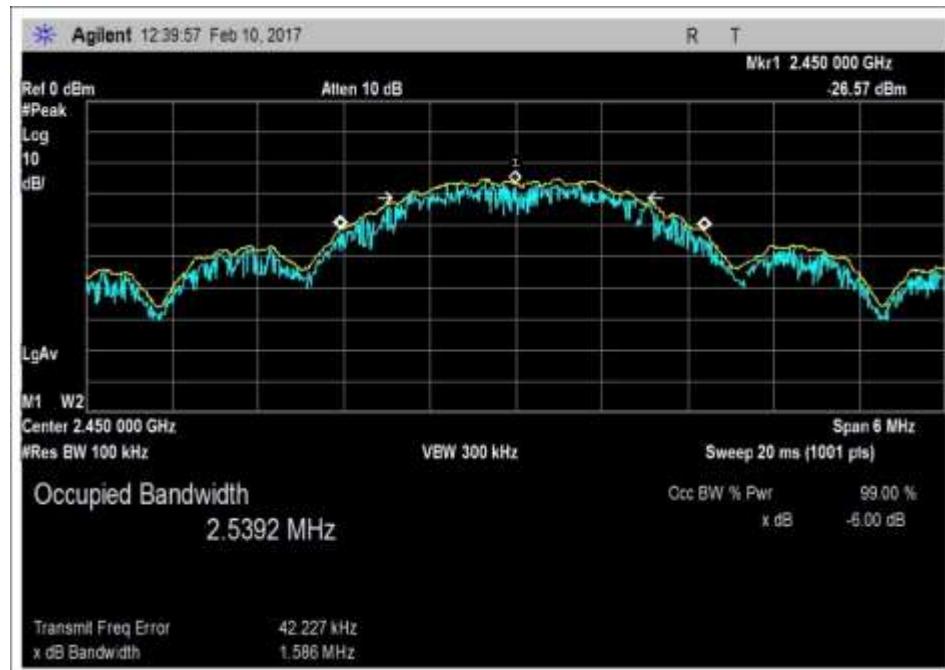
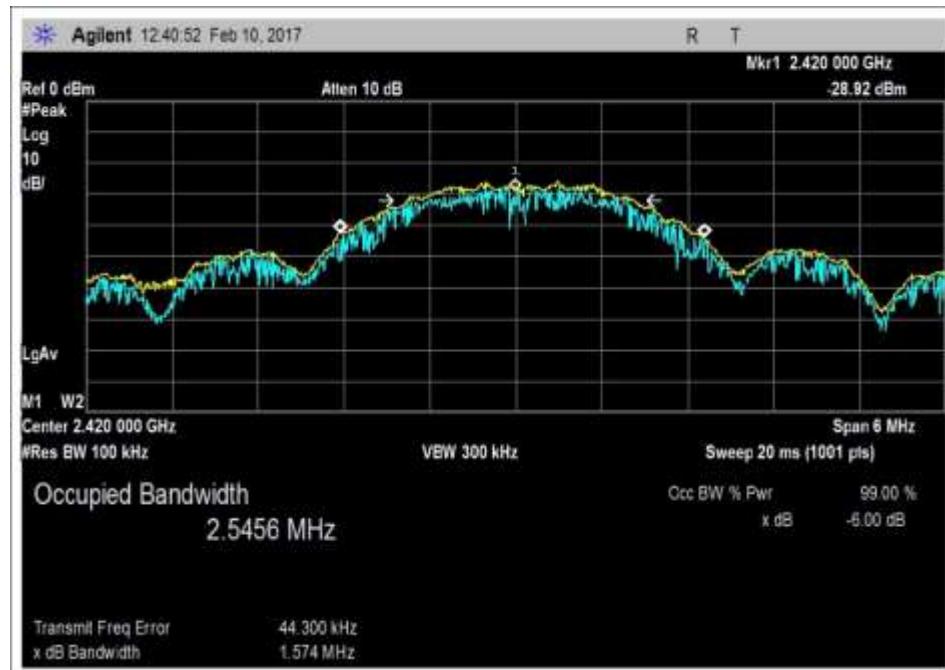
Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	S. Pittsford
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 DTS Meas Guidance v03r05 (04/08/2016)	Test Date(s):	2/10/2017
Configuration:	2		
Test Setup:	Frequency tested: 2420MHz, 2450MHz, 2480MHz Firmware power setting: Max Power EUT Firmware: 6x0G XTest PRM 2.5A(M969745DOC) Duty Cycle: 100% Test Mode: Continuously modulated Test Setup: EUT is set in a test fixture (nearfield probe connected to spectrum analyzer via a cable).		

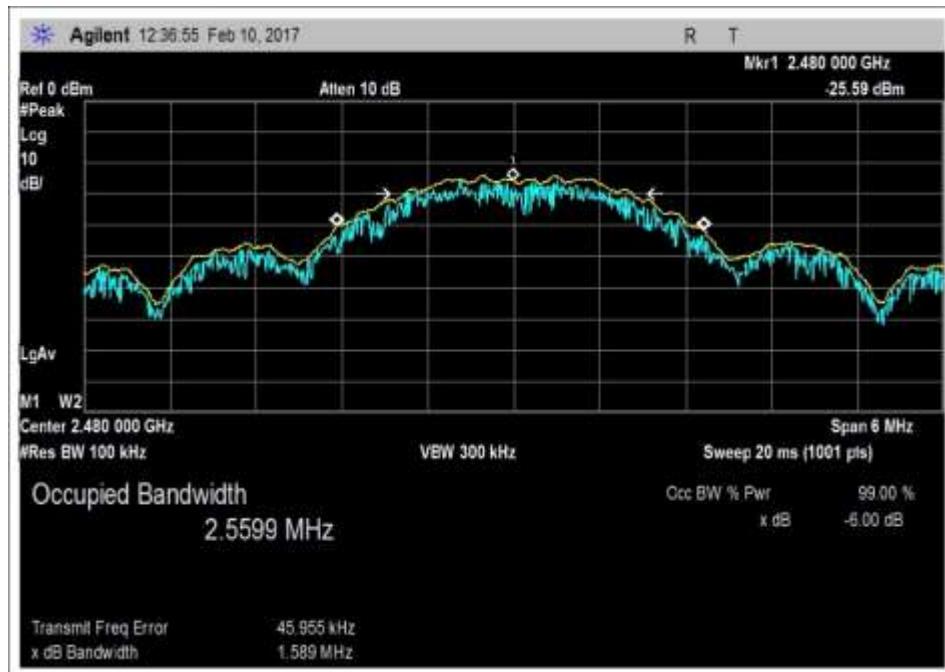
Environmental Conditions			
Temperature (°C)	23.5	Relative Humidity (%):	30

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02673	Spectrum Analyzer	Agilent	E4446A	2/3/2017	2/3/2019
P06867	Cable	Astrolab	32026-29080-29080-84	10/16/2015	10/16/2017

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
2420	1	O-QPSK	1574	≥500	Pass
2450	1	O-QPSK	1586	≥500	Pass
2480	1	O-QPSK	1589	≥500	Pass

Plot(s)





Test Setup Photo(s)



15.247(b)(3) Output Power

Test Setup / Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 DTS Meas Guidance v03r05 (04/08/2016)	Test Date(s):	2/11/2017
Configuration:	2		
Test Setup:	See Data Sheet.		

Environmental Conditions			
Temperature (°C)	22	Relative Humidity (%):	30

Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed using a fresh battery.

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
2420	O-QPSK	Integral 0dBi	91.4	-3.8	≤30	Pass
2450	O-QPSK	Integral 0dBi	92.2	-3.0	≤30	Pass
2480	O-QPSK	Integral 0dBi	91.4	-3.8	≤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:

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

Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Dr. SE • Bothell, WA 98021 • (425) 402-1717
 Customer: **Medtronic MiniMed**
 Specification: **15.247(b) Power Output (2400-2483.5 MHz DTS)**
 Work Order #: **99536** Date: 2/11/2017
 Test Type: **Maximized Emissions** Time: 14:04:29
 Tested By: Steven Pittsford Sequence#: 2
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Frequency tested: 2420MHz, 2450MHz, 2480MHz
 Firmware power setting: Max Power
 EUT Firmware: 6x0G XTest PRM 2.5A(M969745DOC)

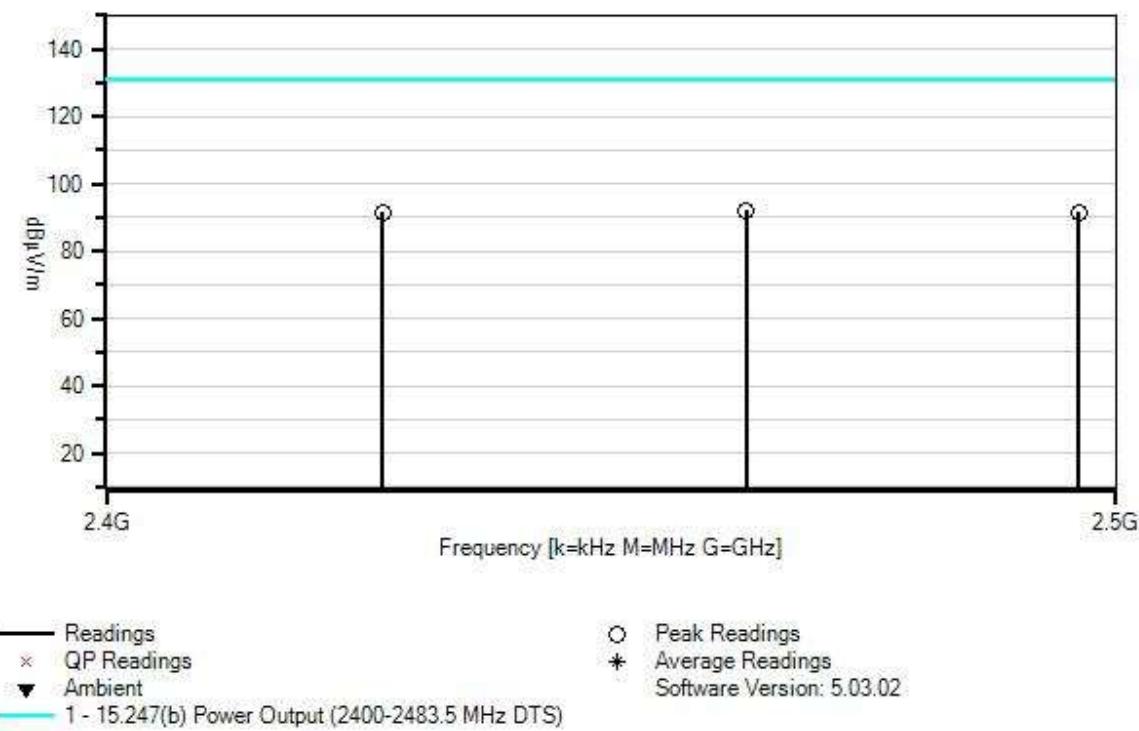
Duty Cycle: 100%

Test Mode: Continuously modulated

Test Setup: The EUT is set 1.5 meters high on a Styrofoam table. X, Y and Z axis are investigated with the worst case reported.

EUT has a fresh battery installed

Medtronic MiniMed WO#: 99536 Sequence#: 2 Date: 2/11/2017
15.247(b) Power Output (2400-2483.5 MHz DTS) Test Distance: 3 Meters Vert

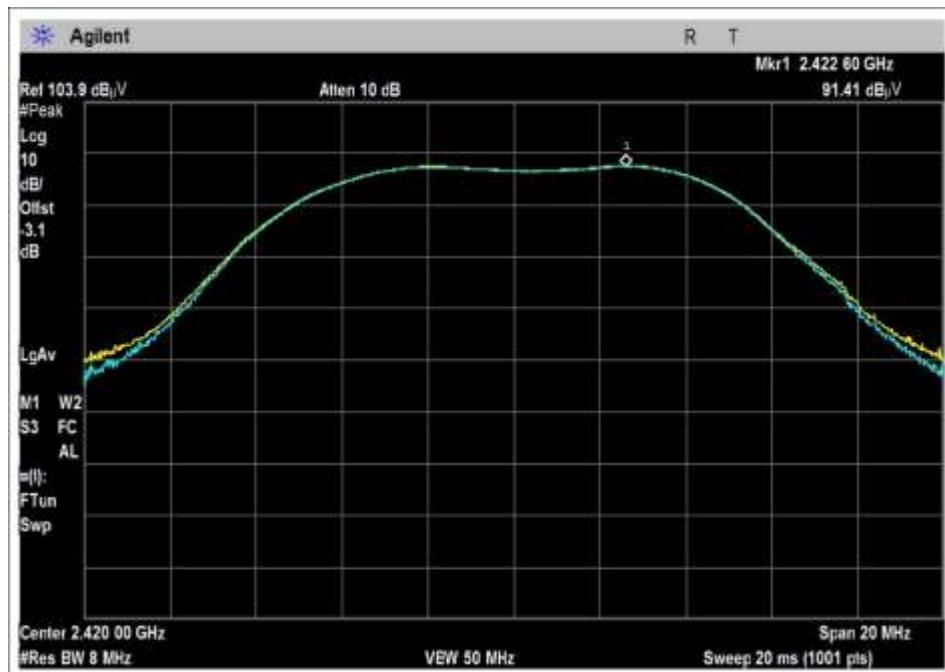


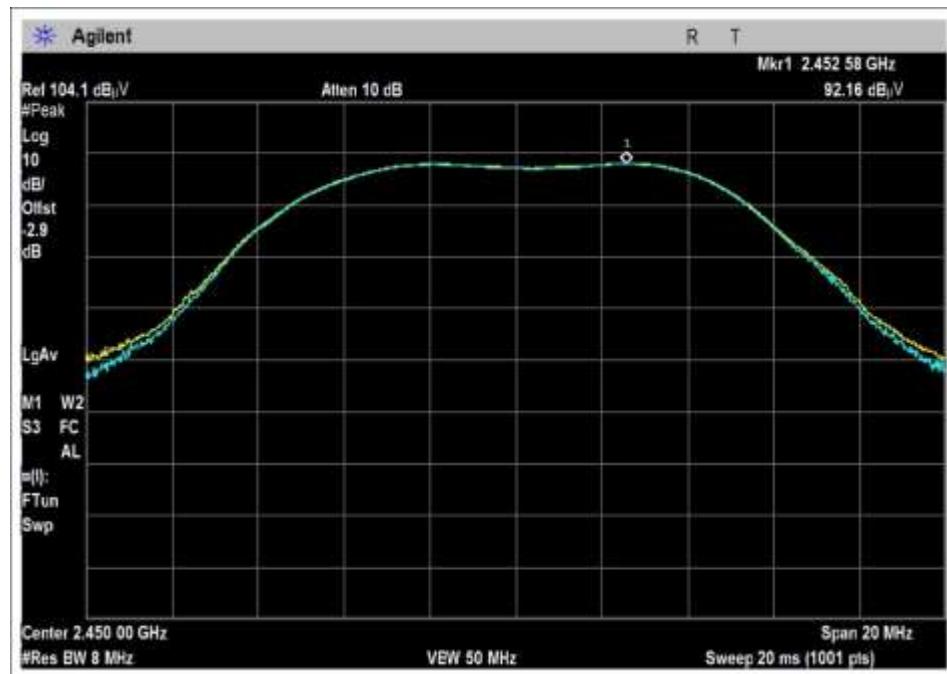
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/18/2015	11/18/2017
T2	ANP06540	Cable	Heliax	10/29/2015	10/29/2017
T3	ANP05305	Cable	ETSI-50T	2/15/2016	2/15/2018
T4	AN03540	Preamp	83017A	4/30/2015	4/30/2017
T5	AN01467	Horn Antenna- ANSI C63.5 Calibration	3115	8/12/2015	8/12/2017
T6	ANP06935	Cable	32026-29801- 29801-18	3/11/2016	3/11/2018

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

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6			Table	dB μ V/m	dB μ V/m		
	MHz	dB μ V	dB	dB	dB	dB				dB	Ant
1	2452.600M	95.1	+0.0	+0.6	+2.9	-34.5	+0.0	92.2	131.2	-39.0	Vert
			+27.7	+0.4							
2	2480.320M	94.3	+0.0	+0.6	+2.9	-34.5	+0.0	91.4	131.2	-39.8	Vert
			+27.7	+0.4							
3	2422.600M	94.5	+0.0	+0.6	+2.8	-34.6	+0.0	91.4	131.2	-39.8	Vert
			+27.7	+0.4							

Plots




Test Setup Photo(s)



X AXIS



Y AXIS



Z AXIS

15.247(e) Power Spectral Density

Test Setup / Conditions / Data			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 DTS Meas Guidance v03r05 (04/08/2016)	Test Date(s):	2/11/2017
Configuration:	2		
Test Setup:	See data sheet.		

Environmental Conditions			
Temperature (°C)	2230	Relative Humidity (%):	

PSD Test Data Summary - Radiated Measurement						
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Field Strength (dBuV/m @3m)	Calculated (dBm/3kHz)	Limit (dBm/3kHz)	Results
2420	O-QPSK	Integral 0dBi	73.1	-22.1	≤8	Pass
2450	O-QPSK	Integral 0dBi	75.5	-19.7	≤8	Pass
2480	O-QPSK	Integral 0dBi	74.0	-21.2	≤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:

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

Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Dr. SE • Bothell, WA 98021 • (425) 402-1717
 Customer: **Medtronic MiniMed**
 Specification: **15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)**
 Work Order #: **99536** Date: 2/11/2017
 Test Type: **Maximized Emissions** Time: 14:23:22
 Tested By: Steven Pittsford Sequence#: 2
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Frequency tested: 2420MHz, 2450MHz, 2480MHz
 Firmware power setting: Max Power
 EUT Firmware: 6x0G XTest PRM 2.5A(M969745DOC)

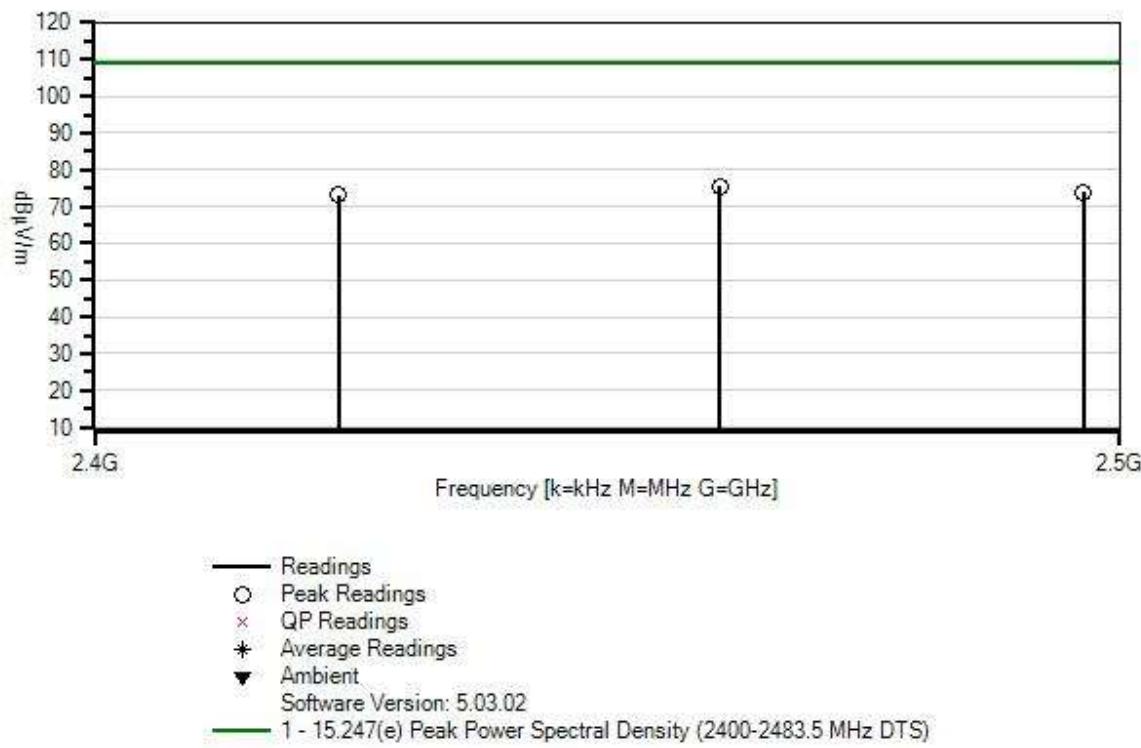
Duty Cycle: 100%

Test Mode: Continuously modulated

Test Setup: The EUT is set 1.5 meters high on a Styrofoam table. X, Y and Z axis are investigated with the worst case reported.

EUT has a fresh battery installed

Medtronic MiniMed WO#: 99536 Sequence#: 2 Date: 2/11/2017
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	AN02872	Spectrum Analyzer	E4440A	11/18/2015	11/18/2017
T2	ANP06540	Cable	Heliax	10/29/2015	10/29/2017
T3	ANP05305	Cable	ETSI-50T	2/15/2016	2/15/2018
T4	AN03540	Preamp	83017A	4/30/2015	4/30/2017
T5	AN01467	Horn Antenna- ANSI C63.5 Calibration	3115	8/12/2015	8/12/2017
T6	ANP06935	Cable	32026-29801- 29801-18	3/11/2016	3/11/2018

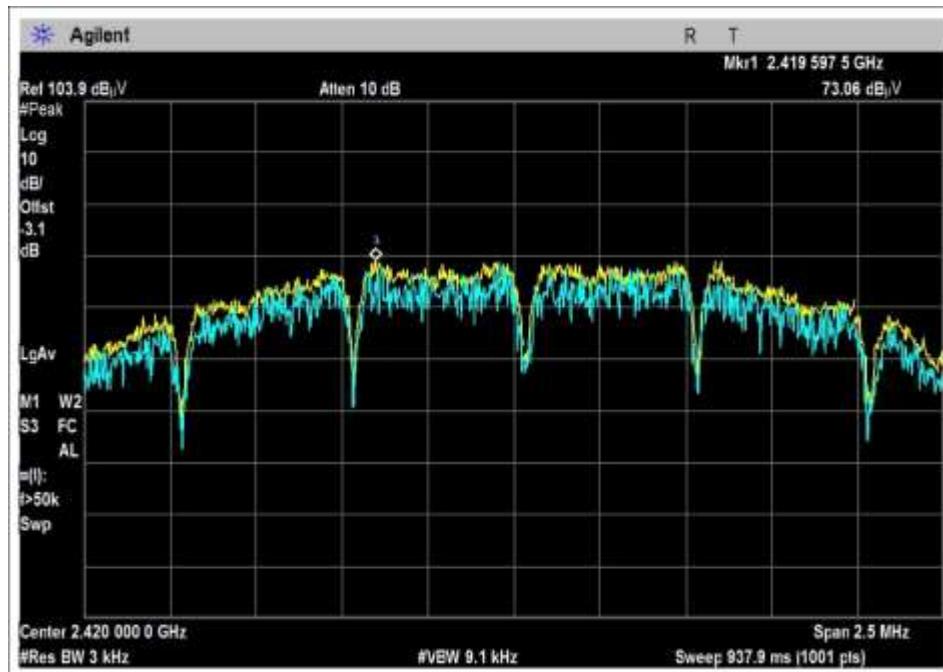
Measurement Data:

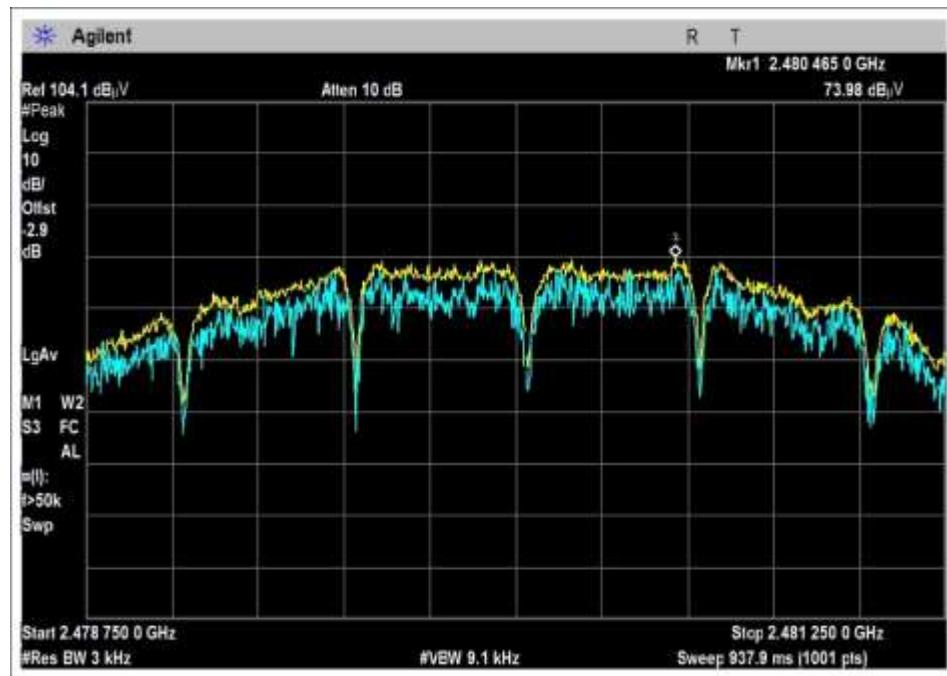
Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6			Table	dB μ V/m	dB μ V/m		
	MHz	dB μ V	dB	dB	dB	dB				dB	Ant
1	2450.588M	78.4	+0.0	+0.6	+2.9	-34.5	+0.0	75.5	109.2	-33.7	Vert
			+27.7	+0.4							
2	2480.465M	76.9	+0.0	+0.6	+2.9	-34.5	+0.0	74.0	109.2	-35.2	Vert
			+27.7	+0.4							
3	2419.598M	76.2	+0.0	+0.6	+2.8	-34.6	+0.0	73.1	109.2	-36.1	Vert
			+27.7	+0.4							

Plot Data





Test Setup Photo(s)





X AXIS



Y AXIS



Z AXIS

15.247(d) Radiated Emissions & Band Edge

Test Setup/Conditions

Test Location:	Bothell Lab C3	Test Engineer:	M. Atkinson/S Pittsford
Test Method:	ANSI C63.10 (2013), KDB 558074 D01 DTS Meas Guidance v03r05 (04/08/2016)	Test Date(s):	2/8/2017 to 2/10/2017
Configuration:	1		

Environmental Conditions

Temperature (°C)	22-23	Relative Humidity (%):	24-30
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See data sheets for test setup and test equipment.

Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Dr. SE • Bothell, WA 98021 • (425) 402-1717
 Customer: **Medtronic MiniMed**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **99536** Date: 2/8/2017
 Test Type: **Maximized Emissions** Time: 11:22:00
 Tested By: Michael Atkinson Sequence#: 1
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Frequency Range: 9kHz-1GHz
 Frequency tested: 2420MHz, 2450MHz, 2480MHz
 Firmware power setting: Max Power
 EUT Firmware: 6x0G XTest PRM 2.5A(M969745DOC)

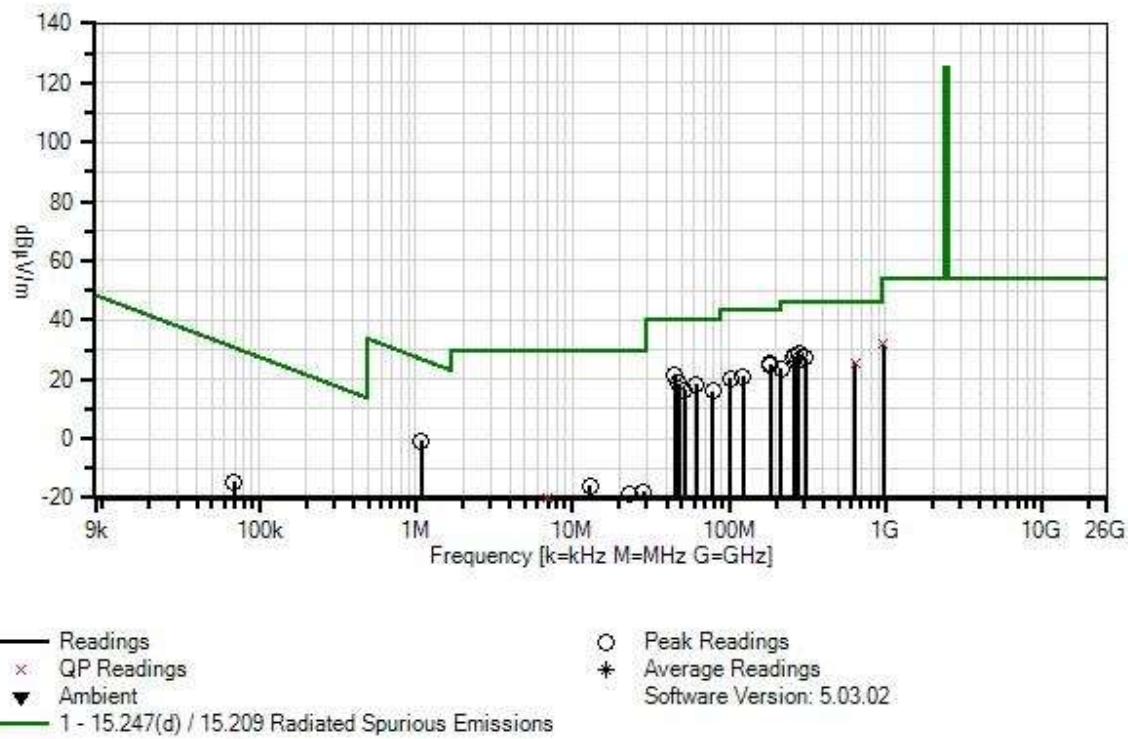
Duty Cycle: 100%

Test Mode: Continuously modulated

Test Setup:

The EUT is set 0.8 meters high on a Styrofoam table. X, Y and Z axis are investigated with the worst case reported.
 EUT has a fresh battery installed

Medtronic MiniMed WO#: 99536 Sequence#: 1 Date: 2/8/2017
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Para



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/18/2015	11/18/2017
T2	ANP06540	Cable	Heliax	10/29/2015	10/29/2017
T3	ANP05963	Cable	RG-214	2/15/2016	2/15/2018
T4	ANP05360	Cable	RG214	11/30/2016	11/30/2018
T5	AN02307	Preamp	8447D	2/15/2016	2/15/2018
T6	AN01991	Biconilog Antenna	CBL6111C	3/11/2016	3/11/2018
T7	ANP05657	Attenuator	PE7004-6	12/22/2015	12/22/2017
T8	ANP05305	Cable	ETSI-50T	2/15/2016	2/15/2018
T9	AN00052	Loop Antenna	6502	4/8/2016	4/8/2018

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6	T7	T8					
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	280.300M	33.7	+0.0	+0.2	+1.6	+1.0	+0.0	28.5	46.0	-17.5	Horiz
			-27.0	+13.0	+6.0	+0.0					Z-Axis
			+0.0								
2	268.600M	33.7	+0.0	+0.2	+1.5	+1.0	+0.0	28.1	46.0	-17.9	Horiz
			-27.0	+12.7	+6.0	+0.0					Z-Axis
			+0.0								
3	184.200M	35.0	+0.0	+0.2	+1.4	+0.8	+0.0	25.2	43.5	-18.3	Horiz
			-27.3	+9.1	+6.0	+0.0					Z-Axis
			+0.0								
4	45.005M	31.7	+0.0	+0.1	+0.5	+0.4	+0.0	21.6	40.0	-18.4	Horiz
			-27.9	+10.8	+6.0	+0.0					X-Axis
			+0.0								
5	260.900M	33.1	+0.0	+0.2	+1.5	+1.0	+0.0	27.4	46.0	-18.6	Vert
			-27.0	+12.6	+6.0	+0.0					Z-Axis
			+0.0								
6	308.400M	31.7	+0.0	+0.2	+1.6	+1.1	+0.0	27.2	46.0	-18.8	Horiz
			-27.1	+13.7	+6.0	+0.0					Z-Axis
			+0.0								
7	184.200M	34.3	+0.0	+0.2	+1.4	+0.8	+0.0	24.5	43.5	-19.0	Horiz
			-27.3	+9.1	+6.0	+0.0					Y-Axis
			+0.0								
8	276.400M	31.7	+0.0	+0.2	+1.6	+1.0	+0.0	26.4	46.0	-19.6	Vert
			-27.0	+12.9	+6.0	+0.0					Y-Axis
			+0.0								
9	215.300M	32.3	+0.0	+0.2	+1.4	+0.9	+0.0	23.6	43.5	-19.9	Horiz
			-27.2	+10.0	+6.0	+0.0					Z-Axis
			+0.0								

10	644.000M	23.1	+0.0	+0.3	+2.1	+1.7	+0.0	25.7	46.0	-20.3	Vert
	QP		-28.1	+20.6	+6.0	+0.0				Z-Axis	
			+0.0								
^	644.000M	28.9	+0.0	+0.3	+2.1	+1.7	+0.0	31.5	46.0	-14.5	Vert
			-28.1	+20.6	+6.0	+0.0				Z-Axis	
			+0.0								
12	47.894M	30.0	+0.0	+0.1	+0.6	+0.4	+0.0	18.6	40.0	-21.4	Vert
			-27.9	+9.4	+6.0	+0.0				X-Axis	
			+0.0								
13	61.502M	33.1	+0.0	+0.1	+0.7	+0.4	+0.0	18.5	40.0	-21.5	Vert
			-27.8	+6.0	+6.0	+0.0				X-Axis	
			+0.0								
14	973.800M	22.4	+0.0	+0.4	+2.5	+2.2	+0.0	32.0	54.0	-22.0	Horiz
	QP		-27.1	+25.5	+6.1	+0.0				Z-Axis	
			+0.0								
^	973.800M	28.3	+0.0	+0.4	+2.5	+2.2	+0.0	37.9	54.0	-16.1	Horiz
			-27.1	+25.5	+6.1	+0.0				Z-Axis	
			+0.0								
16	123.100M	29.0	+0.0	+0.1	+1.2	+0.6	+0.0	20.9	43.5	-22.6	Vert
			-27.6	+11.6	+6.0	+0.0				Z-Axis	
			+0.0								
17	102.789M	29.9	+0.0	+0.1	+1.2	+0.6	+0.0	20.4	43.5	-23.1	Vert
			-27.7	+10.3	+6.0	+0.0				X-Axis	
			+0.0								
18	52.300M	29.5	+0.0	+0.1	+0.6	+0.4	+0.0	16.5	40.0	-23.5	Vert
			-27.9	+7.8	+6.0	+0.0				Z-Axis	
			+0.0								
19	78.744M	29.6	+0.0	+0.1	+0.8	+0.5	+0.0	16.1	40.0	-23.9	Vert
			-27.8	+6.9	+6.0	+0.0				X-Axis	
			+0.0								
20	1.089M	29.3	+0.0	+0.0	+0.0	+0.0	-40.0	-0.8	26.9	-27.7	Para
			+0.0	+0.0	+0.0	+0.1				Z-Axis	
			+9.8								
21	12.905M	15.3	+0.0	+0.0	+0.0	+0.0	-40.0	-15.7	29.5	-45.2	Para
			+0.0	+0.0	+0.0	+0.2				X-Axis	
			+8.8								
22	69.000k	55.3	+0.0	+0.0	+0.0	+0.0	-80.0	-14.5	30.8	-45.3	Para
			+0.0	+0.0	+0.0	+0.0				Z-Axis	
			+10.2								
23	28.380M	15.7	+0.0	+0.0	+0.0	+0.0	-40.0	-17.9	29.5	-47.4	GrdPe
			+0.0	+0.0	+0.0	+0.3				X-Axis	
			+6.1								
24	23.102M	13.3	+0.0	+0.0	+0.0	+0.0	-40.0	-19.0	29.5	-48.5	Perp
			+0.0	+0.0	+0.0	+0.3				Y-Axis	
			+7.4								

25	6.997M	10.7	+0.0	+0.0	+0.0	+0.0	-40.0	-19.9	29.5	-49.4	Para
	QP		+0.0	+0.0	+0.0	+0.1			Z-Axis		
			+9.3								
^	6.997M	17.1	+0.0	+0.0	+0.0	+0.0	-40.0	-13.5	29.5	-43.0	Para
			+0.0	+0.0	+0.0	+0.1			Z-Axis		
			+9.3								
27	28.470M	12.9	+0.0	+0.0	+0.0	+0.0	-40.0	-20.7	29.5	-50.2	Para
			+0.0	+0.0	+0.0	+0.3			Z-Axis		
			+6.1								

Test Location: CKC Laboratories • 22116 23rd Dr SE • Bothell, WA 98021 • (425) 402-1717
 Customer: **Medtronic MiniMed**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **99536** Date: 2/8/2017
 Test Type: **Radiated Scan** Time: 16:18:18
 Tested By: Michael Atkinson Sequence#: 3
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

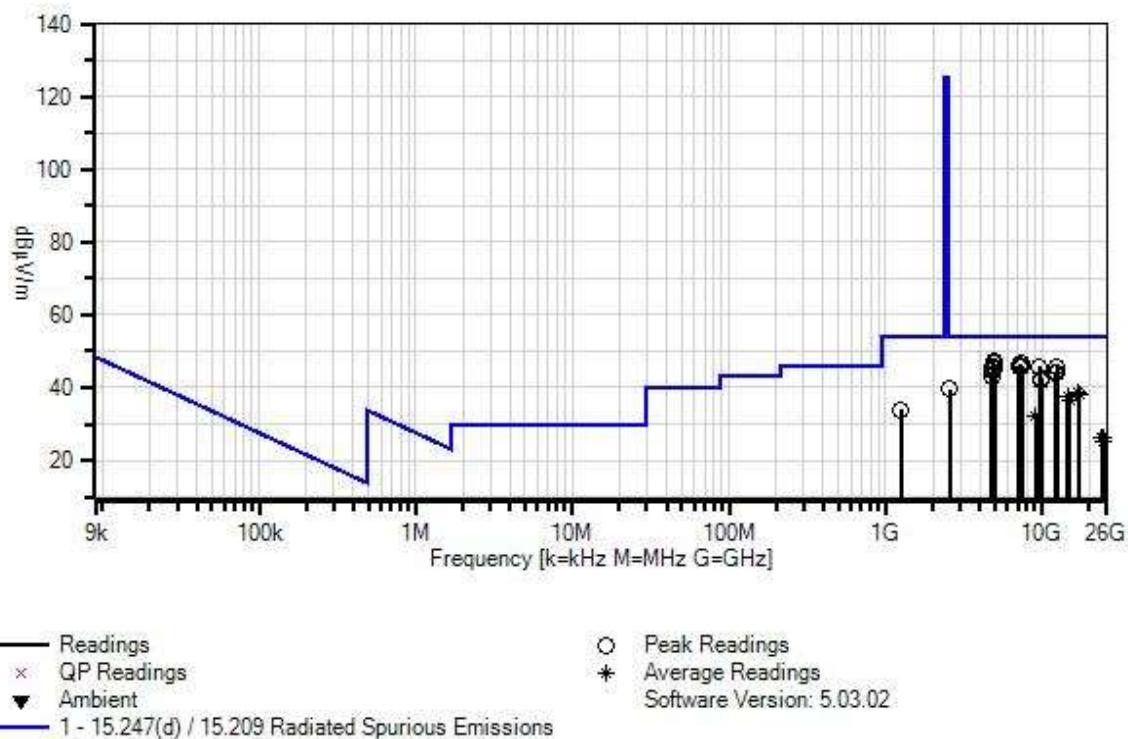
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Frequency Range: 1-26GHz
Frequency tested: 2420MHz, 2450MHz, 2480MHz
Firmware power setting: Max Power
EUT Firmware: 6x0G XTest PRM 2.5A(M969745DOC)
Duty Cycle: 100%
Test Mode: Continuously modulated
Test Setup: The EUT is set 1.5 meters high on a Styrofoam table. X, Y and Z axis are investigated with the worst case reported. EUT has a fresh battery installed.

Medtronic MiniMed WO#: 99536 Sequence#: 3 Date: 2/8/2017
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	AN02872	Spectrum Analyzer	E4440A	11/18/2015	11/18/2017
T2	ANP06540	Cable	Heliax	10/29/2015	10/29/2017
T3	ANP05305	Cable	ETSI-50T	2/15/2016	2/15/2018
T4	AN03540	Preamp	83017A	4/30/2015	4/30/2017
T5	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	8/12/2015	8/12/2017
T6	ANP06935	Cable	32026-29801-29801-18	3/11/2016	3/11/2018
T7	ANP06678	Cable	32026-29801-29801-144	9/19/2016	9/19/2018
T8	ANP06957	Cable	32026-29094K-29094K-72TC	9/19/2016	9/19/2018
T9	AN02742	Active Horn Antenna	AMFW-5F-18002650-20-10P	10/7/2016	10/7/2018

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	4899.300M	43.0	+0.0 +32.7 +0.0	+0.9 +0.5 +0.0	+4.4 +0.0 +0.0	-34.2 +0.0	+0.0	47.3	54.0	-6.7	Horiz
										Mid	
2	4959.900M	42.2	+0.0 +32.8 +0.0	+0.9 +0.5 +0.0	+4.4 +0.0 +0.0	-34.2 +0.0	+0.0	46.6	54.0	-7.4	Horiz
										High	
3	7351.100M	38.5	+0.0 +36.2 +0.0	+1.2 +0.6 +0.0	+4.7 +0.0 +0.0	-34.6 +0.0	+0.0	46.6	54.0	-7.4	Horiz
										Mid	
4	7260.600M	38.2	+0.0 +35.9 +0.0	+1.2 +0.6 +0.0	+4.6 +0.0 +0.0	-34.5 +0.0	+0.0	46.0	54.0	-8.0	Horiz
										Low	
5	12398.500M	32.2	+0.0 +39.5 +0.0	+1.6 +0.9 +0.0	+6.4 +0.0 +0.0	-34.7 +0.0	+0.0	45.9	54.0	-8.1	Horiz
										High	
6	9667.000M	35.3	+0.0 +37.3 +0.0	+1.5 +0.7 +0.0	+6.1 +0.0 +0.0	-35.0 +0.0	+0.0	45.9	54.0	-8.1	Horiz
										Low	
7	7120.000M	38.4	+0.0 +35.4 +0.0	+1.2 +0.7 +0.0	+4.4 +0.0 +0.0	-34.4 +0.0	+0.0	45.7	54.0	-8.3	Horiz
										Low	
8	7438.500M	37.1	+0.0 +36.6 +0.0	+1.3 +0.6 +0.0	+4.8 +0.0 +0.0	-34.7 +0.0	+0.0	45.7	54.0	-8.3	Horiz
										High	
9	4843.000M	41.5	+0.0 +32.7 +0.0	+0.9 +0.5 +0.0	+4.3 +0.0 +0.0	-34.2 +0.0	+0.0	45.7	54.0	-8.3	Horiz
										Low	

10	4899.950M	41.2	+0.0	+0.9	+4.4	-34.2	+0.0	45.5	54.0	-8.5	Vert
			+32.7	+0.5	+0.0	+0.0				Mid	
			+0.0								
11	4960.150M	40.9	+0.0	+0.9	+4.4	-34.2	+0.0	45.3	54.0	-8.7	Vert
			+32.8	+0.5	+0.0	+0.0				High	
			+0.0								
12	4839.200M	40.4	+0.0	+0.9	+4.3	-34.2	+0.0	44.6	54.0	-9.4	Vert
			+32.7	+0.5	+0.0	+0.0				Low	
			+0.0								
13	12100.600	31.1	+0.0	+1.5	+6.5	-34.9	+0.0	44.3	54.0	-9.7	Horiz
	M		+39.3	+0.8	+0.0	+0.0				Low	
			+0.0								
14	12251.100	30.5	+0.0	+1.5	+6.6	-34.8	+0.0	44.0	54.0	-10.0	Horiz
	M		+39.4	+0.8	+0.0	+0.0				Mid	
			+0.0								
15	4762.000M	38.9	+0.0	+0.9	+4.3	-34.2	+0.0	43.1	54.0	-10.9	Vert
			+32.7	+0.5	+0.0	+0.0					
			+0.0								
16	9918.500M	32.3	+0.0	+1.3	+6.1	-35.2	+0.0	42.5	54.0	-11.5	Horiz
			+37.2	+0.8	+0.0	+0.0				High	
			+0.0								
17	9680.600M	31.6	+0.0	+1.5	+6.1	-35.0	+0.0	42.2	54.0	-11.8	Horiz
			+37.3	+0.7	+0.0	+0.0				Low	
			+0.0								
18	9801.100M	31.6	+0.0	+1.4	+6.1	-35.1	+0.0	42.0	54.0	-12.0	Horiz
			+37.3	+0.7	+0.0	+0.0				Mid	
			+0.0								
19	2566.000M	42.3	+0.0	+0.6	+2.9	-34.5	+0.0	39.7	54.0	-14.3	Horiz
			+28.0	+0.4	+0.0	+0.0					
			+0.0								
20	17151.100	19.7	+0.0	+2.0	+8.7	-34.4	+0.0	38.8	54.0	-15.2	Horiz
	M		+41.8	+1.0	+0.0	+0.0				Mid	
	Ave		+0.0								
^	17151.100	29.6	+0.0	+2.0	+8.7	-34.4	+0.0	48.7	54.0	-5.3	Horiz
	M		+41.8	+1.0	+0.0	+0.0				Mid	
			+0.0								
22	16940.600	20.0	+0.0	+2.1	+8.6	-34.4	+0.0	38.6	54.0	-15.4	Horiz
	M		+41.3	+1.0	+0.0	+0.0					
	Ave		+0.0								
^	16940.600	31.3	+0.0	+2.1	+8.6	-34.4	+0.0	49.9	54.0	-4.1	Horiz
	M		+41.3	+1.0	+0.0	+0.0				Low	
			+0.0								

24	17358.500	18.4	+0.0	+2.0	+8.8	-34.5	+0.0	38.0	54.0	-16.0	Horiz
	M		+42.3	+1.0	+0.0	+0.0					
	Ave		+0.0							High	
^	17358.500	29.8	+0.0	+2.0	+8.8	-34.5	+0.0	49.4	54.0	-4.6	Horiz
	M		+42.3	+1.0	+0.0	+0.0					
			+0.0							High	
26	14520.600	21.7	+0.0	+1.8	+7.7	-34.9	+0.0	37.6	54.0	-16.4	Horiz
	M		+40.3	+1.0	+0.0	+0.0					
	Ave		+0.0							Low	
^	14520.600	33.4	+0.0	+1.8	+7.7	-34.9	+0.0	49.3	54.0	-4.7	Horiz
	M		+40.3	+1.0	+0.0	+0.0					
			+0.0							Low	
28	14701.100	22.2	+0.0	+1.8	+7.8	-34.9	+0.0	37.5	54.0	-16.5	Horiz
	M		+39.7	+0.9	+0.0	+0.0					
	Ave		+0.0							Mid	
^	14701.100	32.8	+0.0	+1.8	+7.8	-34.9	+0.0	48.1	54.0	-5.9	Horiz
	M		+39.7	+0.9	+0.0	+0.0					
			+0.0							Mid	
30	14878.557	21.9	+0.0	+1.8	+7.7	-34.9	+0.0	36.4	54.0	-17.6	Horiz
	M		+39.0	+0.9	+0.0	+0.0					
	Ave		+0.0							High	
^	14878.557	35.0	+0.0	+1.8	+7.7	-34.9	+0.0	49.5	54.0	-4.5	Horiz
	M		+39.0	+0.9	+0.0	+0.0					
			+0.0							High	
32	1252.000M	43.3	+0.0	+0.4	+2.1	-36.3	+0.0	34.0	54.0	-20.0	Horiz
			+24.2	+0.3	+0.0	+0.0					
			+0.0								
33	9019.000M	20.8	+0.0	+1.3	+6.0	-34.6	+0.0	32.0	54.0	-22.0	Horiz
	Ave		+37.8	+0.7	+0.0	+0.0					
			+0.0							Low	
^	9019.000M	36.9	+0.0	+1.3	+6.0	-34.6	+0.0	48.1	54.0	-5.9	Horiz
			+37.8	+0.7	+0.0	+0.0					
			+0.0							Low	
35	24200.000	25.6	+0.0	+0.0	+0.0	+0.0	+0.0	26.2	54.0	-27.8	Vert
	M		+0.0	+0.0	+8.5	+4.5					
	Ave		-12.4								
^	24200.000	38.2	+0.0	+0.0	+0.0	+0.0	+0.0	38.8	54.0	-15.2	Vert
	M		+0.0	+0.0	+8.5	+4.5					
			-12.4								
37	24500.000	25.1	+0.0	+0.0	+0.0	+0.0	+0.0	26.0	54.0	-28.0	Vert
	M		+0.0	+0.0	+8.6	+4.5					
	Ave		-12.2								
^	24500.000	38.5	+0.0	+0.0	+0.0	+0.0	+0.0	39.4	54.0	-14.6	Vert
	M		+0.0	+0.0	+8.6	+4.5					
			-12.2								
39	24800.000	24.0	+0.0	+0.0	+0.0	+0.0	+0.0	25.3	54.0	-28.7	Vert
	M		+0.0	+0.0	+8.6	+4.6					
	Ave		-11.9								
^	24800.000	37.2	+0.0	+0.0	+0.0	+0.0	+0.0	38.5	54.0	-15.5	Vert
	M		+0.0	+0.0	+8.6	+4.6					
			-11.9								

Band Edge

Band Edge Summary

Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	O-QPSK	Integral 0dBi	26.1 (Ave)	<54	Pass
2390.0	O-QPSK	Integral 0dBi	38.9 (Peak)	<74	Pass
2400.0	O-QPSK	Integral 0dBi	27.0 (Ave)	<54	Pass
2400.0	O-QPSK	Integral 0dBi	39.9 (Peak)	<74	Pass
2483.5	O-QPSK	Integral 0dBi	48.8 (Ave)	<54	Pass
2483.5	O-QPSK	Integral 0dBi	59.3 (peak)	<74	Pass

Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Dr. SE • Bothell, WA 98021 • (425) 402-1717
 Customer: **Medtronic MiniMed**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **99536** Date: 2/8/2017
 Test Type: **Maximized Emissions** Time: 15:08:37
 Tested By: Michael Atkinson Sequence#: 2
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Frequency tested: 2420MHz, 2480MHz
 Firmware power setting: Max Power
 EUT Firmware: 6x0G XTest PRM 2.5A(M969745DOC)

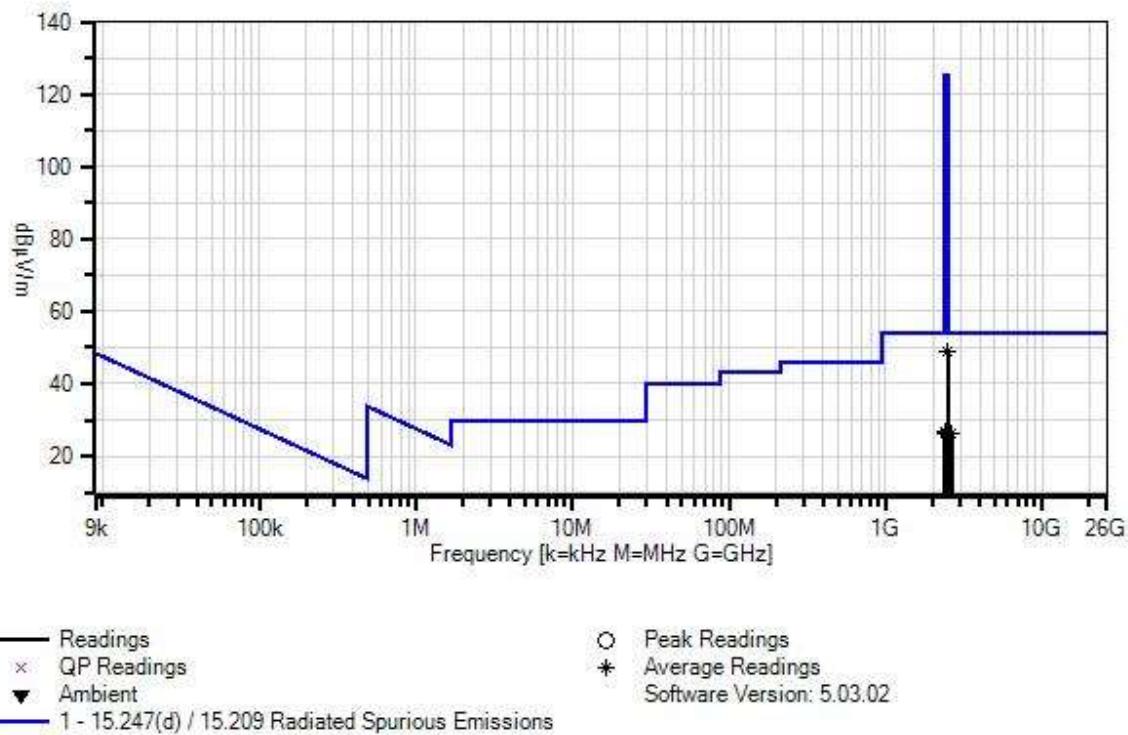
Duty Cycle: 100%

Test Mode: Continuously modulated

Test Setup:

The EUT is set 1.5 meters high on a Styrofoam table. X, Y and Z axis are investigated with the worst case reported.

Medtronic MiniMed WO#: 99536 Sequence#: 2 Date: 2/8/2017
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/18/2015	11/18/2017
T2	ANP06540	Cable	Heliax	10/29/2015	10/29/2017
	ANP05963	Cable	RG-214	2/15/2016	2/15/2018
	ANP05360	Cable	RG214	11/30/2016	11/30/2018
	AN02307	Preamp	8447D	2/15/2016	2/15/2018
	AN01991	Biconilog Antenna	CBL6111C	3/11/2016	3/11/2018
	ANP05657	Attenuator	PE7004-6	12/22/2015	12/22/2017
T3	ANP05305	Cable	ETSI-50T	2/15/2016	2/15/2018
	AN00052	Loop Antenna	6502	4/8/2016	4/8/2018
T4	AN03540	Preamp	83017A	4/30/2015	4/30/2017
T5	AN01467	Horn Antenna- ANSI C63.5 Calibration	3115	8/12/2015	8/12/2017
T6	ANP06935	Cable	32026-29801- 29801-18	3/11/2016	3/11/2018

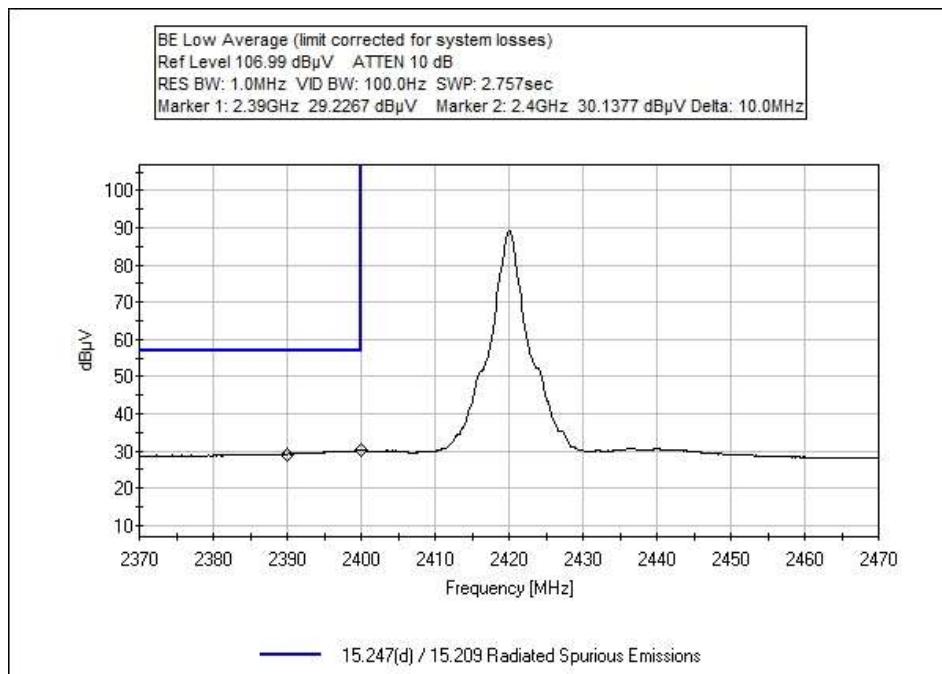
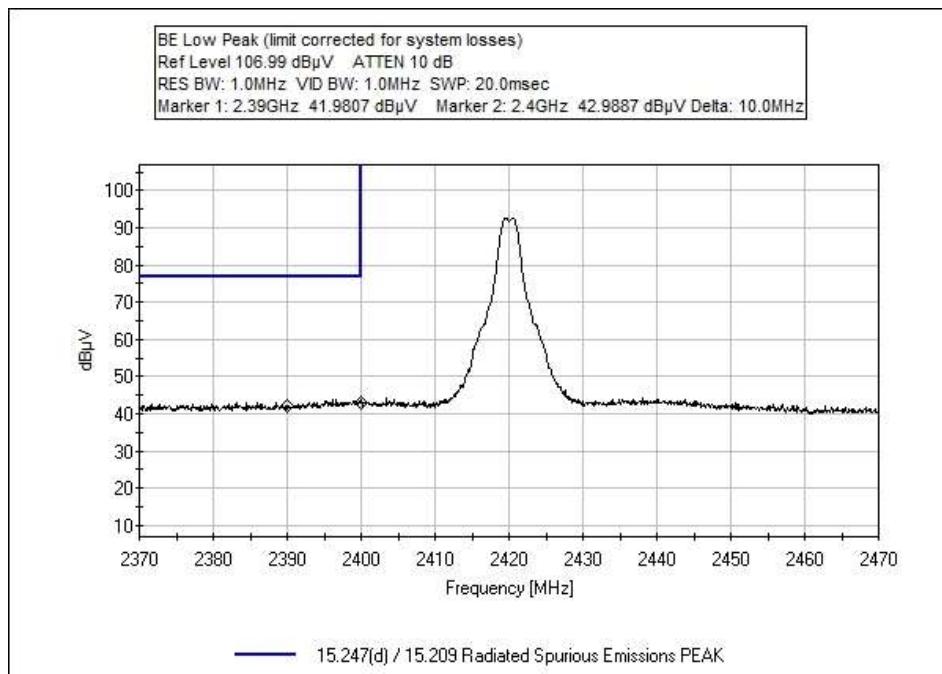
Measurement Data:

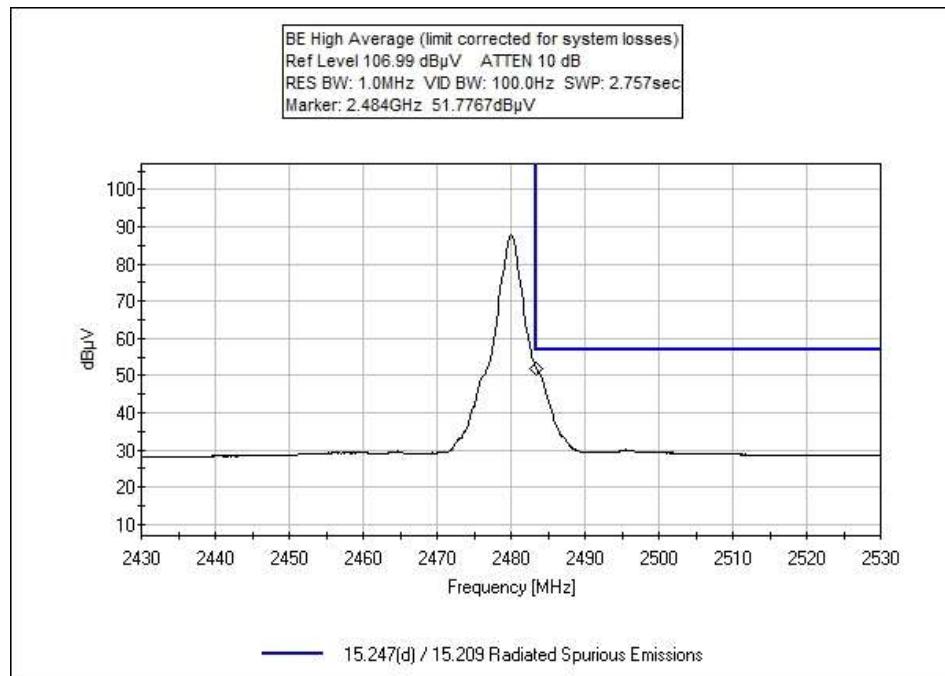
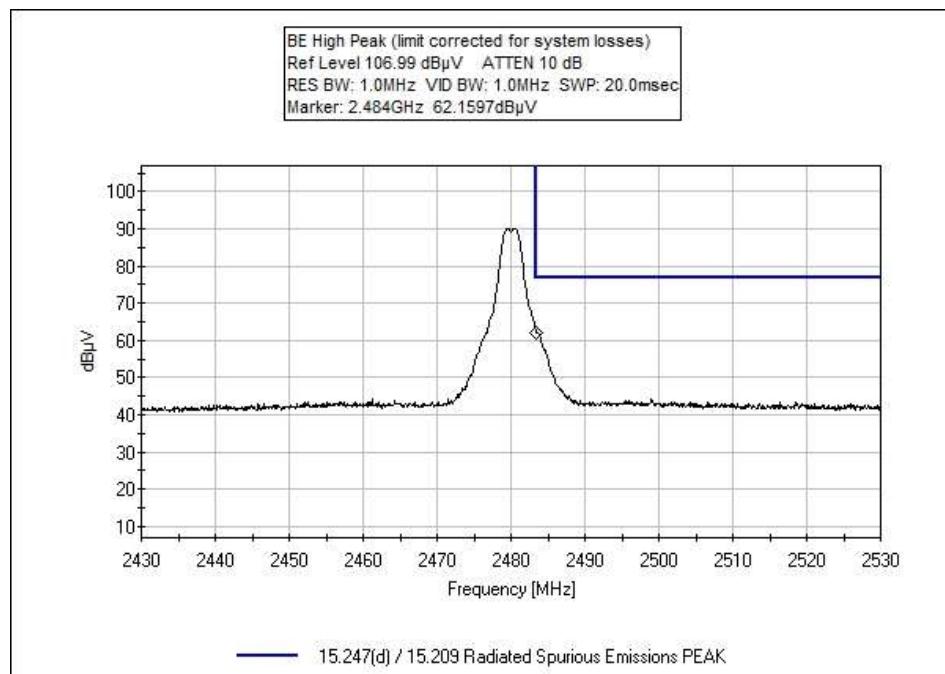
Reading listed by margin.

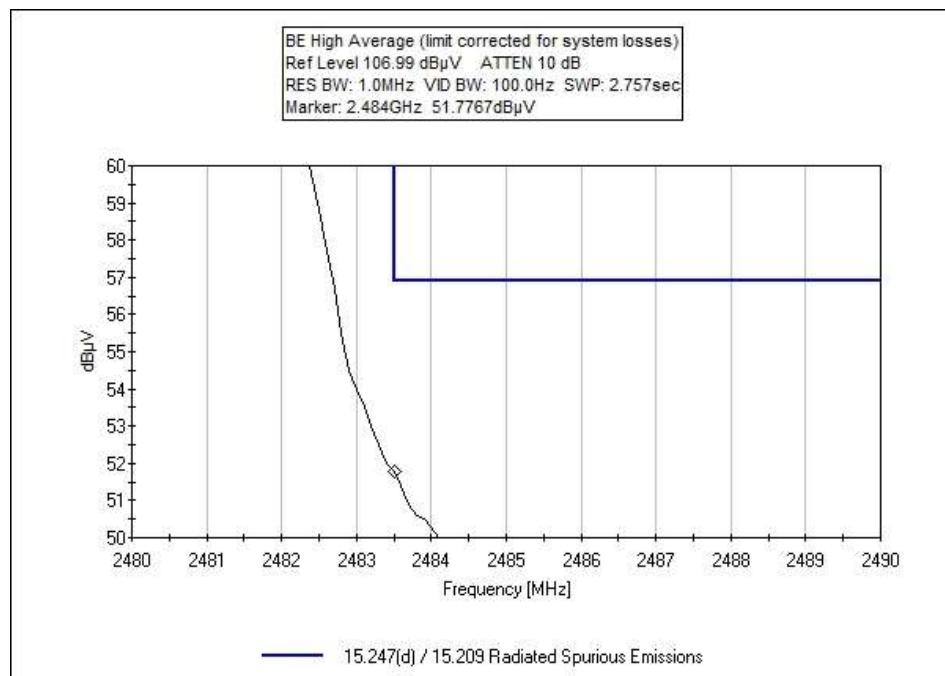
Test Distance: 3 Meters

#	Freq MHz	Rdng dB μ V	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar
			T5 dB	T6 dB						Ant	
1	2483.500M Ave	51.7 +27.7	+0.0 +0.4	+0.6 +0.4	+2.9	-34.5	+0.0	48.8	54.0	-5.2	Horiz
^	2483.500M	62.2	+0.0 +27.7	+0.6 +0.4	+2.9	-34.5	+0.0	59.3	54.0	+5.3	Horiz
3	2400.000M Ave	30.1 +27.7	+0.0 +0.4	+0.6 +0.4	+2.8	-34.6	+0.0	27.0	54.0	-27.0	Horiz
^	2400.000M	43.0	+0.0 +27.7	+0.6 +0.4	+2.8	-34.6	+0.0	39.9	54.0	-14.1	Horiz
5	2390.000M Ave	29.2 +27.7	+0.0 +0.4	+0.6 +0.4	+2.8	-34.6	+0.0	26.1	54.0	-27.9	Horiz
^	2390.000M	42.0	+0.0 +27.7	+0.6 +0.4	+2.8	-34.6	+0.0	38.9	54.0	-15.1	Horiz
7	2655.000M Ave	28.0 +28.4	+0.0 +0.4	+0.7 +0.4	+3.0	-34.5	+0.0	26.0	54.0	-28.0	Horiz
^	2655.000M	40.3	+0.0 +28.4	+0.7 +0.4	+3.0	-34.5	+0.0	38.3	54.0	-15.7	Horiz

Band Edge Plots







Test Setup Photo(s)



9KHz – 1GHz



1-26GHz



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

Reported uncertainties 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.