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FCC Part 15 Report of Measurements

On

Unity Infusion Pump

Customer Name: Deka Research and Development

Customer P.O.: DEKA 132937

Date of Report Rev: June 18, 2020

Test Report No: R-6508N-1, Rev. A

Test Start Date: March 23, 2020

Test Finish Date: March 23, 2020

Test Technician: M. Seamans

Approved By: T. Hannemann

Report Rev Prepared By: T. Hannemann



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Technical Information

Report Number: R-6508N-1, Rev. A

Customer: Deka Research and Development

Address: 340 Commercial St.
Manchester, NH 03101

Manufacturer: Deka Research and Development

Manufacturer Address: 340 Commercial St.
Manchester, NH 03101

Test Sample: Unity Infusion Pump

Model Number: DKPI-21096-001

FCC ID Number: 2ATGA01

Antenna Type: ½ Wave Patch Antenna Gain -10dB

Power Requirements: 5 VDC via one (1) Lithium Ion Battery

Frequency of Operation: 2.400 GHz to 2.4835 GHz
(3) Lowest channel, mid-band channel and highest channel

Tested Frequencies:

Test Specification:

FCC Rules and Regulations Part 15, Subpart C, Section 15.249

Test Procedure:

ANSI C63.4:2014

ANSI C63.10:2013

Test Facility:

Retlif Testing Laboratories

101 New Boston Road

Goffstown, NH 03045

FCC Designation Number: US5327



Retlif Testing Laboratories

Report No. R-6508N-1, Rev. A

Tests Performed

The test methods performed on the EUT are shown below:

Testing Dates	Test Method	Test Results
March 23, 2020	15.249 (a) Fundamental & Harmonic Emissions	Complied
March 23, 2020	15.249 (d) Out of Band/Bandedge Emissions	Complied
March 23, 2020	15.249 (e) Peak Field Strength	Complied

Test Sample Description:

The Unity Infusion Pump is designed to infuse a fluid subcutaneously into the patient based on an individualized software programmed schedule. The Pump is powered by an operator chargeable – rechargeable battery. The Pump has no provisions for AC connection, the battery must be removed from the Pump for charging. The Pump communicates with a remote interface via Bluetooth.

The Unity Infusion Pump was manufactured by Deka Research & Development Corporation of Manchester, NH 03101.

Support Equipment:

Description	Manufacturer	Part Number	Model Number	Serial Number
Laptop Computer	Compaq	N/A	Presario CQ62	N/A
Pump Interface	Deka	DKPI-50061-0091	DKPI-50061-0091	N/A
Battery Breakout 2	Deka	DKPI-50054-0090	DKPI-50054-0090	N/A



Retlif Testing Laboratories

Report No. R-6508N-1, Rev. A

Certification and Signatures

We certify that this report is a true representation of the results obtained from the tests of the equipment stated. We further certify that the measurements shown in this report were made in accordance with the procedures indicated and vouch for the qualifications of all Retlif Testing Laboratories personnel taking them.



Todd Hannemann
EMC Test Engineer
iNARTE Certified Technician ATL-0255-T



Scott Wentworth
Branch Manager

Non-Warranty Provision

The testing services have been performed, findings obtained and reports prepared in accordance with generally accepted laboratory principles and practices. This warranty is in lieu of all others, either expressed or implied.

Non-Endorsement

This test report contains only findings and results arrived at after employing the specific test procedures and standards listed herein. It is not intended to constitute a recommendation, endorsement or certification of the product or material tested. This report must not be used by the client to claim product endorsement by ANSI National Accreditation Board (ANAB).



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Report No. R-6508N-1, Rev. A

Revision History

Revisions to this document are listed below; the latest revised document supersedes all previous issues of this document.

Revision	Date	Pages Affected
-	June 9, 2020	Original Release
A	June 18, 2020	Global Changes: • Test Report No. R-6508N-1to R-6508N-1, Rev. A
		7: • Added RF exposure calculations



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Report No. R-6508N-1, Rev. A

Measurement Procedures:

15.249 (a/d) Field Strength of Fundamental, Harmonic and Out of Band/Band Edge Emissions (Radiated Emissions)

The field strength of the fundamental, harmonic and out of band/bandedge emissions were measured in the frequency range of 30 MHz to 25 GHz. The EUT was placed on a 80cm high wooden test stand located 3 meters from the test antenna on a FCC listed open area test site. Emissions from the EUT were maximized and the field strength of each observed emission was measured, recorded and compared to the specified limits of 15.249 (a)/(d)/(e)/15.209 as appropriate. Peak field strength of emissions were measured, recorded and verified to meet the specified limit (limit corresponds to 20dB above the maximum permitted average limit). When necessary, the marker/delta method was used to verify bandedge compliance.

Table 1 - Field Strength of Emissions, Limits

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
2400 – 2483.5 MHz	50	500



Retlif Testing Laboratories

Report No. R-6508N-1, Rev. A

RF Exposure Limits

Transmitters operating under 15.249 must be operated in a manner that ensures the public is not exposed to RF energy levels in excess of the commission's guidelines. Based on the transmitter power and maximum antenna gain (see calculation below) the minimum separation distance was calculated to determine the distance for acceptable MPE power density levels to meet both the Occupational/Controlled Exposure and the General Population/Uncontrolled Exposure requirements of FCC Part 1.1310. The calculation below uses the more stringent General Population MPE Limits.

Field strength to power calculations from ANSI C63.10

E = Measured Electric Field Strength = 89.89 dBuV/M

d = Radiated test Measurement Distance = 3 Meters

EIRP Log = E + 20log(d) - 104.7

EIRP Log = 89.89 + 20log(3) - 104.7

EIRP Log = -5.27 dBm

EIRP Linear = 0.000297 W

Gain = Max Power Gain of Antenna = -10 dBi = 0.1 Numeric

Power = EIRP Linear / Gain Numeric

Power = 0.000297 / 0.1

Power = Max Power Input to Antenna = 0.3mW

D = Minimum Separation Distance in cm

S = Max allowed Power Density in mW/cmsq

Per 1.1310 For the Frequency of 2400 MHz S = 1 mW/cmsq

$$1 \text{ mW/cmsq} = \frac{0.3 \times 0.1}{4 \times (3.14) \times D^2} = \frac{0.03}{12.56 \times D^2}$$

$$D^2 = \frac{0.03}{12.56 \times 1}$$

$$D = \sqrt{0.002} = 0.05 \text{ cm}$$



Retlif Testing Laboratories

Report No. R-6508N-1, Rev. A

Equipment Lists

Field Strength of Emissions

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1232	AGILENT / HP	PRE-AMPLIFIER	1 - 26.5 GHz	8449B	5/24/2019	5/31/2020
3258	ETS / EMCO	ANTENNA, DOUBLE RIDGED GUIDE	1 - 18 GHz	3115	12/2/2019	6/30/2021
4029B	RETLIF	OPEN AREA TEST SITE, ATTENUATION	3 / 10 Meters	RNH	9/30/2019	9/30/2021
5070	ROHDE & SCHWARZ	RECEIVER, EMI	20 Hz - 40 GHz	ESIB40	1/23/2020	1/31/2021
5179B	MICRO-COAX	CABLE, COAXIAL	10 kHz - 18 GHz	UFB311A-1-036050U50U	11/6/2019	11/30/2020
5242	TELEDYNE MICROWAVE	CABLE, COAXIAL	10 kHz - 6 GHz	PR90-195-1275, 106'	9/12/2019	9/30/2020

Out of Band/Bandedge Emissions

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1232	AGILENT / HP	PRE-AMPLIFIER	1 - 26.5 GHz	8449B	5/24/2019	5/31/2020
3258	ETS / EMCO	ANTENNA, DOUBLE RIDGED GUIDE	1 - 18 GHz	3115	12/2/2019	6/30/2021
3427B	ETS / EMCO	ANTENNA, BICONICAL	20 - 200 MHz	3104	4/25/2019	10/31/2020
3430	MCS	ANTENNA, HORN	18 - 26.5 GHz	K-5039	No Calibration Required	
4029B	RETLIF	OPEN AREA TEST SITE, ATTENUATION	3 / 10 Meters	RNH	9/30/2019	9/30/2021
443	ELECTRO-METRICS	ANTENNA, LOG PERIODIC	200 MHz - 1000 MHz	LPA-25	12/13/2019	6/29/2021
5070	ROHDE & SCHWARZ	RECEIVER, EMI	20 Hz - 40 GHz	ESIB40	1/23/2020	1/31/2021
5179B	MICRO-COAX	CABLE, COAXIAL	10 kHz - 18 GHz	UFB311A-1-036050U50U	11/6/2019	11/30/2020
5234	PASTERNAK	CABLE, COAXIAL	10 kHz - 18 GHz	PE302-230	8/14/2019	8/31/2020
5242	TELEDYNE MICROWAVE	CABLE, COAXIAL	10 kHz - 6 GHz	PR90-195-1275, 106'	9/12/2019	9/30/2020

Field Strength of Harmonics

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1232	AGILENT / HP	PRE-AMPLIFIER	1 - 26.5 GHz	8449B	5/24/2019	5/31/2020
3258	ETS / EMCO	ANTENNA, DOUBLE RIDGED GUIDE	1 - 18 GHz	3115	12/2/2019	6/30/2021
3430	MCS	ANTENNA, HORN	18 - 26.5 GHz	K-5039	No Calibration Required	
4029B	RETLIF	OPEN AREA TEST SITE, ATTENUATION	3 / 10 Meters	RNH	9/30/2019	9/30/2021
5070	ROHDE & SCHWARZ	RECEIVER, EMI	20 Hz - 40 GHz	ESIB40	1/23/2020	1/31/2021
5179B	MICRO-COAX	CABLE, COAXIAL	10 kHz - 18 GHz	UFB311A-1-036050U50U	11/6/2019	11/30/2020
5229	FLORIDA RS TECHNOLOGY	CABLE, COAXIAL	DC - 40 GHz	FLRST-2.92 (1026)	11/1/2019	11/30/2020
5234	PASTERNAK	CABLE, COAXIAL	10 kHz - 18 GHz	PE302-230	8/14/2019	8/31/2020



Retlif Testing Laboratories

Report No. R-6508N-1, Rev. A

Test Setup Photographs



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Report No. R-6508N-1, Rev. A

Test Setup Photographs Field Strength of Emissions



Horizontal Antenna Polarization



Vertical Antenna Polarization



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Report No. R-6508N-1, Rev. A

Test Setup Photographs
Field Strength of Spurious Emissions and Harmonics



EUT Configuration



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Report No. R-6508N-1, Rev. A

Test Setup Photographs

Field Strength of Spurious Emissions and Harmonics



30 to 200 MHz, Horizontal Antenna Polarization



30 to 200 MHz, Vertical Antenna Polarization



Retlif Testing Laboratories

Report No. R-6508N-1, Rev. A

Test Setup Photographs

Field Strength of Spurious Emissions and Harmonics



200 MHz to 1 GHz, Horizontal Antenna Polarization



200 MHz to 1 GHz, Vertical Antenna Polarization



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Report No. R-6508N-1, Rev. A

Test Setup Photographs
Field Strength of Spurious Emissions and Harmonics



1 to 18 GHz, Horizontal Antenna Polarization



1 to 18 GHz, Vertical Antenna Polarization



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Report No. R-6508N-1, Rev. A

Test Setup Photographs
Field Strength of Spurious Emissions and Harmonics



18 to 26.5 GHz, Horizontal Antenna Polarization



18 to 26.5 GHz, Vertical Antenna Polarization



Retlif Testing Laboratories

Report No. R-6508N-1, Rev. A

**FCC Section 15.249(a)
Field Strength of Emissions
Test Data**



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Report No. R-6508N-1, Rev. A

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	Field Strength of Emissions - Fundamental Field Strength
Customer	DEKA Research and Development
Job Number	R-6508N-1
Test Sample	Unity Infusion Pump
Part Number	DKPI-21096-001
Serial Number	200200026
Test Specification	FCC Part 15, Subpart C Paragraph: 15.249(a)
Operating Mode	Transmitting Bluetooth Signal
Technician	M. Seamans
Date	March 23 rd , 2020

Notes: Test Distance: 3 meters Detector: Peak Resolution BW: 1MHz
 No Duty Cycle Correction applied to the Peak Reading, EUT unable to transmit single pulse train at a defined Frequency.

TEST PARAMETERS

Frequency	Antenna Position	Measured level	Correction Factor	Corrected Peak Reading	Duty Cycle Factor	Peak Reading	Converted Peak Reading	Average Limit at 3m
MHz	H/V	dBuV	dB	dBuV/m	dB	dBuV/m	mV/m	mV/m
2402	V	86.03	1.63	87.66	0.00	87.66	24.154	50
2440	V	85.95	2.56	88.51	0.00	88.51	26.637	50
2480	V	86.37	3.52	89.89	0.00	89.89	31.224	50

TEST PARAMETERS

Frequency	Antenna Position	Measured level	Correction Factor	Corrected Peak Reading			Converted Peak Reading	Peak Limit at 3m
MHz	H/V	dBuV	dB	dBuV/m			mV/m	mV/m
2402	V	86.03	1.63	87.66			24.154	500
2440	V	85.95	2.56	88.51			26.637	500
2480	V	86.37	3.52	89.89			31.224	500

Peak Limit is 20dB higher than the Average limit.



Retlif Testing Laboratories

Report No. R-6508N-1, Rev. A

**FCC Section 15.249(a)
Field Strength of Harmonics
Test Data**



Retlif Testing Laboratories

Report No. R-6508N-1, Rev. A

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	Field Strength of Harmonics
Customer	DEKA Research and Development
Job Number	R-6508N-1
Test Sample	Unity Infusion Pump
Part Number	DKPI-21096-001
Serial Number	200200026
Test Specification	FCC Part 15, Subpart C Paragraph: 15.249(a)
Operating Mode	Transmitting Bluetooth Signal
Technician	M. Seamans
Date	March 23 rd , 2020

Notes: Test Distance: 3 meters Detector: Peak (Ambient Measurements use Average Detector)
 No Duty Cycle Correction applied to the Peak Reading, EUT unable to transmit single pulse train at a defined Frequency.

TEST PARAMETERS

Test Frequency	Antenna Position	EUT Orientation	Peak Reading	Duty Cycle Correction	Corrected Reading		Converted Peak Reading	Average Limit at 3M
MHz	(H/V)	X/Y/Z	dBuV	dB	dBuV/m		uV/m	uV/m
1000.00	-	-	-	-	-		-	500.00
	-	-	-	-	-		-	
	-	-	-	-	-		-	
4804.00*	H	Y	35.21	-	35.21		57.61	
7206.00*	H	Y	39.27	-	39.27		91.94	
9608.00*	H	Y	42.30	-	42.30		130.32	
12010.00*	H	Y	46.06	-	46.06		213.80	
14412.00*	H	Y	49.84	-	49.84		310.46	
16814.00*	H	Y	50.65	-	50.65		340.80	
19216.00*	H	Y	28.55	-	28.55		26.76	
21618.00*	H	Y	28.41	-	28.41		26.33	
24020.00*	H	Y	29.20	-	29.20		28.84	
	-	-	-	-	-		-	
	-	-	-	-	-		-	
25000.00	-	-	-	-	-		-	500.00

EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * Indicates Ambient Reading (Average Detector)



Retlif Testing Laboratories

Report No. R-6508N-1, Rev. A

**FCC Section 15.249(d)
Out of Band/Bandedge Emissions
Test Data**



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Report No. R-6508N-1, Rev. A

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	Out of Band/Banded Emissions 30 MHz to 1 GHz
Customer	DEKA Research and Development
Job Number	R-6508N-1
Test Sample	Unity Infusion Pump
Part Number	DKPI-21096-001
Serial Number	200200026
Test Specification	FCC Part 15, Subpart C Paragraph: 15.249(d), 15.209
Operating Mode	Transmitting Bluetooth Signal
Technician	M. Seamans
Date	March 23 rd , 2020

Notes: Test Distance: 3 meters Detector: Quasi-Peak

TEST PARAMETERS

Frequency	Antenna Position	EUT Orientation	Meter Reading	Correction Factor	Corrected Reading			Limit at 3M
MHz	(H/V) / Height	Degrees	dBuV	dB	dBuV/m			dBuV/m
30.00	-	-	-	-	-			40.0
	-	-	-	-	-			
38.00*	V-1m	0.0	11.75	12.35	24.10	*		
	-	-	-	-	-			
88.00	-	-	-	-	-			40.0
88.00	-	-	-	-	-			43.5
	-	-	-	-	-			
115.00*	V-1m	0.0	8.34	14.56	22.90	*		
130.00*	V-1m	0.0	6.53	14.67	21.20	*		
170.00*	V-1m	0.0	8.24	17.26	25.50	*		
	-	-	-	-	-			
216.00	-	-	-	-	-			43.5
216.00	-	-	-	-	-			46.0
	-	-	-	-	-			
611.00*	V-1m	0.0	6.81	23.49	30.30	*		
	-	-	-	-	-			
960.00	-	-	-	-	-			46.0
960.00	-	-	-	-	-			54.0
	-	-	-	-	-			
975.00*	V-1m	0.0	7.89	29.71	37.60	*		
	-	-	-	-	-			
1000.00	-	-	-	-	-			54.0

EUT emissions within 10 dB of the specified test limit were evaluated at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).



Retlif Testing Laboratories

Report No. R-6508N-1, Rev. A

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	Out of Band/Bandedge Emissions 1 GHz to 25 GHz	
Customer	DEKA Research and Development	
Job Number	R-6508N-1	
Test Sample	Unity Infusion Pump	
Part Number	DKPI-21096-001	
Serial Number	200200026	
Test Specification	FCC Part 15, Subpart C	Paragraph: 15.249(d), 15.209
Operating Mode	Transmitting Bluetooth Signal	
Technician	M. Seamans	
Date	March 23 rd , 2020	

Notes: Test Distance: 3 meters Detector: Average

Emissions at the band edges were measured to be more than 10 dB below the specified limit in 15.209.

TEST PARAMETERS

Frequency	Antenna Position	EUT Orientation	Meter Reading	Correction Factor	Corrected Reading			Average Limit at 3M
MHz	(H/V) / Height	Degrees	dBuV	dB	dBuV/m			dBuV/m
1000.00	-	-	-	-	-			54.0
	-	-	-	-	-			
	-	-	-	-	-			
7206.00*	H	0.0	32.02	7.25	39.27	*		
9608.00*	H	0.0	32.19	10.11	42.30	*		
12010.00*	H	0.0	32.41	13.65	46.06	*		
14412.00*	H	0.0	32.76	17.08	49.84	*		
	-	-	-	-	-			
	-	-	-	-	-			
	-	-	-	-	-			
	-	-	-	-	-			
	-	-	-	-	-			
25000.00	-	-	-	-	-			54.0

EUT emissions within 10 dB of the specified test limit were evaluated at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).



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Report No. R-6508N-1, Rev. A