

EMISSIONS TEST REPORT

Report Number: 3152088BOX-001b

Project Number: 3152088

Testing performed on the

Personal Diabetes Manager

Model: G2PDM w/USB

To

FCC Part 15 Subpart C, Section 15.225


For

Insulet Corporation

Test Performed by:
Intertek – ETL SEMKO
70 Codman Hill Road
Boxborough, MA 01719


Test Authorized by:
Insulet Corporation
9 Oak Park Drive
Bedford, MA 01730

Prepared by:


Vathana Ven

Date: 08/27/08

Reviewed by:


Jeff Goulet

Date: 08/28/08

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1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of:

Company: Insulet Corporation
9 Oak Park Drive
Bedford, MA 01730
Contact: Peter Nachtygal
Telephone: 781-457-4739
Fax: 781-457-5011
Email: pnachtygal@insulet.com

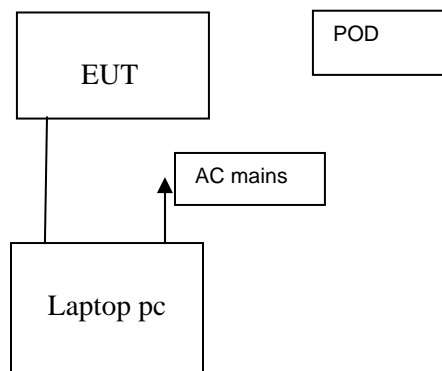
1.2 Equipment Under Test

Equipment Type: Personal Diabetes Manager
Model Number(s): G2PDM w/ USB
Serial number(s): 20000549, 20000112
Manufacturer: Insulet Corporation
EUT receive date: 04/01/ 2008
EUT received condition: A production unit was received with no visible damage.
Test start date: 04/01/ 2008
Test end date: 05/21/2008

1.3 Test Plan Reference: ANSI C63.4-2003

1.4 Test Configuration: The EUT is powered from a fresh 3V battery.

1.4.1 Block Diagram



1.4.2. Cables:

Cable	Shielding	Connector	Length (m)	Qty.
USB	Foil	Plastic	<3	1
AC mains	None	Plastic	<3	1

1.4.3. Support Equipment:

Name: Insulin Pump
Model No.: POD
Serial No.: 62308

Name: Dell laptop
Model No.: PP18L
Serial No.: Not labeled

Name: DELL ac adapter
Model No.: LA90PS0-00
Serial No.: Not labeled

Name: ACiSYS IR wireless interface
Not labeled
Not labeled

1.5 Mode(s) of Operation:

The EUT was wired to transmit continuously in modulated and unmodulated modes. It was also transferring data in the USB mode

1.6 Floor Standing Equipment: Applicable:_____ Not Applicable: X

2.0 Test Summary

TEST STANDARD	RESULTS	
FCC Part 15 Subpart C, Section 15.225		
SUB-TEST	TEST PARAMETER	PASS/FAIL
Spurious Radiated Emissions	FCC Part 15 Subpart C, Section 15.209 – 9kHz-1000MHz	Pass
Fundamental Radiated Emissions	FCC Part 15 Subpart C, Section 15.225	Pass
Frequency Stability	FCC Part 15 Subpart C, Section 15.225 – $\pm 0.01\%$ of Fundamental Frequency	Pass
Line Conducted Emissions	Not Applicable – battery powered	Not Applicable

REVISION SUMMARY – The following changes have been made to this Report:

<u>Date</u>	<u>Project No.</u>	<u>Project Handler</u>	<u>Page(s)</u>	<u>Item</u>	<u>Description of Change</u>
8/27/08	3152088	Nick Abbondante	All	Report number, frequency stability	Updated report number of revised report, added more frequency stability data
7/7/08	3152088	Nick Abbondante	All	Report number, IEC 60601 testing, FCC data	Updated report number of revised report, removed references to IEC 60601-1-2 testing, and updated data table to reflect the FCC limit

3.0 Sample Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$\begin{aligned} RA &= 52.0 \text{ dB}\mu\text{V} \\ AF &= 7.4 \text{ dB/m} \\ CF &= 1.6 \text{ dB} \\ AG &= 29.0 \text{ dB} \\ FS &= 32 \text{ dB}\mu\text{V/m} \end{aligned}$$

$$\text{Level in } \mu\text{V/m} = [10(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB μ V

- RF = Reading from receiver in dB μ V
- LF = LISN Correction Factor in dB
- CF = Cable Correction Factor in dB
- AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where UF = Net Reading in } \mu\text{V}$$

Example:

$$\begin{aligned} NF &= RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V} \\ UF &= 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 254 \mu\text{V/m} \end{aligned}$$

3.1 Measurement Uncertainty

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes.

The expanded uncertainty ($k = 2$) for radiated emissions from 30 to 1000 MHz has been determined to be:

± 3.5 dB at 10m, ± 3.8 dB at 3m

The expanded uncertainty ($k = 2$) for mains conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 2.6 dB

The expanded uncertainty ($k = 2$) for telecom port conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 3.2 for ISN and voltage probe measurements

± 3.1 for current probe measurements

3.2 Site Description

Test Site(s): 1, 2

Our OATS are 3m and 10m sheltered emissions measurement ranges located in a light commercial environment in Boxborough, Massachusetts. They meet the technical requirements of ANSI C63.4-2003 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity (12,000 lb. in Site 3) is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

Test Results: Pass

Test Standard: FCC Part 15 Subpart C, Section 15.225

Test: Radiated Emissions

Performance Criterion: Readings below 15.225 and 15.209 limits.

Test Environment:

Environmental Conditions During Testing:	Ambient (°C):	20 21	Humidity (%):	30 29	Pressure (hPa):	1050 1022
Pretest Verification Performed	Yes		Equipment under Test:	G2PDM w/ USB		
Test Engineer(s):	Gary Ball/Vathana Ven		EUT Serial Number:	20000549		

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	01/25/2009
3	ANTENNA	EMCO	3142	9711-1225	06/05/2008
4	3 Meter In floor cable for site 2	ITS	RG214B/U	S2 3M FLR	09/17/2008
5	LOOP ANTENNA	Empire	LP-105	905	09/21/2008
6	ANTENNA, LOOP	Solar Electronics	7334-1	11899	11/26/2008
7	Digital 4 Line Barometer	Mannix	0ABA116	BAR1	05/20/2008
8	ANTENNA	EMCO	3142	9711-1224	12/05/2008
9	EMI Receiver Set W/RF Filter	Hewlett Packard	8542E	3625A00188	09/25/2008
10	RF FILTER	Hewlett Packard	85420E	3427A00126	09/25/2008
11	10 Meter in floor cable for site 1	ITS	RG214B/U	S1 10M FLR	09/07/2008

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

Test Results:

Radiated Emissions

Company: Insulet Corporation
 Model #: Gen II PDM
 Serial #: 20000549
 Engineers: Vathana Ven
 Project #: 3149944 Date(s): 05/06/08
 Standard: FCC Part 15 Subpart C 15.225
 Receiver: R&S ESCI (ROS002) Limit Distance (m): 3
 PreAmp: NONE Test Distance (m): 3
 Modes: Wireless and USB
 PreAmp Used? (Y or N): N Voltage/Frequency: Battery Frequency Range: 9KHz - 30 MHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Antenna & Cables: LF Bands: N, LF, HF, SHF
 Antenna: Loop2_E-Field_09-21-08.txt SOL1_11-26-08
 Cable(s): S2 3M FLR 9-17-08.txt NONE
 Barometer: BAR2
 Location: Site 2
 Temp/Humidity/Pressure: 24 deg. C 30% 1050 mB

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; NF = Noise Floor; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	
QP	V	0.500	-15.7	54.1	0.0	0.0	0.0	38.4	73.6	-35.2	9/300 kHz	FCC
QP	V	5.000	-15.3	44.9	0.2	0.0	0.0	29.8	69.5	-39.7	9/300 kHz	NF
QP	V	10.000	-16.0	41.4	0.4	0.0	0.0	25.8	69.5	-43.7	9/300 kHz	NF
QP	V	15.000	-17.0	41.1	0.4	0.0	0.0	24.5	69.5	-45.0	9/300 kHz	NF
QP	V	20.000	-16.6	40.0	0.5	0.0	0.0	23.9	69.5	-45.6	9/300 kHz	NF
QP	V	25.000	-15.8	40.1	0.6	0.0	0.0	24.9	69.5	-44.6	9/300 kHz	NF

Radiated Emissions

Company: Insulet Corporation
 Model #: Gen II PDM
 Serial #: 20000549
 Engineers: Vathana Ven
 Project #: 3149944 Date(s): 05/06/08
 Standard: FCC Part 15 Subpart C 15.225
 Receiver: R&S ESCI (ROS002) Limit Distance (m): 3
 PreAmp: NONE Test Distance (m): 3
 Mode: Wireless
 PreAmp Used? (Y or N): N Voltage/Frequency: Battery Frequency Range: 13.56 MHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Antenna & Cables: LF Bands: N, LF, HF, SHF
 Antenna: Loop2_E-Field_09-21-08.txt Loop2_E-Field_09-21-08.txt
 Cable(s): S2 3M FLR 9-17-08.txt NONE
 Barometer: BAR2
 Location: Site 2
 Temp/Humidity/Pressure: 24 deg. C 30% 1050 mB

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; NF = Noise Floor; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	
QP	V	13.558	15.0	41.1	0.4	0.0	0.0	56.5	124.0	-67.5	9/300 kHz	FCC
QP	V	13.556	8.3	41.1	0.4	0.0	0.0	49.8	124.0	-74.2	9/300 kHz	
QP	V	13.553	4.7	41.1	0.4	0.0	0.0	46.2	124.0	-77.8	9/300 kHz	
QP	V	13.410	-5.0	41.1	0.4	0.0	0.0	36.5	90.5	-54.0	9/300 kHz	RB
QP	V	13.110	-11.0	41.1	0.4	0.0	0.0	30.5	80.5	-50.0	9/300 kHz	
QP	V	13.567	4.3	41.1	0.4	0.0	0.0	45.8	124.0	-78.2	9/300 kHz	
QP	V	13.569	0.6	41.1	0.4	0.0	0.0	42.1	90.5	-48.4	9/300 kHz	
QP	V	13.710	-11.8	41.1	0.4	0.0	0.0	29.7	90.5	-60.8	9/300 kHz	
QP	V	13.715	-10.8	41.1	0.4	0.0	0.0	30.7	80.5	-49.8	9/300 kHz	
QP	V	14.010	-13.0	41.1	0.4	0.0	0.0	28.5	80.5	-52.0	9/300 kHz	

Test Results continued:

Company: Insulet Corp
 Model #: Gen II PDM
 Serial #: 20000549
 Engineers: Gary Ball
 Project #: 3149944
 Standard: FCC Part 15, Subpart C 15.209
 Receiver: HP 8542E (REC3/RECFL2)
 PreAmp: NONE
 Mode: Wireless
 PreAmp Used? (Y or N): N
 Voltage/Frequency: 3VDC Battery
 Frequency Range: 30-1000 MHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Antenna & Cables: N Bands: N, LF, HF, SHF
 Antenna: LOG3 V10m 12-05-08.txt LOG3 H10m 12-05-08.txt
 Cable(s): S1 10m Floor 9-7-08..txt NONE.
 Barometer: BAR1

Location: Site 1
 Date(s): 04/03/08
 Temp/Humidity/Pressure: 21C 29% 1022

Limit Distance (m): 3
 Test Distance (m): 10

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	
QP	V	40.650	9.8	9.1	0.9	0.0	-10.5	30.3	40.0	-9.7	120/300 kHz	FCC
QP	V	67.800	8.6	5.5	1.2	0.0	-10.5	25.8	40.0	-14.2	120/300 kHz	
QP	V	108.400	5.0	8.1	1.7	0.0	-10.5	25.3	43.5	-18.2	120/300 kHz	RB
QP	V	122.040	6.2	7.5	1.8	0.0	-10.5	26.0	43.5	-17.5	120/300 kHz	
QP	V	135.800	6.3	7.5	2.0	0.0	-10.5	26.3	43.5	-17.2	120/300 kHz	RB
QP	V	149.300	5.9	9.3	2.1	0.0	-10.5	27.9	43.5	-15.6	120/300 kHz	
QP	V	189.880	6.7	11.2	2.3	0.0	-10.5	30.8	43.5	-12.7	120/300 kHz	

Company: Insulet Corp
 Model #: Gen II PDM
 Serial #: 20000549
 Engineers: Gary Ball
 Project #: 3149944
 Standard: FCC Part 15 Subpart C 15.209
 Receiver: HP 8542E (REC3/RECFL2)
 PreAmp: NONE
 PreAmp Used? (Y or N): N
 Voltage/Frequency: 3VDC Battery
 Frequency Range: 30-1000 MHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

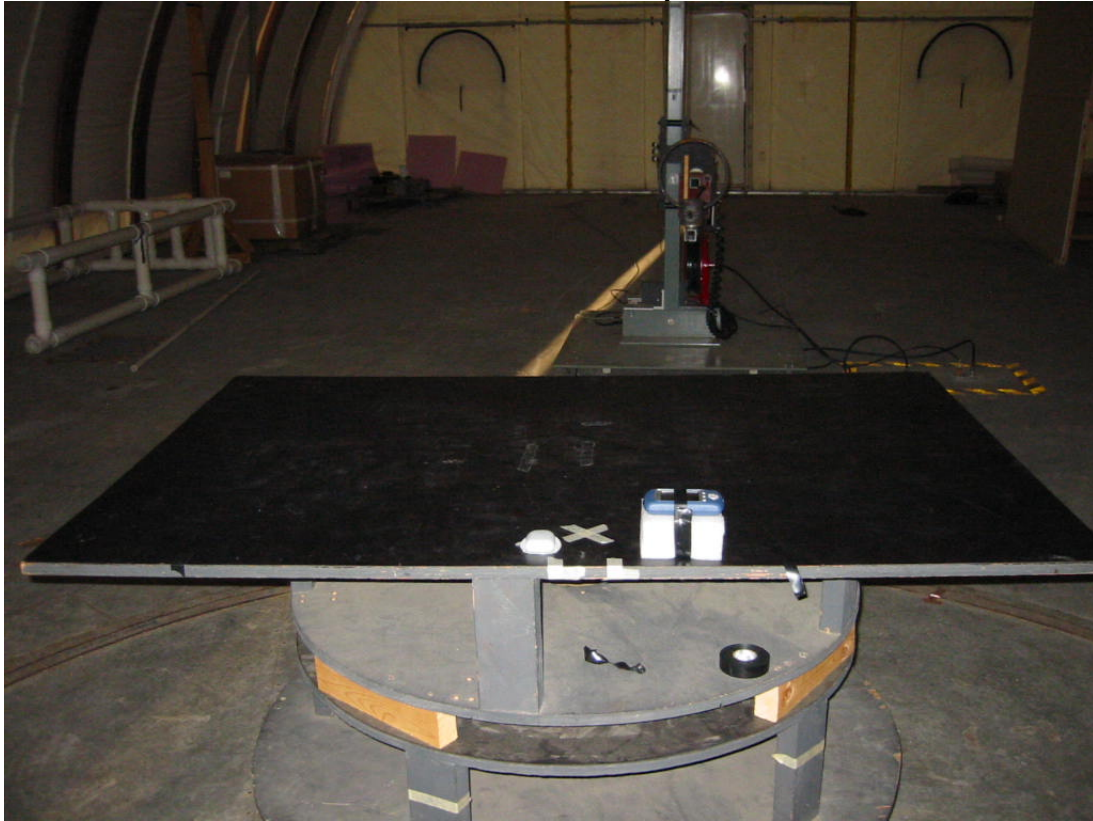
Antenna & Cables: N Bands: N, LF, HF, SHF
 Antenna: LOG3 V10m 12-05-08.txt LOG3 H10m 12-05-08.txt
 Cable(s): S1 10m Floor 9-7-08..txt NONE.
 Barometer: BAR1

Location: Site 1
 Date(s): 04/03/08
 Temp/Humidity/Pressure: 19C 29% 1023mb

Limit Distance (m): 10
 Test Distance (m): 10

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	
Note: With USB Cable and Dell Laptop PC												FCC
QP	V	39.660	8.1	9.3	0.9	0.0	-10.5	28.9	40.0	-11.1	120/300 kHz	
QP	V	49.860	11.8	6.6	1.1	0.0	-10.5	30.0	40.0	-10.0	120/300 kHz	
QP	V	108.400	3.2	8.1	1.7	0.0	-10.5	23.5	43.5	-20.0	120/300 kHz	RB
QP	V	133.600	5.6	7.5	1.9	0.0	-10.5	25.5	43.5	-18.0	120/300 kHz	RB
QP	V	149.300	5.6	9.3	2.1	0.0	-10.5	27.6	43.5	-15.9	120/300 kHz	
QP	V	189.880	3.2	11.2	2.3	0.0	-10.5	27.3	43.5	-16.2	120/300 kHz	
QP	V	265.900	6.7	13.7	3.4	0.0	-10.5	34.3	46.0	-11.7	120/300 kHz	

Radiated Emissions Setup Photos



Radiated Emissions Setup Photos continued



Radiated Emissions Setup Photos Continued



Radiated Emissions Setup Photos continued



Test Results: Pass

Test Standard: FCC Part 15 Subpart C, Section 15.225

Test: Frequency Stability

Performance Criterion: Frequency remains within the assigned band

EUT Operating Voltage: Battery powered

Test Environment:

Environmental Conditions During Testing:	Ambient (°C):	23	Humidity (%):	31	Pressure (hPa):	1001
Pretest Verification Performed	Yes		Equipment under Test:	G2PDM w/ USB		
Test Engineer(s):	Vathana Ven, Nicholas Abbondante		EUT Serial Number:	20000549, 2000112		

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	Small Temperature/Humidity Chamber	Bryant Manufacturing	TH-5S	1207	02/13/2009
2	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	01/25/2009
3	6 line Digital Barometer*	Mannix	0ABA8886	SAF285	12/28/2008
4	Spectrum Analyzer	Hewlett Packard	8591E	3346A02319	05/06/2009
5	DC Power Supply (0-25V 0-10A)	Kepco	ATE 25-10M	62616	Verified
6	DMM	Fluke	73	70612227	09/04/2008
7	Temp/Humidity Chamber	Envirotronics	SH27C	08015563S11264	03/18/2009

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	2/07/05 Revision

Test Results:

Date(s): 7-May-08

EUT S/N: 20000549

Test: FCC Part 15 Subpart C, Section 15.225 (Frequency Stability)

Mode: Continuous unmodulated

Test Equipment Used:

ROS002

SAF187

SAF285

23 deg. C

31% 1001 mB

Temp. (Celsius)	Frequency (MHz)	Deviation (MHz)	Deviation (%)	Max.Drift (MHz)
-10	13.56050	-0.00005	-0.00037	0.00136
0	13.55999	0.00049	0.00360	0.00136
10	13.56045	0.00003	0.00022	0.00136
20	13.56048	0.00000	0.00000	0.00136
30	13.55999	-0.00049	-0.00360	0.00136
40	13.56019	0.00029	0.00213	0.00136

Frequency Stability

Company: Insulet Corporation

Model #: Gen II PDM

Serial #: 20000112

Engineer(s): Nicholas Abbondante

Project #: 3153449

Standard: FCC 15.225

Test Equipment Used:

SA0003

148007

146021

148013

Location: Littleton

Date(s): 05/21/08

Nominal f: 13.56 MHz

Voltage:

3 VDC

%	Voltage Volts	Temp Celsius	Flow, MHz	Deviation, kHz	Fhigh, MHz	Deviation, kHz	Max Drift, kHz
-20%	2.4	-20	13.557080	0.00	13.566380	0.30	1.356
+0%	3	-20	13.556780	0.30	13.566380	0.30	1.356
+0%	3	+20	13.557080	0.00	13.566680	0.00	1.356
-20%	2.4	+55	13.556630	0.45	13.566530	0.15	1.356
+0%	3	+55	13.556780	0.30	13.566600	0.08	1.356

Note that Flow and Fhigh were measured at the 15 dB down points of the modulated waveform.