



166 South Carter, Genoa City, WI 53128

Company: Danco, Inc.
Model Tested: 1400708
Report Number: 21072
Project Number: 7126

Code of Federal Regulations 47 Part 15 – Radio Frequency Devices

Subpart C – Intentional Radiators

Section 15.231

**Periodic operation in the band 40.66 - 40.70 MHz
and above 70 MHz**

THE FOLLOWING **MEETS THE ABOVE TEST SPECIFICATION**

Formal Name:	OneTap
Kind of Equipment:	Standalone battery operated transmitter for water filtration system
Frequency Range:	433.92 MHz
Test Configuration:	Battery operated transmitter tested for intentional radiated emissions in three orthogonal planes.
Model Number(s):	1400708
Model(s) Tested:	1400708
Serial Number(s):	none (Test Sample)
Date of Tests:	June 16, 2015
Test Conducted For:	Danco, Inc. 501 Earl Road Shorewood, IL 60404, USA

NOTICE: “This test report relates only to the items tested and must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government”. Please see the "Description of Test Sample" page listed inside of this report.

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Company:
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Project Number:

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SIGNATURE PAGE

Tested By:

Paul Leo
Test Engineer

Reviewed By:

William Stumpf
OATS Manager

Approved By:

Brian Mattson
General Manager



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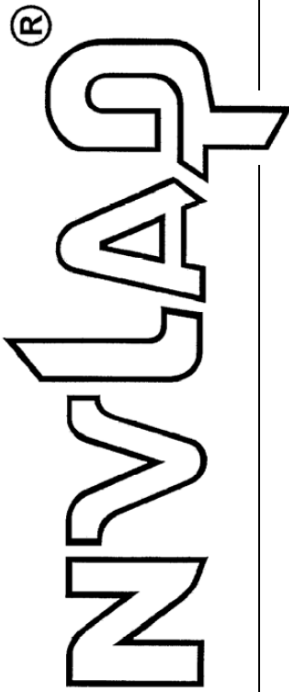


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United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 100276-0

D.L.S. Electronic Systems, Inc.
Wheeling, IL

is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communiqué dated January 2009).*



2014-10-01 through 2015-09-30

Effective dates

Wm. D. M. L.

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)



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1.0 Summary of Test Report

It was determined that the Danco, Inc. OneTap, Model 1400708, complies with the requirements of CFR 47 Part 15 Subpart C Section 15.231.

Subpart C Section 15.231 Applicable Technical Requirements Tested:

Section	Description	Procedure	Note	Compliant?
15.231(c)	20 dB Emission Bandwidth	ANSI C63.4-2014 & ANSI C63.10-2013	1,2	Yes
15.231(a)(1)	Automatic Deactivation	ANSI C63.4-2014 & ANSI C63.10-2013	1,2	Yes
15.231(b) (and 15.205)	Field Strength of Emissions - Fundamental and Spurious -	ANSI C63.4-2014 & ANSI C63.10-2013	1,2	Yes
15.35(c)	Duty Cycle	ANSI C63.4-2014 & ANSI C63.10-2013	1,2	Yes

Note 1: Tested in 3 orthogonal planes.

Note 2: Radiated emission measurement.

2.0 Introduction

On June 16, 2015 the OneTap, Model 1400708, as provided from Danco, Inc. was tested to the requirements of CFR 47 Part 15 Subpart C Section 15.231. To meet these requirements, the procedures contained within this report were performed by personnel of D.L.S Electronic Systems, Inc. who are responsible to Donald L. Sweeney, Senior EMC Engineer.

3.0 Test Facilities

D.L.S. Electronic Systems, Inc. is a full service EMC/Safety Testing Laboratory accredited to ISO 17025. NVLAP Certificate and Scope can be viewed at <http://www.dlsemc.com/certificate>. Our facilities are registered with the FCC, Industry Canada, and VCCI.

Wisconsin Test Facility:

D.L.S. Electronic Systems, Inc.
166 S. Carter Street
Genoa City, Wisconsin 53128

Wheeling Test Facility:

D.L.S. Electronic Systems, Inc.
1250 Peterson Drive
Wheeling, IL 60090

FCC Registration # 90531



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4.0 Description of Test Sample

Description:

The OneTap transmitter is a battery powered device that resides on top of the counter. Its purpose is to communicate to a filter system that resides below the counter that filtered water is requested. The unit tested used production PCB assemblies mounted in a 3-D printed acrylic based photo-polymer (plastic) prototype housing. The production housing will be made from ABS (plastic) and rubber components.

Type of Equipment / Frequency Range:

Water Filtration System Transmitter / 433.92 MHz

Physical Dimensions of Equipment Under Test:

Length: 76 mm x Width: 76 mm x Height: 18 mm

Power Source:

3V DC battery.

Internal Frequencies:

26 MHz, 16 MHz

Transmit / Receive Frequencies Used For Test Purpose:

433.92 MHz

Type of Modulation(s) / Antenna Type:

OOK / Integral antenna

Description of Circuit Board(s) / Part Number:

XMTR PCB	1401 Rev 1.3
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5.0 Test Equipment

A list of the equipment used can be found in the table below. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.

D.L.S. Wisconsin – OATS 2 30 to 1000MHz

Description	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Dates	Cal Due Dates
Receiver	Rohde & Schwarz	ESI 26	837491/010	20 Hz – 26 GHz	7-17-14	7-17-15
Preamplifier	Rohde & Schwarz	TS-PR10	032001/004	9 kHz – 1 GHz	1-7-15	1-7-16
Antenna	EMCO	3104C	00054892	20 MHz – 200 MHz	10-1-14	10-1-16
Antenna	EMCO	3146	1205	200 MHz – 1 GHz	10-24-14	10-24-16
Test Software	Rohde & Schwarz	ESK-1	V1.7.1	N/A	N/A	N/A

Above 1 GHz

Description	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Dates	Cal Due Dates
Preamp	Miteq	AMF-7D-01001800-22-10P	17779900	1GHz-18GHz	1-26-15	1-26-16
Horn Antenna	Com Power	AH118	071127	1-18GHz	9-3-14	9-3-16
Test Software	Rohde & Schwarz	ESK-1	V1.7.1	N/A	N/A	N/A

6.0 Test Arrangements

Radiated Emissions Measurement Arrangement:

All radiated emission measurements were performed at D.L.S. Electronic Systems, Inc. and set up according to ANSI C63.4-2014 and ANSI C63.10-2013, unless otherwise noted. Description of procedures and measurements can be found in Appendix B – Measurement Data. See Appendix A for additional photos of the test set up.

Unless otherwise noted, the bandwidth of the measuring receiver / analyzer used during testing is shown below.

Frequency Range	Bandwidth (-6 dB)
10 to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
30 MHz to 1 GHz	120 kHz
Above 1 GHz	1 MHz



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7.0 Test Conditions

Test Conditions recorded during test:

Temperature and Humidity:

70°F at 20% RH

Battery Voltage:

3 V DC

8.0 Modifications Made To EUT For Compliance

None noted at time of test.

9.0 Additional Descriptions

The EUT is the transmitter portion of a wirelessly controlled filtered water on demand system. The system consists of two boards - a receiver unit mounted on the filter unit and the transmitter. The system "wakes up" when the water is turned on at the faucet. Filtered water can then be obtained by pressing a button on the transmitter. The transmitter is on only when the user presses the button on the device. The maximum transmit time no matter how long the user holds down the button is 65.93ms.

10.0 Results

Measurements were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013. Graphical and tabular data can be found in Appendix B at the end of this report.

11.0 Conclusion

The OneTap, Model 1400708, as provided from Danco, Inc. tested in June, 2015 **meets** the requirements of CFR 47 Part 15 Subpart C Section 15.231.



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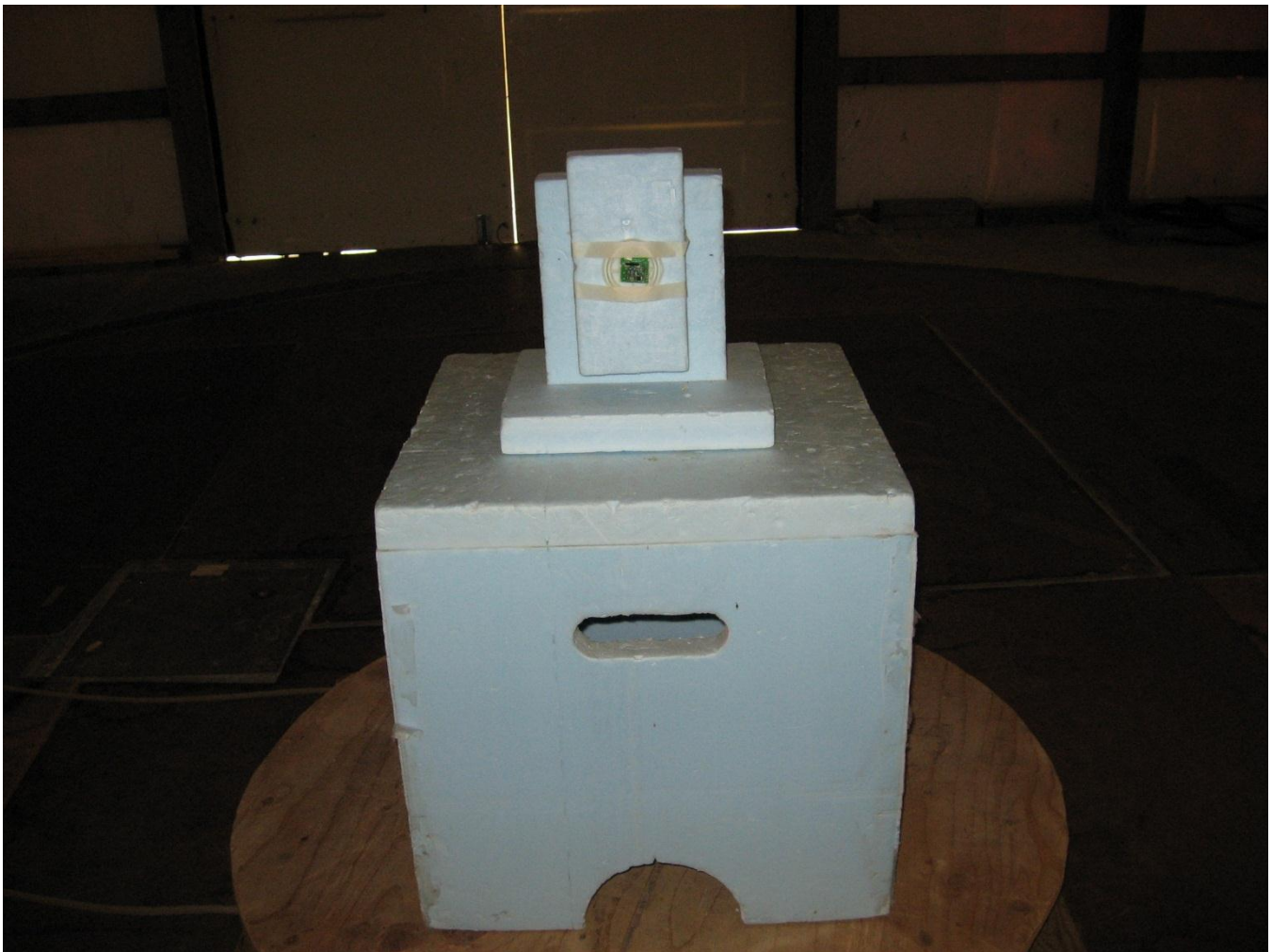
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Appendix A – Test Photos

Photo Information and Test Setup:

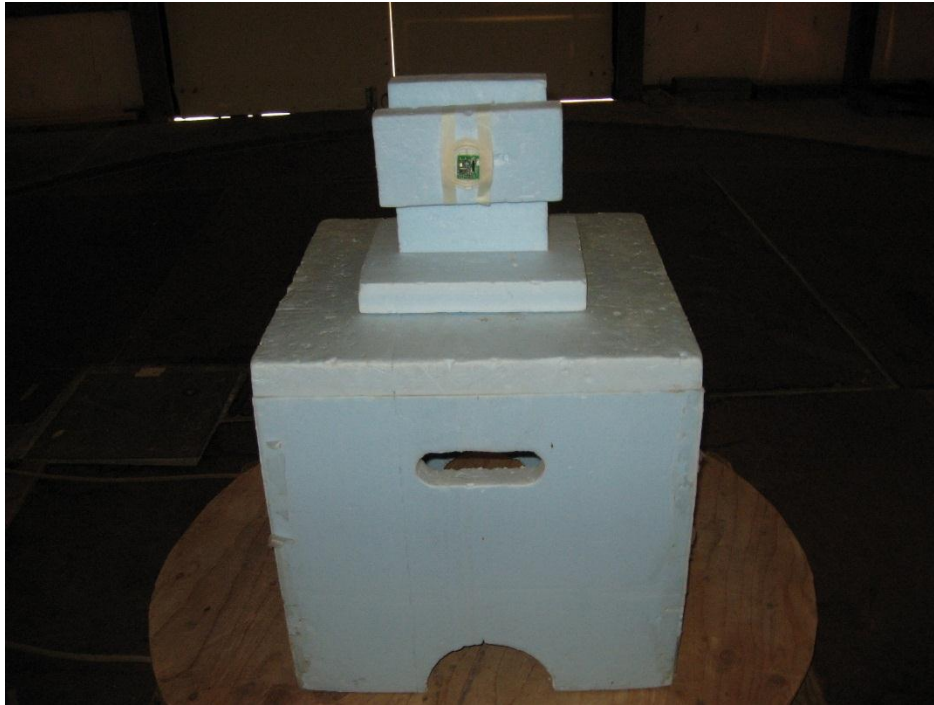
Item: OneTap, Model 1400708

Radiated Emissions – ‘X’ Position



Appendix A

Radiated Emissions – ‘Y’ Position



Radiated Emissions – ‘Z’ Position



Appendix A

Radiated Emissions – Above 1000 MHz – Front



Radiated Emissions – Above 1000 MHz – Back





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Appendix B – Measurement Data

B1.0 Emission Bandwidth – 20 dB

Rule Part:

Section 15.231 (c)

Test Procedure:

ANSI C63.4-2014 and ANSI C63.10-2013

Limit:

Section 15.231 (c) :

$$433.92 \text{ MHz} \times 0.25\% = 1.0848 \text{ MHz}$$

Results:

Compliant
20 dB bandwidth: **486.97kHz**

Sample Equation(s):

None

Notes:

This was a radiated emissions measurement. The maximum field strength of the emission was determined and the bandwidth was measured from the points at 20 dB down from the modulated carrier.

Using the ANSI 63.10 test procedure it was impossible to achieve a RBW of 1% to 5% of the OBW. Because the carrier was >20db above the modulation products the standard 100khz RBW was used.



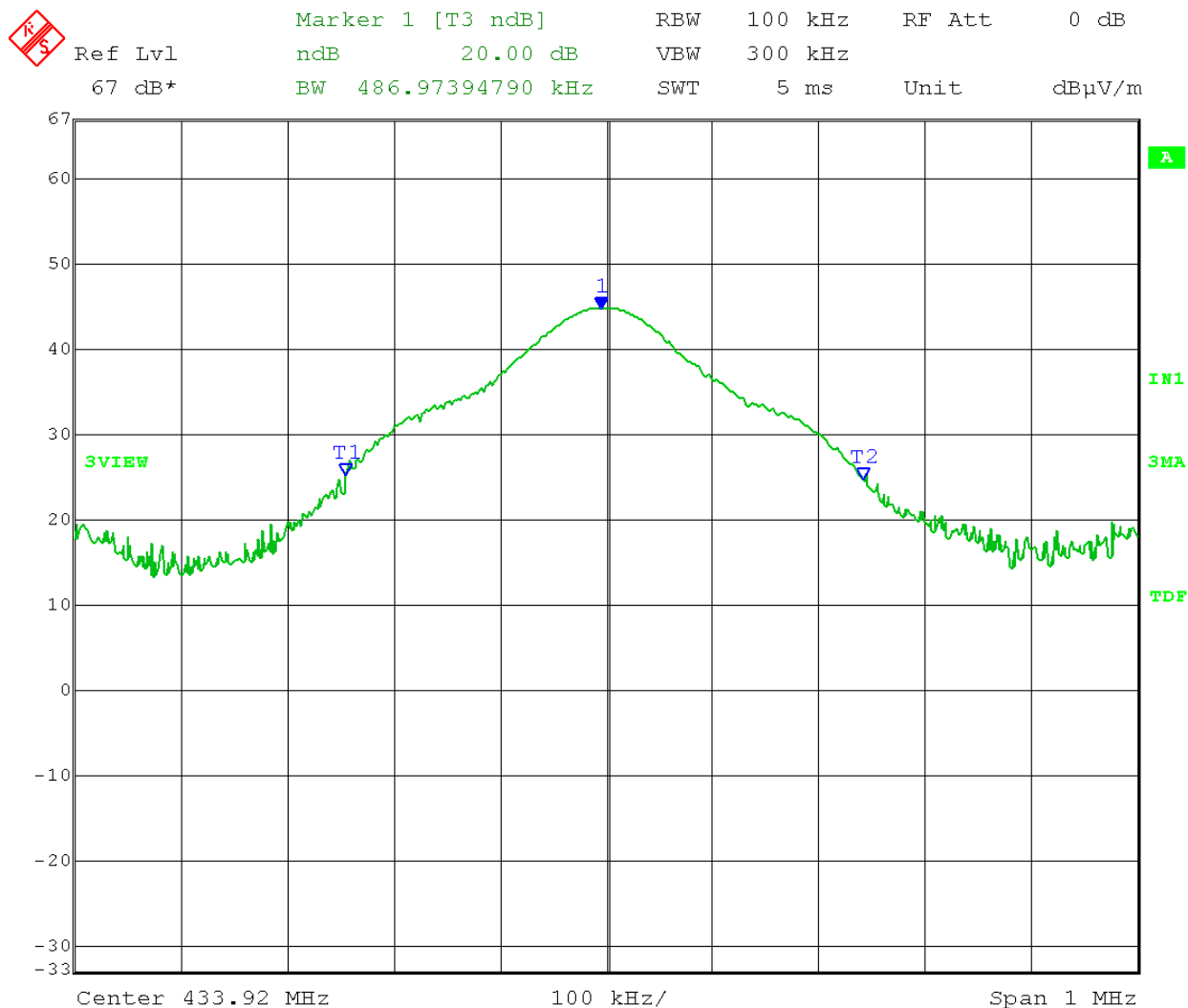
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Company: Danco, Inc.
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Test Date: 6-16-2015
Company: Danco, Inc.
EUT: OneTap
Test: 20 dB Bandwidth
Operator: Paul L

Comment: SPAN 2 to 5 times occupied bandwidth
RBW between 1% and 5% of occupied bandwidth

20 dB Bandwidth = 486.97khz



Date: 16.JUN.2015 16:08:06



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Appendix B

B2.0 Automatic Deactivation

Rule Part:

15.231 (a) (1)

Test Procedure:

ANSI C63.4-2014 and ANSI C63.10-2013

Limit:

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Results:

Compliant
Time of deactivation: 65.93ms

Sample Equation(s):

None

Notes:

The transmitter is On only when the user presses the switch. The maximum transmit time regardless of how long the user holds down the switch is 65.93ms.

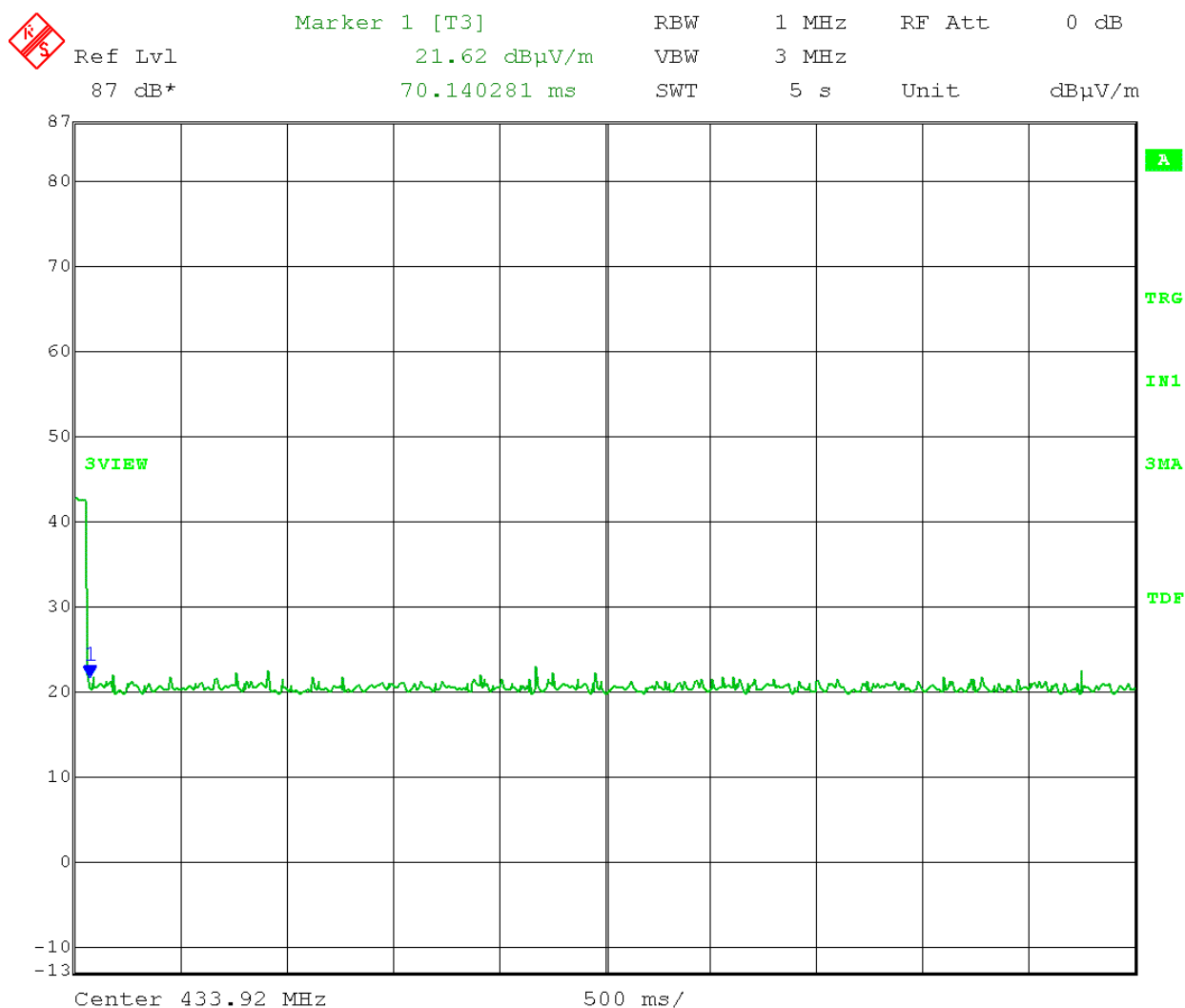


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Company: Danco, Inc.
Model Tested: 1400708
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Test Date: 6-16-2015
Company: Danco, Inc
EUT: OneTap
Test: Automatic Deactivation
Operator: Paul L

Comment: A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds after being released.



Date: 16.JUN.2015 16:17:49



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Company:	Danco, Inc.
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Appendix B

B3.0 Field Strength of Emissions – Fundamental and Spurious

Rule Part:

15.231 (b) including 15.205

Test Procedure:

ANSI C63.4-2014 and ANSI C63.10-2013

Limit:

Fundamental (F) $\mu\text{V/m}$ at 3 meters: $41.6667(F) - 7083.3333$

The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

Results:

Compliant

Sample Equation(s):

$41.6667(F) - 7083.3333 = 10996.68 \mu\text{V/m}$ at 3 meters

$20 * \log(10996.68) = 80.825 \text{ dB } \mu\text{V/m}$ at 3 meters

Final Corrected = Total Level - Duty Cycle Correction

Margin = Limit - Final Corrected

Level = Total Level - System Loss - Antenna Factor

Notes:

Measurements were taken of the fundamental and spurious at a distance of three meters between the EUT and the measuring antenna. The EUT was rotated in 3 orthogonal planes and the highest emission was recorded. Since the unit was not able to transmit continuously, at a 100 % duty cycle, compliance is determined by comparing peak data, minus duty cycle correction, to the average limit.

Radiated Fundamental and Spurious Emissions – 30 MHz to 5.0 GHz

Tested at a 3 Meter Distance

EUT: OneTap
Manufacturer: Danco, Inc.
Operating Condition: 70 deg F; 20% R.H.
Test Site: Site 2
Operator: Paul L
Test Specification: FCC Part 15.231(b) and 15.205
Comment: Transmit frequency: 433.92 MHz
Date: 06-16-2015
Notes: All other emissions at least 20 dB under the limit.

Frequency (MHz)	Measurement Type	Antenna Polarization	Level (dBuV)	Antenna Factor (dB/m)	System Loss (dB)	Duty Cycle Correction (dB)	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	EUT Angle (deg)	Comment
433.94	Max Peak	Vert	75.50	16.40	-21.5	0	70.4	100.82	30.4	1.00	270	Fundamental
433.94	Average	Vert	75.50	16.40	-21.5	-3.618	66.8	80.82	14.0	1.00	270	Fundamental
433.94	Max Peak	Horz	71.80	16.40	-21.5	0	66.7	100.82	34.1	2.50	330	Fundamental
433.94	Average	Horz	71.80	16.40	-21.5	-3.618	63.1	80.82	17.7	2.50	330	Fundamental
867.88	Max Peak	Vert	60.18	22.92	-19.3	0	63.8	80.8	17.0	1.00	90	Harmonic
867.88	Average	Vert	60.18	22.92	-19.3	-3.618	60.2	60.8	0.6	1.00	90	Harmonic
867.88	Max Peak	Horz	58.88	22.92	-19.3	0	62.5	80.8	18.3	1.00	0	Harmonic
867.88	Average	Horz	58.88	22.92	-19.3	-3.618	58.9	60.8	1.9	1.00	0	Harmonic
1301.82	Max Peak	Vert	78.44	25.66	-57.0	0	47.1	74	26.9	1.00	270	Restricted Band
1301.82	Average	Vert	78.44	25.66	-57.0	-3.618	43.5	54	10.5	1.00	270	Restricted Band
1301.82	Max Peak	Horz	74.04	25.66	-57.0	0	42.7	74	31.3	1.25	90	Restricted Band
1301.82	Average	Horz	74.04	25.66	-57.0	-3.618	39.1	54	14.9	1.25	90	Restricted Band
1735.75	Max Peak	Vert	69.51	25.99	-56.0	0	39.5	80.8	41.3	1.00	180	Harmonic
1735.75	Average	Vert	69.51	25.99	-56.0	-3.618	35.9	60.8	24.9	1.00	180	Harmonic
1735.75	Max Peak	Horz	66.81	25.99	-56.0	0	36.8	80.8	44.0	1.25	90	Harmonic
1735.75	Average	Horz	66.81	25.99	-56.0	-3.618	33.2	60.8	27.6	1.25	90	Harmonic
2169.69	Max Peak	Vert	67.83	28.37	-55.6	0	40.6	80.8	40.2	1.00	0	Harmonic
2169.69	Average	Vert	67.83	28.37	-55.6	-3.618	37.0	60.8	23.8	1.00	0	Harmonic
2169.69	Max Peak	Horz	67.13	28.37	-55.6	0	39.9	80.8	40.9	1.00	45	Harmonic
2169.69	Average	Horz	67.13	28.37	-55.6	-3.618	36.3	60.8	24.5	1.00	45	Harmonic

Radiated Fundamental and Spurious Emissions – 30 MHz to 5.0 GHz

Tested at a 3 Meter Distance

EUT: OneTap
Manufacturer: Danco, Inc.
Operating Condition: 70 deg F; 20% R.H.
Test Site: Site 2
Operator: Paul L
Test Specification: FCC Part 15.231(b) and 15.205
Comment: Transmit frequency: 433.92 MHz
Date: 06-16-2015
Notes: All other emissions at least 20 dB under the limit.

Frequency (GHz)	Measurement Type	Antenna Polarization	Level (dBuV)	Antenna Factor (dB/m)	System Loss (dB)	Duty Cycle Correction (dB)	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	EUT Angle (deg)	Comment
2603.62	Max Peak	Vert	68.29	29.81	-55.6	0	42.5	80.8	38.3	1.00	0	Harmonic
2603.62	Average	Vert	68.29	29.81	-55.6	-3.618	38.9	60.8	21.9	1.00	0	Harmonic
2603.62	Max Peak	Horz	68.89	29.81	-55.6	0	43.1	80.8	37.7	1.25	0	Harmonic
2603.62	Average	Horz	68.89	29.81	-55.6	-3.618	39.5	60.8	21.3	1.25	0	Harmonic
3037.56	Max Peak	Vert	74.35	29.95	-55.8	0	48.5	80.8	32.3	1.50	180	Harmonic
3037.56	Average	Vert	74.35	29.95	-55.8	-3.618	44.9	60.8	15.9	1.50	180	Harmonic
3037.56	Max Peak	Horz	78.55	29.95	-55.8	0	52.7	80.8	28.1	1.00	180	Harmonic
3037.56	Average	Horz	78.55	29.95	-55.8	-3.618	49.1	60.8	11.7	1.00	180	Harmonic
3471.50	Max Peak	Vert	70.58	30.92	-56.1	0	45.4	80.8	35.4	1.00	90	Harmonic
3471.50	Average	Vert	70.58	30.92	-56.1	-3.618	41.8	60.8	19.0	1.00	90	Harmonic
3471.50	Max Peak	Horz	70.28	30.92	-56.1	0	45.1	80.8	35.7	1.00	45	Harmonic
3471.50	Average	Horz	70.28	30.92	-56.1	-3.618	41.5	60.8	19.3	1.00	45	Harmonic
3905.43	Max Peak	Vert	72.49	31.23	-56.7	0	47.0	74	27.0	1.00	180	Restricted Band
3905.43	Average	Vert	72.49	31.23	-56.7	-3.618	43.4	54	10.6	1.00	180	Restricted Band
3905.43	Max Peak	Horz	69.07	31.23	-56.7	0	43.6	74	30.4	1.25	0	Restricted Band
3905.43	Average	Horz	69.07	31.23	-56.7	-3.618	40.0	54	14.0	1.25	0	Restricted Band
4339.40	Max Peak	Vert	72.84	32.06	-56.7	0	48.2	74	25.8	1.00	180	Restricted Band
4339.40	Average	Vert	72.84	32.06	-56.7	-3.618	44.6	54	9.4	1.00	180	Restricted Band
4339.40	Max Peak	Horz	71.24	32.06	-56.7	0	46.6	74	27.4	1.25	0	Restricted Band
4339.40	Average	Horz	71.24	32.06	-56.7	-3.618	43.0	54	11.0	1.25	0	Restricted Band



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Appendix B

B4.0 Duty Cycle Correction

Rule Part:

15.35 (c)

Test Procedure:

ANSI C63.4-2014 and ANSI C63.10-2013

Limit:

Informative

Results:

Informative

Sample Equation(s):

See Data

Notes:

EUT was not able to transmit continuously, compliance is determined by comparing peak data minus duty cycle correction to the average limit.



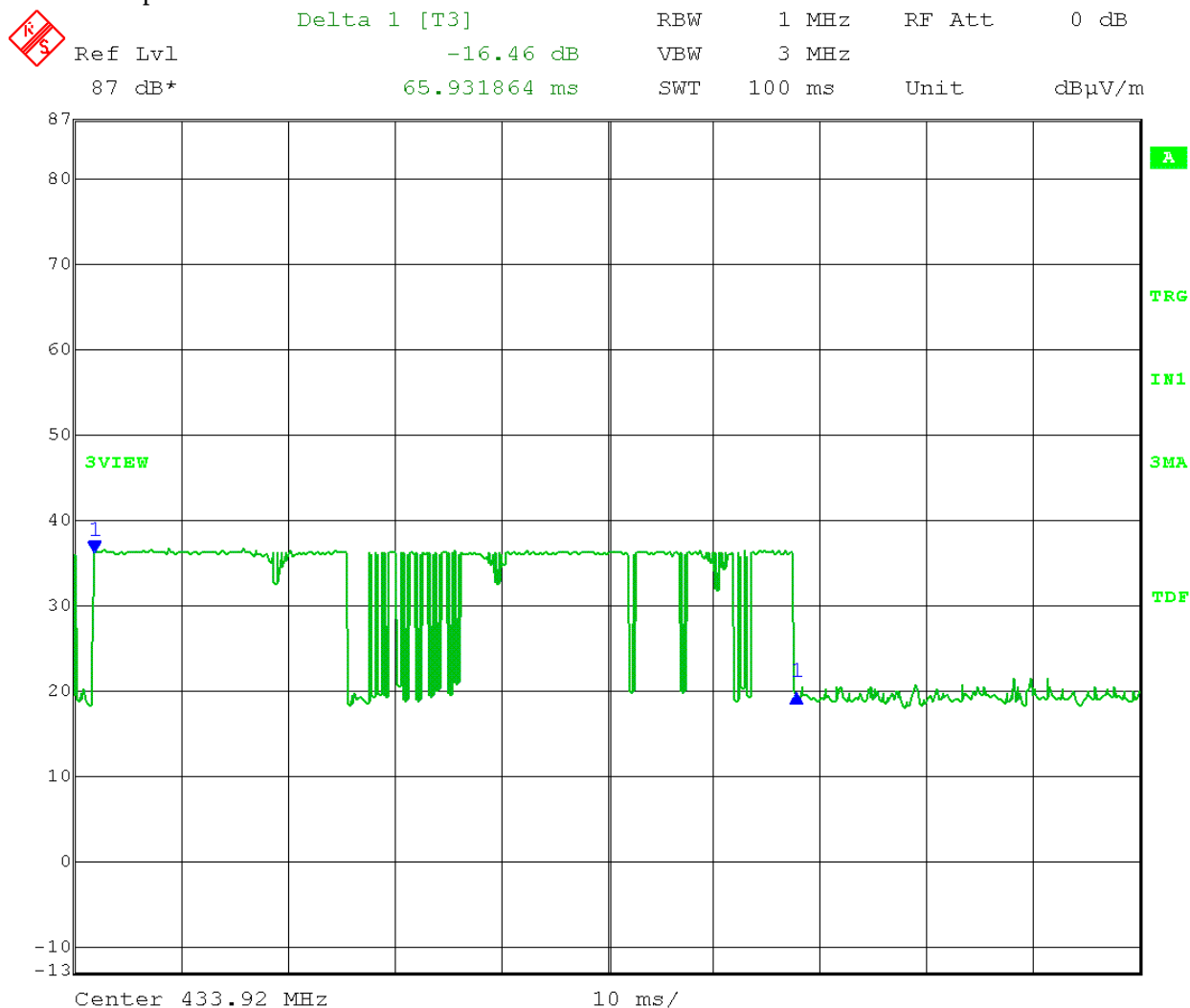
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Company: Danco, Inc.
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Test Date: 6-16-2015
Company: Danco, Inc.
EUT: OneTap
Test: Duty Cycle – worst case for normal operation
Operator: Paul L

Comment: ON time of one pulse train = 65.93ms
Duty Cycle correction = $20 \log (65.93/100) = -3.618 \text{ dB}$

100ms sweep:



Date: 16.JUN.2015 08:53:43



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END OF REPORT

Revision #	Date	Comments	By
1.0	6-22-2015	Preliminary Release	JS
1.1	11-5-2015	Product name & description added	JS