Excellence in Compliance Testing

Certification Test Report

FCC ID: SO7-206C0000
IC: 11009A-206C0000

FCC Rule Part: 15.231
IC Radio Standards Specification: RSS-210

ACS Report Number: 14-0169.W04.1A

Manufacturer: Pella Corporation
Model: 206C0000

Test Begin Date: April 24, 2014
Test End Date: May 8, 2014

Report Issue Date: May 29, 2014

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Prepared by: _____

Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This report contains 20 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210 for a class II permissive change.

The purpose of the class II permissive change is to include a new antenna and antenna matching circuit design as well as changes to the transmit duty cycle.

1.2 Product description

The 206C0000 Roller Shade can be automatically raised and lowered to improve the comfort and convenience of the home.

Frequency Range: 433.92 MHz
Operating channels: 1
Modulation: ASK (OOK)
Operating Voltage: 9VDC battery
Antenna Type / Gain: Loop Antenna; -6dBi gain

Manufacturer Information:
Pella Corporation
102 Main St
Pella, IA 50009
USA

Test Sample Serial Number(s): FCC2 PC

Test Sample Condition: The test sample was provided in working order with no visible defects.

1.3 Test Methodology and Considerations

The EUT was evaluated in an orientation representative of typical installation.

Only those characteristics affected by the modifications described in section 1.1 were reported.

The EUT is a battery powered device; therefore AC power line conducted emissions were not performed.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 200612-0. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Registration Number: 511277
Industry Canada Lab Code: IC 4175A-1
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

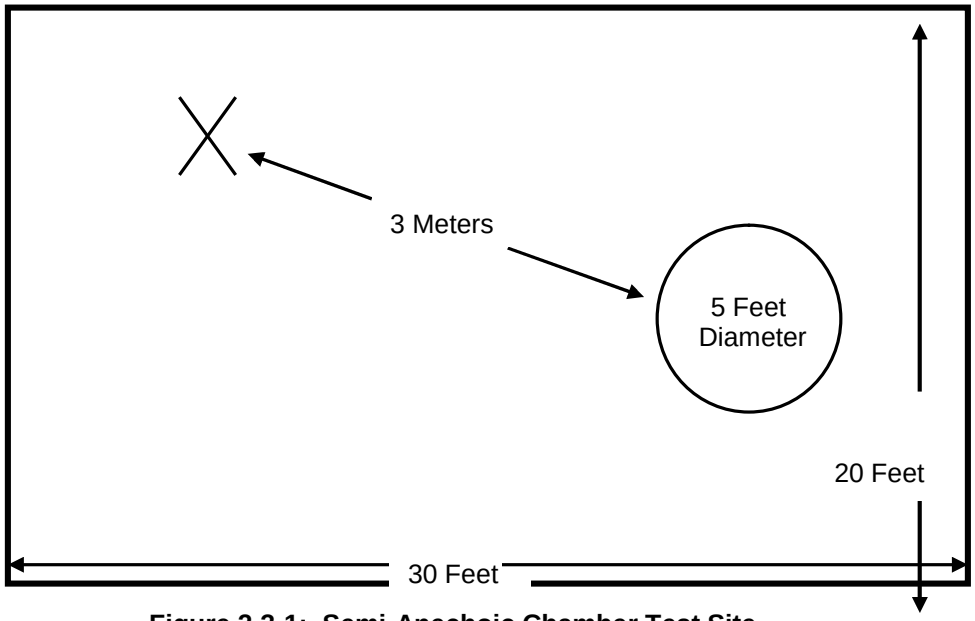

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

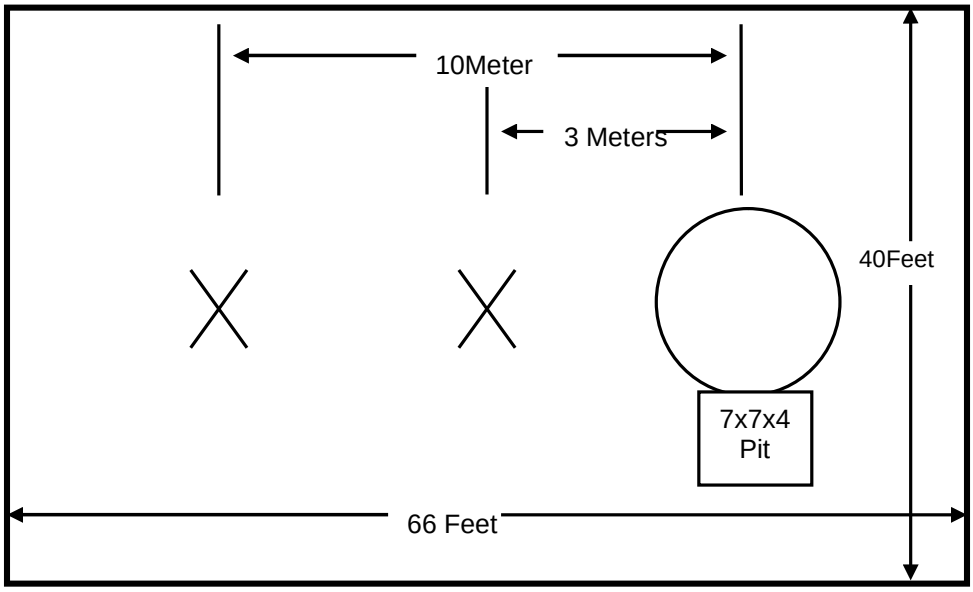

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal ground reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 4.1.3-1:

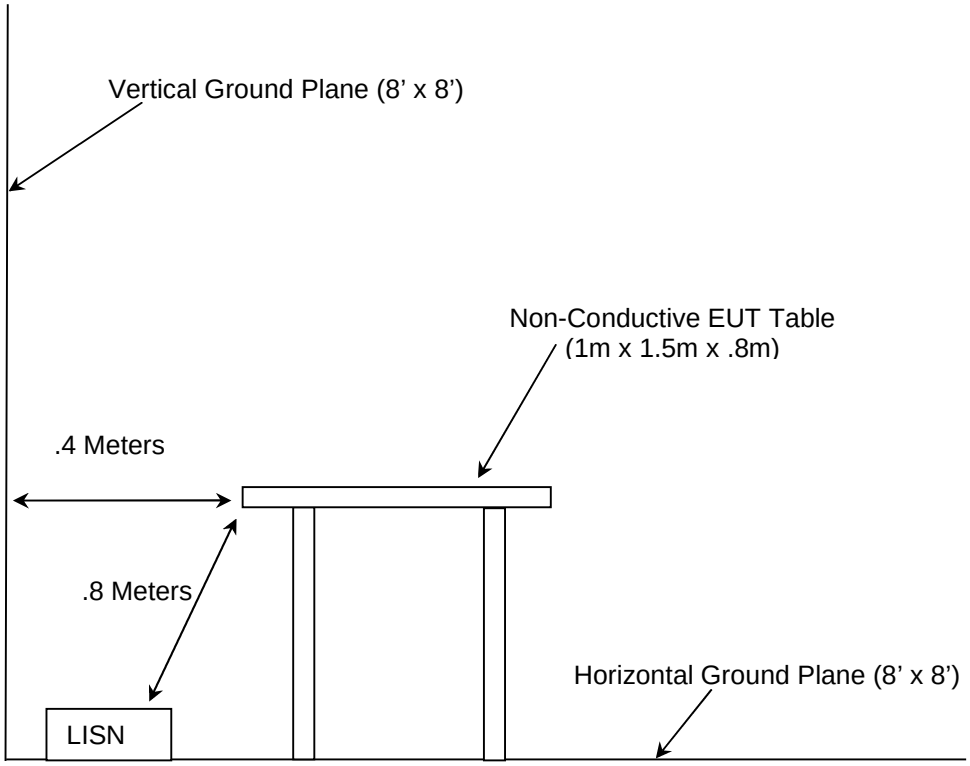

Figure 2.4-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2014
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2014
- Industry Canada Radio Standards Specification: RSS-210 – Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8, December 2010
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3, December 2010.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
1	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	833771/007	8/2/2012	8/2/2014
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	8/2/2012	8/2/2014
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/23/2013	4/23/2015
40	EMCO	3104	Antennas	3211	2/14/2013	2/14/2015
73	Agilent	8447D	Amplifiers	2727A05624	7/16/2013	7/16/2014
167	ACS	Chamber EMI Cable Set	Cable Set	167	11/7/2013	11/7/2014
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	3/17/2014	3/17/2015
331	Microwave Circuits	H1G513G1	Filters	31417	6/19/2013	6/19/2014
338	Hewlett Packard	8449B	Amplifiers	3008A01111	7/30/2013	7/30/2015
412	Electro Metrics	LPA-25	Antennas	1241	7/27/2012	7/27/2014
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	11/7/2013	11/7/2014
616	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	N/A	9/26/2013	9/26/2014
622	Rohde & Schwarz	FSV40	Analyzers	101338	11/19/2013	11/19/2014

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item #	Manufacturer	Equipment Type	Model Number	Serial Number
The EUT operates standalone therefore no support equipment was utilized.				

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

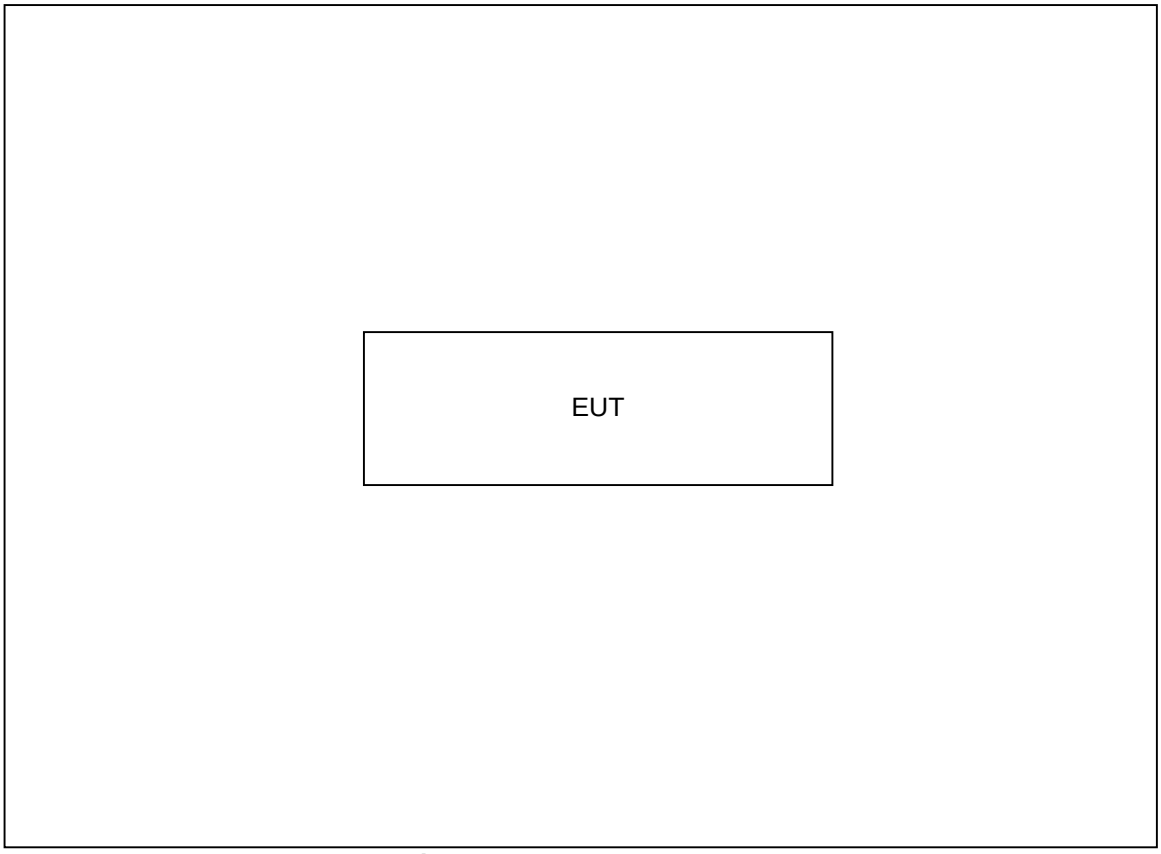

Figure 6-1: EUT Test Setup

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: CFR 47 Part 15.203

The EUT utilizes a loop antenna that is designed on a printed circuit board, thus satisfying Part 15.203. The antenna gain is -6 dBi.

7.2 Power Line Conducted Emissions – FCC: CFR 47 Part 15.207/ IC: RSS-GEN 7.2.4

7.2.1 Measurement Procedure

The EUT is battery operated therefore power line conducted emissions is not applicable.

7.3 Periodic Operation – FCC: CFR 47 15.231(a) / IC: RSS-210 A1.1.1

7.3.1 Test Methodology

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

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

The transmitter was activated automatically and was evaluated using a spectrum analyzer at zero span with a > 5 second sweep time.

7.3.2 Test Results

The transmitter ceased operation 269.57 ms after being activated. The results are shown in Figure 7.3.2-1.

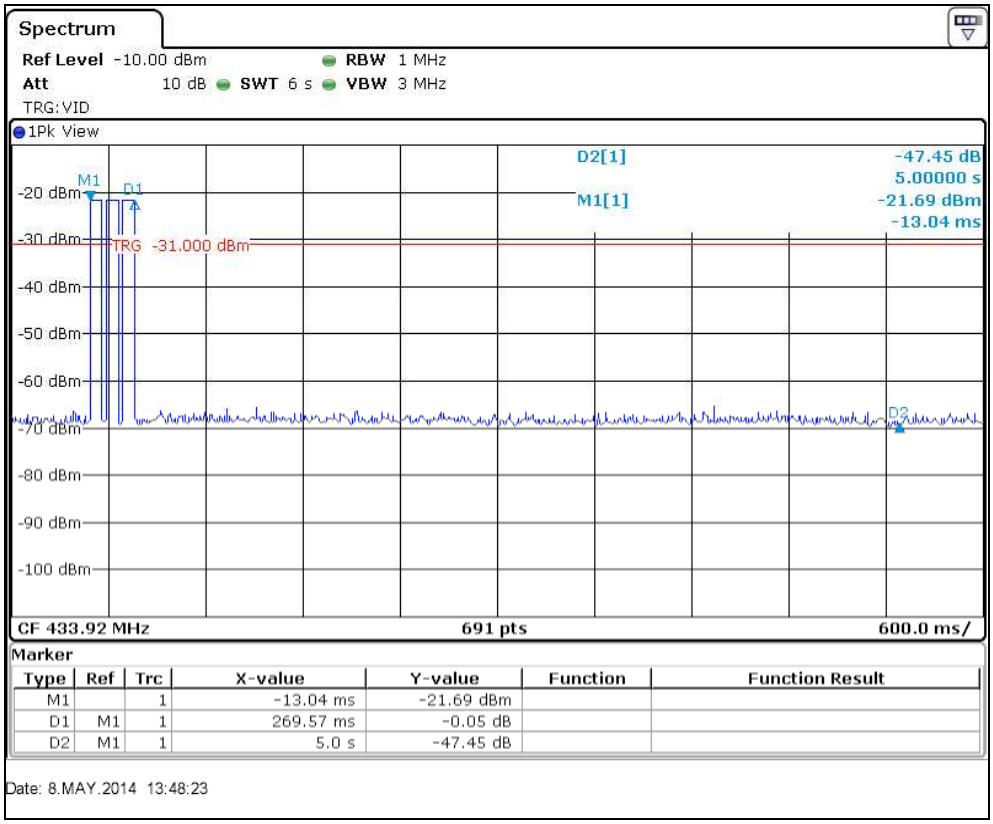

Figure 7.3.2-1: TX Hold Time

7.4 Radiated Emissions – FCC: CFR 47 15.231(b) / IC: RSS-210 A1.1.2

7.4.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 5GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz. For frequencies above 1000MHz, average and peak measurements were made with RBW of 1 MHz and a VBW of 3 MHz. For wanted emissions that require an average measurement, a RBW greater than the emission bandwidth shall be used. Therefore, a 1MHz RBW was used to measure the fundamental emissions.

Further, compliance with the provisions of 15.205 was demonstrated using the measurement instrumentation specified in that section where applicable.

7.4.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 9.235 dB to account for the duty cycle of the EUT. The worst case duty cycle was determined to be 34.533%. The duty cycle correction factor is determined using the formula: 20log (34.533/100) = -9.235 dB. Determination of the duty cycle correction is included in the plots and justification below.

Period (T) = 100 ms
Number Pulses (N1) = 193
Pulse Width (T1) = 0.117ms
Number Pulse (N2) = 48
Pulse Width (T2) = 0.249ms
(N1*T1 + N2*T2)/T = ((193*0.117) + (48*0.249))/100 = 0.3453
20*Log(0.3453) = -9.235 dB Average Correction Factor

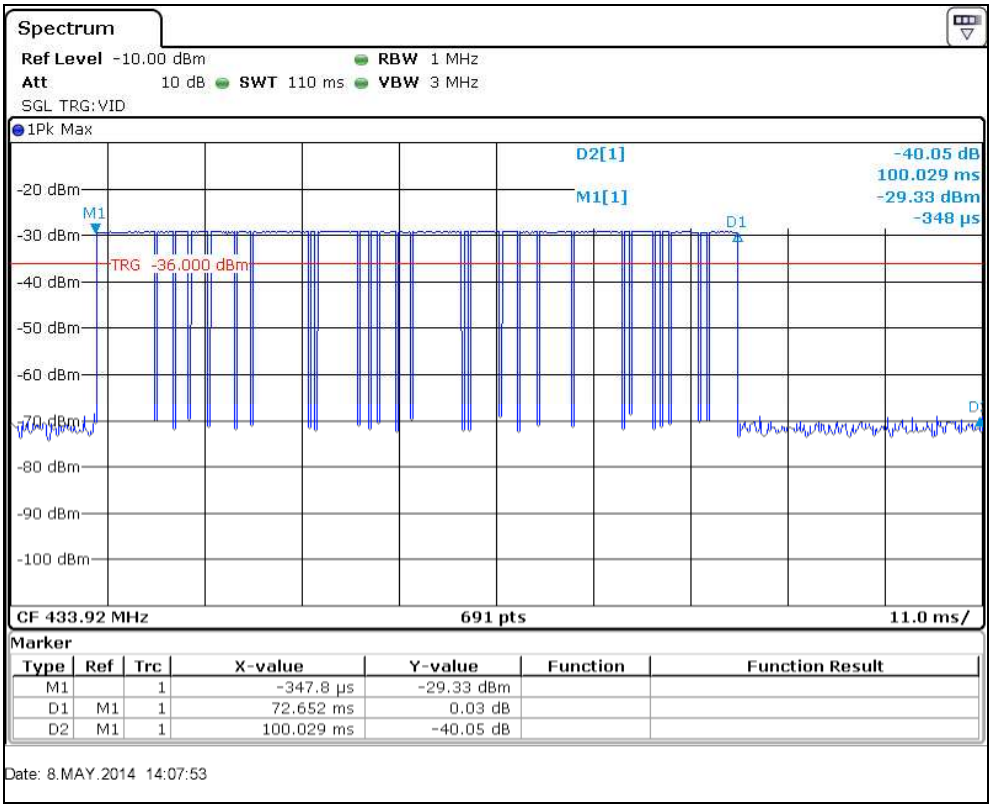

Figure 7.4.2-1: Duty Cycle – 100ms Period

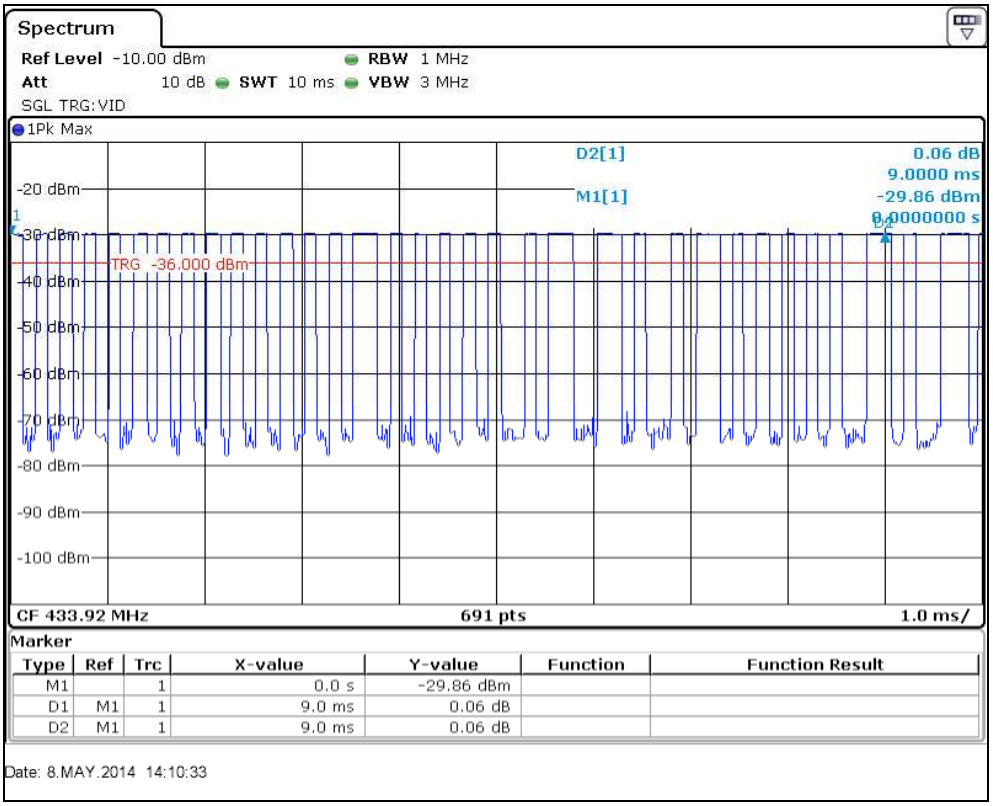

Figure 7.4.2-2: Pulse Train – 0-10ms

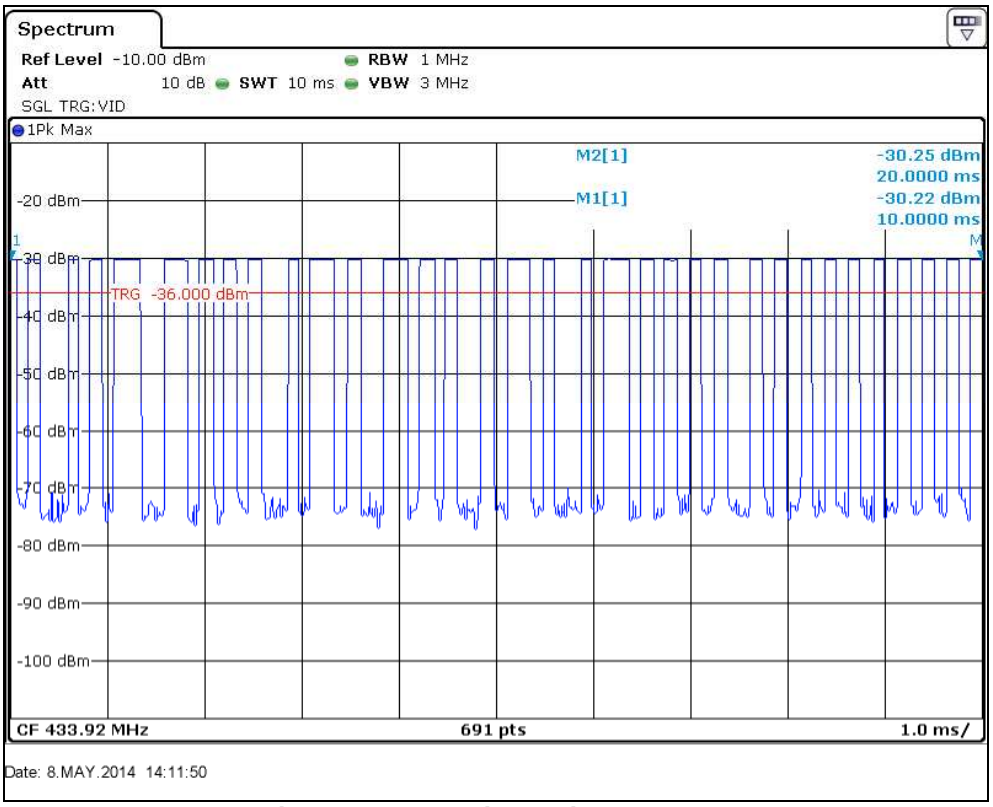

Figure 7.4.2-3: Pulse Train – 10-20ms

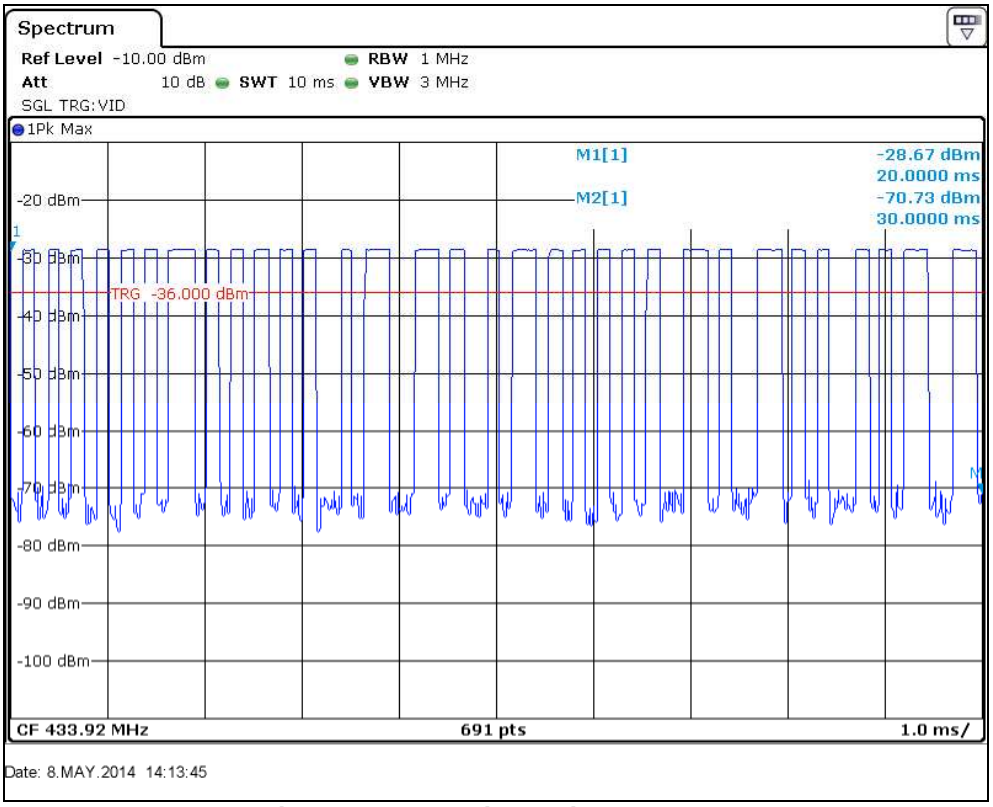

Figure 7.4.2-4: Pulse Train – 20-30ms

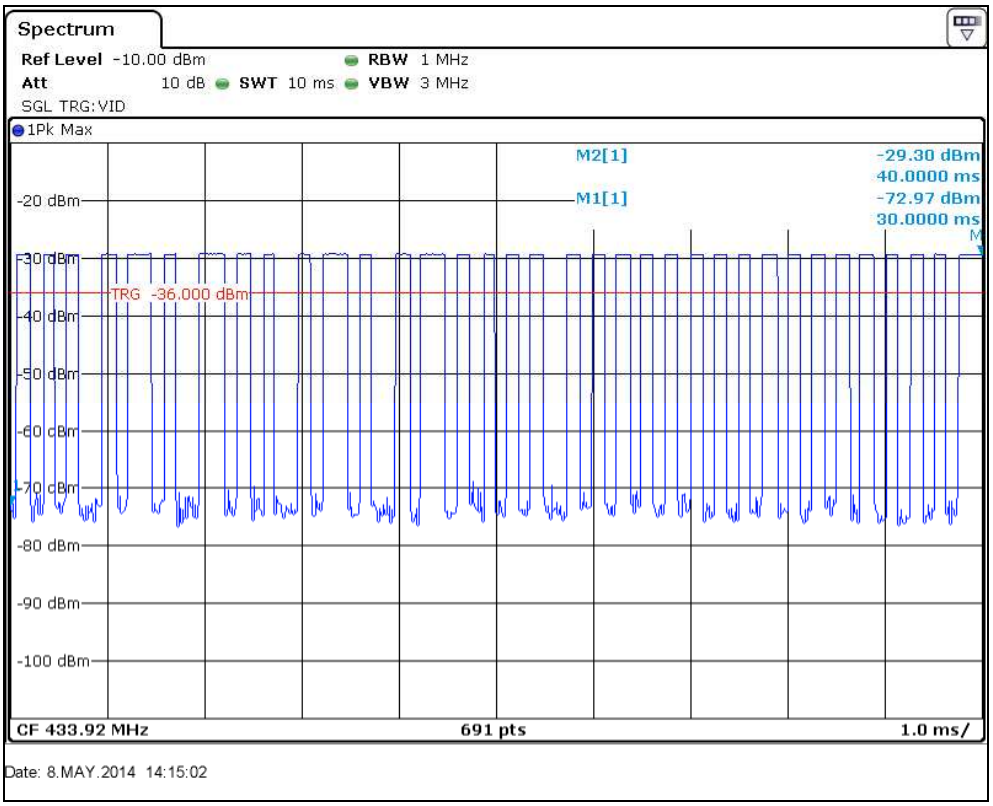

Figure 7.4.2-5: Pulse Train – 30-40ms

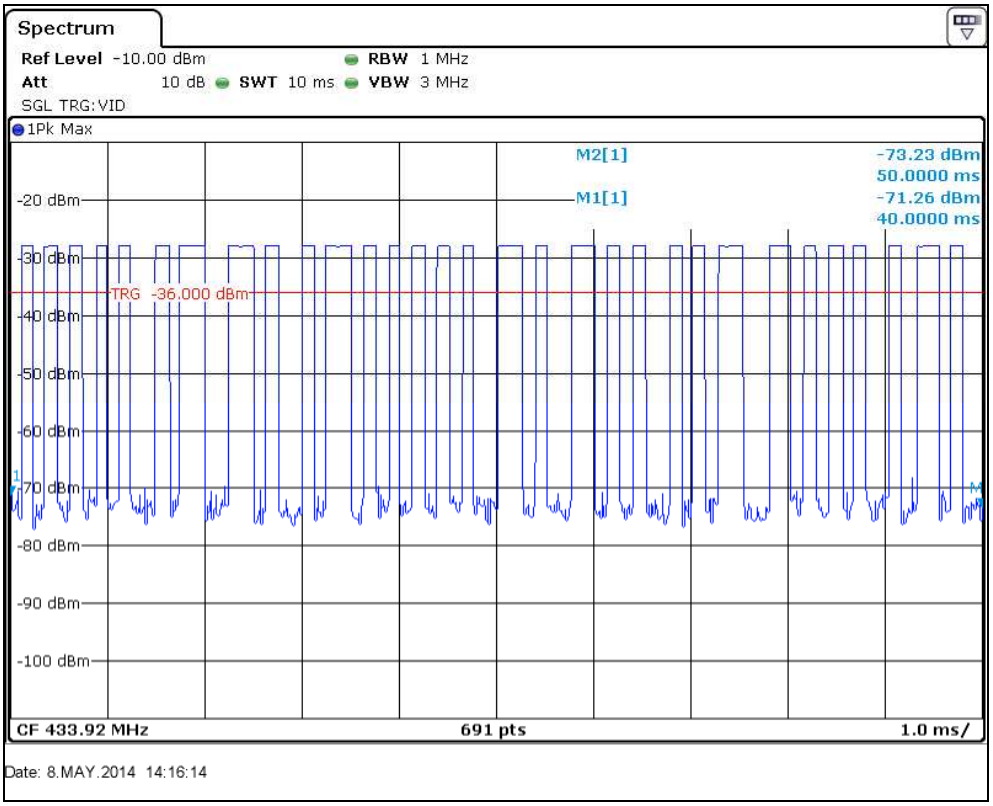

Figure 7.4.2-6: Pulse Train – 40-50ms

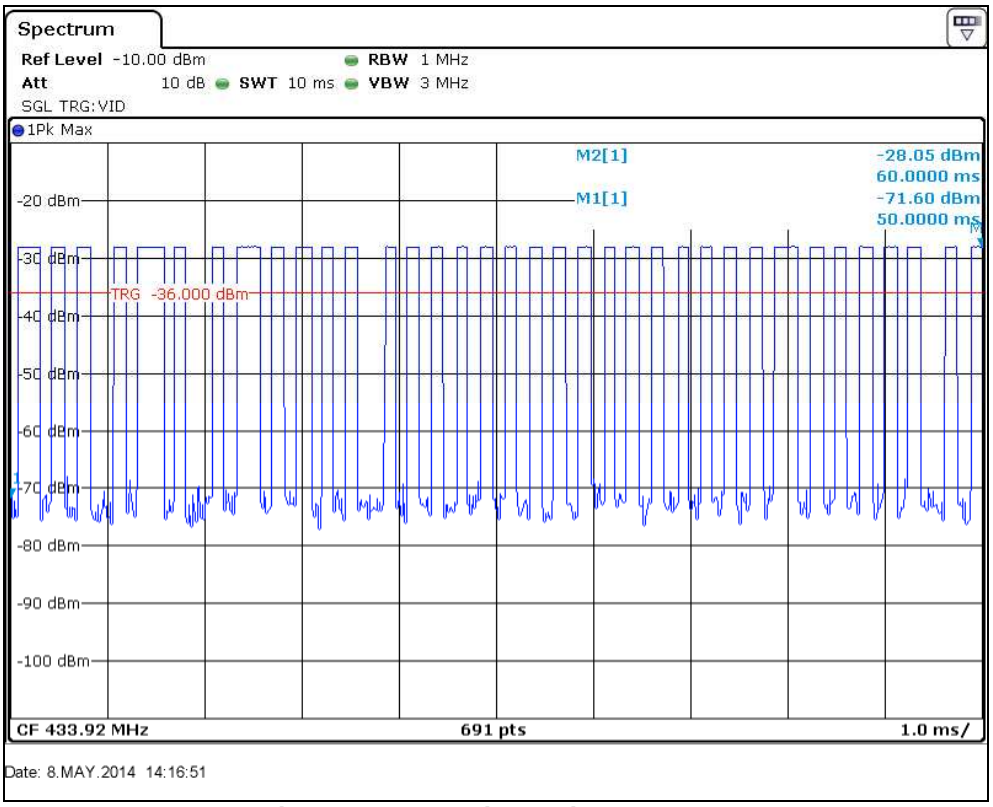

Figure 7.4.2-7: Pulse Train – 50-60ms

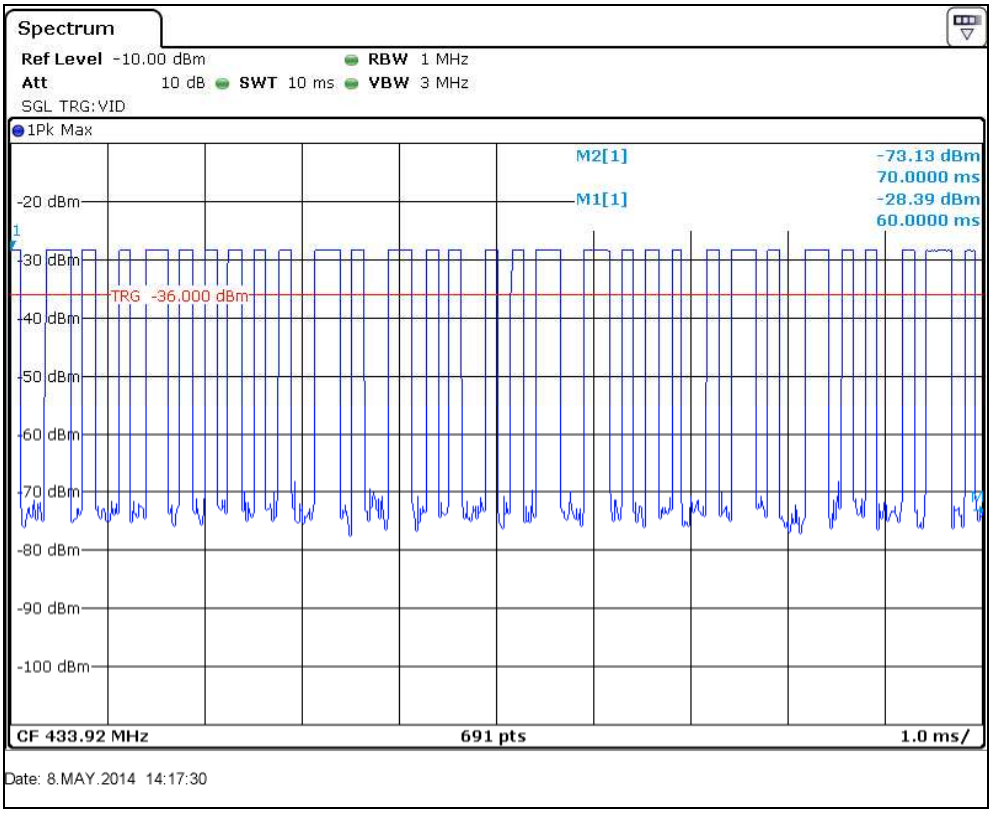

Figure 7.4.2-8: Pulse Train – 60-70ms

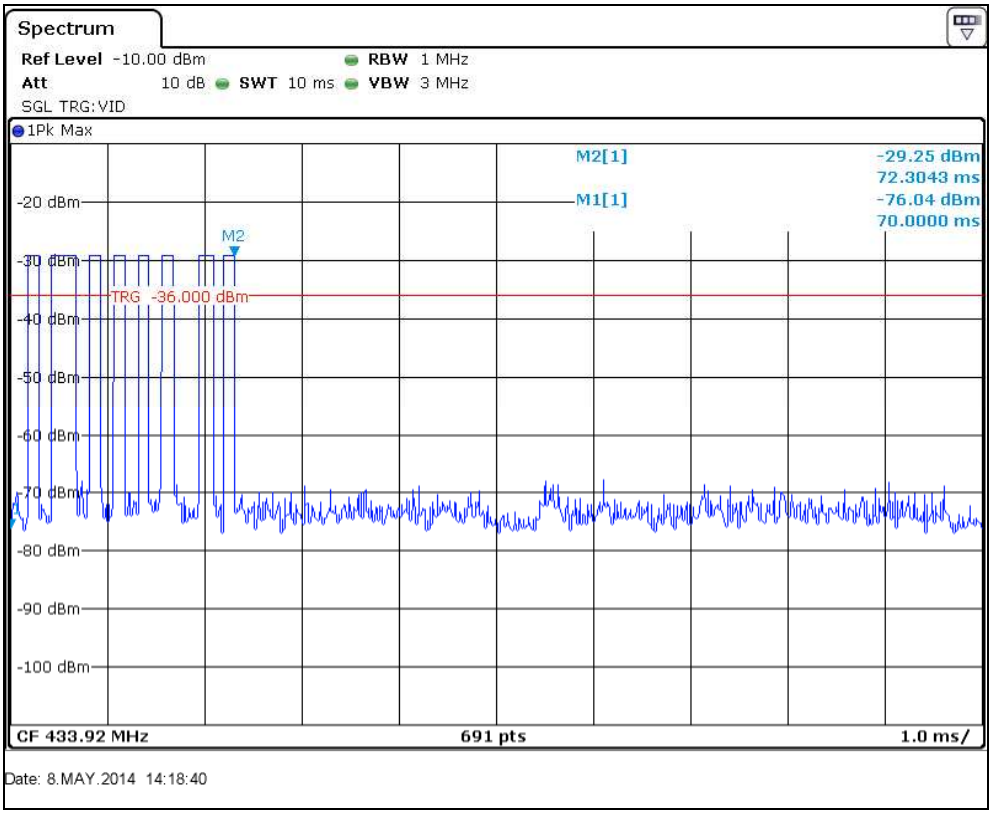

Figure 7.4.2-9: Pulse Train – 70-80ms

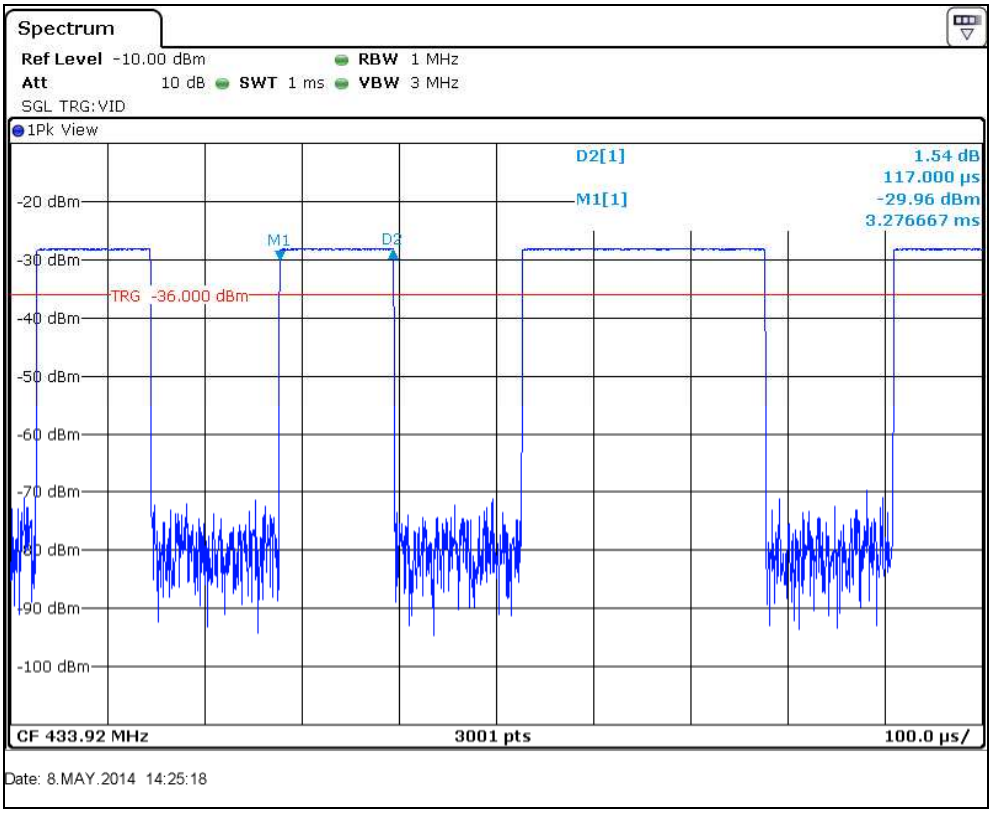

Figure 7.4.2-10: Duty Cycle – Pulse Width (T1)

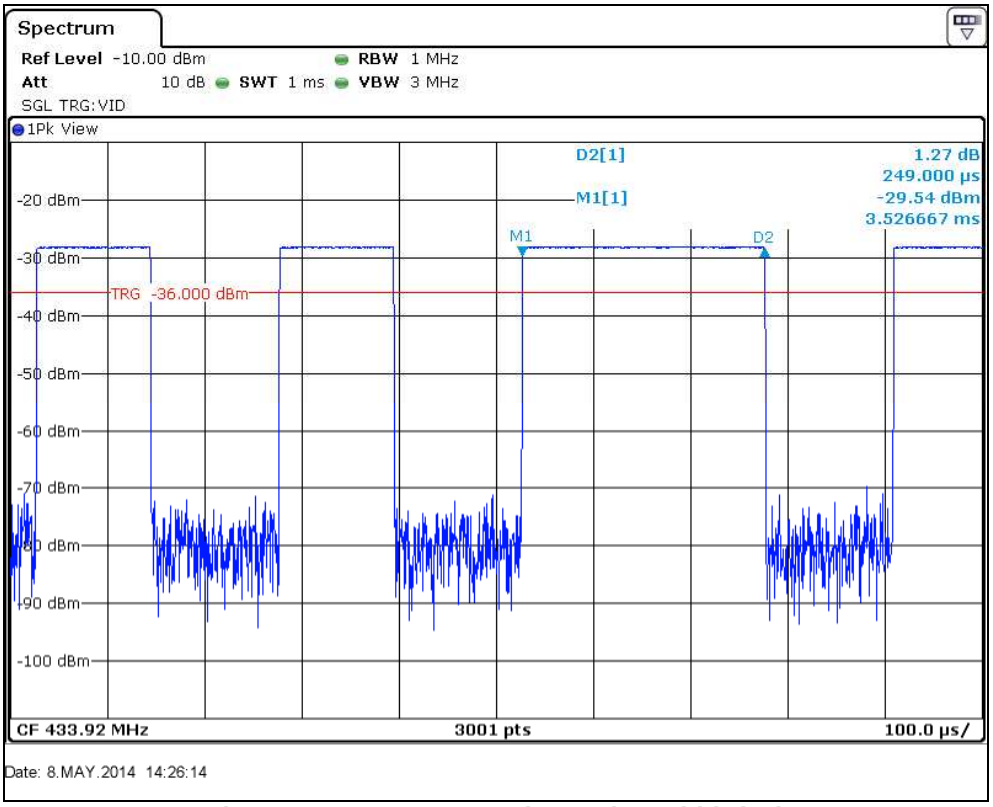

Figure 7.4.2-11: Duty Cycle – Pulse Width (T2)

7.4.3 Test Results

Radiated spurious emissions are reported in Table 7.4.3-1. Emissions not reported were below the noise floor of the measurement system.

Table 7.4.3-1: Radiated Emissions

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Fundamental Emission										
433.92	102.29	95.50	H	-7.30	94.99	78.96	100.8	80.8	5.8	1.9
433.92	96.28	89.48	V	-7.30	88.98	72.94	100.8	80.8	11.8	7.9
Spurious Emissions										
867.84	56.22	48.19	H	1.32	57.54	40.28	80.8	60.8	23.3	20.5
867.84	46.57	38.48	V	1.32	47.89	30.57	80.8	60.8	32.9	30.3
1301.76	66.07	52.15	H	-12.06	54.01	30.86	74.0	54.0	20.0	23.1
1301.76	74.09	59.25	V	-12.06	62.03	37.96	74.0	54.0	12.0	16.0
1735.68	52.34	42.63	H	-9.17	43.17	24.23	80.8	60.8	37.6	36.6
1735.68	52.76	43.96	V	-9.17	43.59	25.56	80.8	60.8	37.2	35.3
2169.6	53.39	44.53	H	-7.19	46.20	28.11	80.8	60.8	34.6	32.7
2169.6	51.43	41.56	V	-7.19	44.24	25.14	80.8	60.8	36.6	35.7
2603.52	53.48	44.12	H	-5.12	48.36	29.77	80.8	60.8	32.4	31.1
2603.52	52.18	43.66	V	-5.12	47.06	29.31	80.8	60.8	33.7	31.5
3037.44	49.21	38.39	H	-3.27	45.94	25.88	80.8	60.8	34.9	34.9
3037.44	50.67	40.24	V	-3.27	47.40	27.73	80.8	60.8	33.4	33.1
3471.36	49.91	39.33	H	-1.80	48.11	28.29	80.8	60.8	32.7	32.5
3471.36	52.68	42.56	V	-1.80	50.88	31.52	80.8	60.8	29.9	29.3
4339.2	49.27	38.20	H	0.66	49.93	29.63	74.0	54.0	24.1	24.4
4339.2	47.64	36.74	V	0.66	48.30	28.17	74.0	54.0	25.7	25.8

7.4.4 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U = Uncorrected Reading
R_C = Corrected Level
AF = Antenna Factor
CA = Cable Attenuation
AG = Amplifier Gain
DC = Duty Cycle Correction Factor

Example Calculation: Fundamental Frequency

PEAK:
Corrected Level: 102.29 - 7.30 = 94.99dBuV
Margin: 100.8dBuV – 94.99dBuV = 5.8dB

AVERAGE:
Corrected Level: 95.50 - 7.30 - 9.235 = 78.96dBuV
Margin: 80.8dBuV – 78.96dBuV = 1.9dB

8 CONCLUSION

In the opinion of ACS, Inc. the 206C0000 manufactured by Pella Corporation met the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT