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FCC PART 15.231 TEST REPORT

LOW POWER UNLICENSED TRANSMITTER

Applicant	PELLA CORPORATION
Address	102 MAIN STREET PELLA IOWA 50009
FCC ID	SO7-206J0000
Product Description	REMOTE WINDOW SHADE CONTROLLER
Date Sample Received	3/24/2014
Date Tested	March 24, 2014
Tested By	Cory Leverett
Approved By	Cory Leverett
Timco Report No.	418AUT14
Test Results	☒ Pass ☐ Fail

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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

Summary

The device under test does:
☒ fulfill the general approval requirements as identified in this test report
☐ not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, Fl 32669

Authorized Signatory Name:

Cory Douglas Leverett
Engineering Project Manager

Date: **March 24, 2014**

REPORT SUMMARY

Disclaimer	The test results only relate to the item tested.
Applicable Rule(s)	FCC Pt 15.231, Pt 15.209, Pt 15.207, ANSI C63.4: 2003
Related Report(s) or Approval(s)	418BUT14TestReport (Receiver portion of this Transceiver)

Receiver
The receiver portion of this system has been tested and meets all of the FCC requirements per FCC rules Part 15.109. A report was issued and a copy of this report is available upon request.

TEST ENVIRONMENT

Test Facility	The test sites are located at 849 NW State Road 45 Newberry, FL 32669 USA.
Test Condition:	Temperature: 26°C Relative humidity: 50%

TEST SETUP

Test Exercise (e.g software description, test signal, etc.):	The DUT was placed in continuous transmit mode of operation.
Deviation from the standard(s)	No deviation from the standard(s)
Modification to the DUT:	No modification was made to the DUT.
Supporting Peripheral Equipment	Not applicable. The device is a stand-alone remote control transceiver.

DUT SPECIFICATION

Applicant	PELLA CORPORATION		
Description	Remote Controlled Window Shades Transceiver		
FCC ID	SO7-206J0000		
Model Number	206J0000		
Frequency Range	433.92MHz		
DUT Power Source	☐ 110–120Vac/50– 60Hz		
	☐ DC Power		
	☒ Battery Operated Exclusively		
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☒ Fixed	☐ Mobile	☐ Portable

MANUFACTURE DECLARATION OF COMPLIANCE WITH PART 15.231(A)

Item	Description	Yes	No
1	Does this device transmit a signal that is only used to control another device?	X	
2	Does this device send data with this control signal?	X	
3	Does this device send data? Data is, things like: temperature, wind direction, fluid amount, rate of flow, etc.	X	
4	Does this device transmit continuously or automatically?		X
5	If manually operated does this device stop transmitting within 5 seconds of releasing the button?	X	
6	If automatically operated does it deactivate 5 seconds after activation?		X
7	Does it transmit at regular predetermined intervals?		X
8	Does it poll or send supervisory information?	NA	
	If yes does it do a system integrity check? How often?	NA	
9	Is this a fire, security or safety of life device?		X
	If YES does the device stop transmitting after the alarm condition is satisfied?		X
10	Duty cycle: Maximum on-time?	See Note	
	If YES, on-time in 100 ms? If Other, please specify here	See Note	
	On time in	See Note	
11	Modulation technique: Please specify the modulation of the test sample, FM, FSK, on-off keying, or others?	ASK	

Note 1 : Because of the fast rise time & short duration of the pulses, the manufacturer has provided a written a statement in the "Theory of Operation" that discusses the duty cycle. Please see the attestation below in Note 2.

Note 2 : The manufacturer has declared in their "Theory of Operation" that the on time in any 100ms transmission is less than 50ms, this theory is proven through the bit symmetry. Therefore all results are calculated with a duty cycle correction factor of 50%.

TEST EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/11	03/31/14
Antenna-Active Loop	ETS-Lindgren	6502	00062529	10/09/2013	10/09/2015
Antenna: Biconnical	Eaton	94455-1	1057	06/14/13	06/14/15
Antenna: Log-Periodic	Eaton	96005	1243	05/31/13	05/31/15
Signal Generator	HP	8640B	2308A21464	09/18/13	09/18/15
Software: Field Strength Program	Timco	N/A	Version 4.0	N/A	N/A
EMI Test *Receiver*	Rhode & Schwarz	ESU 40	100320	03/21/13	03/21/15
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	10/05/12	10/05/14

*EMI Test Receiver Firmware Version: 4.73 Service Pack 1

TEST PROCEDURES

Power line conducted Emissions: The test procedure used was ANSI C63.4-2003.

Spurious Emissions: The test procedure used was ANSI C63.4-2003 using a spectrum analyzer with a preselector. The bandwidth of the spectrum analyzer was 100 kHz with an appropriate sweep speed. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100 kHz and the video bandwidth was always greater than the RBW.

Occupied Bandwidth: A small sample of the transmitter output was fed into the spectrum analyzer and a was generated. The vertical scale is set to 10 dB per division.

Formula Of Conversion Factors: The field strength at 3m was established by adding the meter reading of the spectrum analyzer to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB/m. The gain of the preselector was accounted for in the spectrum analyzer reading.

Example:

Freq MHz	Meter Reading dBµV	ACF dB/m	Cable Loss dB	Field Strength dBµV/m @ 3 m
33	20	+10.36	+1.2	= 31.56

ANSI C63.4-2003 Measurement: The DUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The DUT was placed in the center of the table. The table used for radiated measurements is capable of continuous rotation. The spectrum was scanned from the lowest frequency generated (26MHz) all the way to the 10th harmonic of the fundamental emission.

Peak readings were taken in three (3) orthogonal planes when necessary and the highest readings were converted to average readings based on the duty cycle.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

RADIATION INTERFERENCE

Rules Part No.: 15.231

Requirements:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dBμV/m)	Field Strength of Harmonics and Spurious Emissions (dBμV/m @ 3m)
40.66 to 40.70	67.04	47.04
70 to 130	61.94	41.94
130 to 174	61.94 to 71.48	41.94 to 51.48
174 to 260	71.48	51.48
260 to 470	71.48 to 81.94	51.48 to 61.94
470 and above	81.94	61.94

No fundamental frequency is allowed in the restricted bands.

Spurious emissions in the restricted bands must be less than 54 dBμV/m or to the limits of 15.209.

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows:
1) for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F)-6136.3636;
2) for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F)-7083.3333.

Sample calculation of limit @ 315 MHz:

41.6667 (315)-7083.3333 = 6041.68 uV/m
20log(6041.68) = 75.62dBuV/m limit @ 315 MHz

Sample calculation of limit @ 433.92 MHz:

41.6667 (433.9)-7083.3333 = 10,995.85 uV/m
20log(10,995.85) = 80.82 dBuV/m limit @ 433.9 MHz

FOR THIS DUT:
The limit for average field strength in dBuV/m for the fundamental frequency is 80.82 dBμV/m.

The limit for average field strength in dBuV/m for the harmonics and other spurious frequencies is 60.82 dBμV/m unless it is in a restricted band.

Test Data:

Sample B (6-Cell 9V model) was the worst case								
Tuned Frequency MHz	**Emission Frequency MHz**	**Meter Reading dBuV**	**Ant. Polarity**	**Coax Loss dB**	**Correction Factor dB/m**	**Duty Cycle Factor dB**	**Field Strength dBuV/m**	**Margin dB**
433.9	**433.91**	**61.6**	**V**	**1.23**	**15.84**	**6.00**	**72.70**	**8.12**
433.9	**433.91**	**68.7**	**H**	**1.23**	**15.84**	**6.00**	**79.74**	**1.08**
433.9	**865.80**	**14.7**	**H**	**1.93**	**23.02**	**6.00**	**33.60**	**28.34**
433.9	**867.90**	**13.5**	**V**	**1.93**	**23.06**	**6.00**	**32.49**	**29.45**
433.9	***1,300.00**	**16.1**	**H**	**2.34**	**28.42**	**6.00**	**40.90**	**13.1**
433.9	***1,302.00**	**25.9**	**V**	**2.34**	**28.42**	**6.00**	**50.66**	**3.34**
433.9	**1,735.00**	**15.1**	**H**	**2.69**	**30.17**	**6.00**	**41.98**	**19.96**
433.9	**1,736.00**	**26.3**	**V**	**2.69**	**30.17**	**6.00**	**53.13**	**8.81**
433.9	**2,168.00**	**18.1**	**H**	**3.02**	**31.97**	**6.00**	**47.13**	**14.81**
433.9	**2,170.00**	**29.5**	**V**	**3.02**	**31.97**	**6.00**	**58.48**	**3.46**
433.9	**2,604.00**	**29.2**	**V**	**3.32**	**32.87**	**6.00**	**59.42**	**2.52**
433.9	**2,608.00**	**20.0**	**H**	**3.33**	**32.87**	**6.00**	**50.15**	**11.79**
433.9	**3,037.00**	**14.7**	**H**	**3.63**	**33.48**	**6.00**	**45.84**	**16.1**
433.9	**3,037.00**	**26.1**	**V**	**3.63**	**33.48**	**6.00**	**57.21**	**4.73**

* -Denotes restricted bands

Note 1 : Emissions that are 20 dB below the limit are not required to be reported.

Note 2 : Both samples were tested, only the worst case emissions are reported

CALCULATION OF DUTY CYCLE

The period of the pulse train is determined by observing it on an oscilloscope or a spectrum analyzer with zero (0) frequency span. A plot is then made of the pulse train with a sweep time of 100 milliseconds. This sweep determines the duration of the pulse train. This sweep allows the determination of the number of and type of pulses, i.e. long & short. Plots are then made showing the duration of each type of pulse and its duration. From the 100-millisecond plot, the number of a given type of pulse is then multiplied by the duration of that type pulse. This allows the calculation of the amount of time the DUT is on within 100 ms.

Long Pulse	Na
Short Pulse	Na
On Time	Na
Length of Pulse Train	Please read manufacturers theory of operation, an accurate 100ms plot was unobtainable
Total	Na

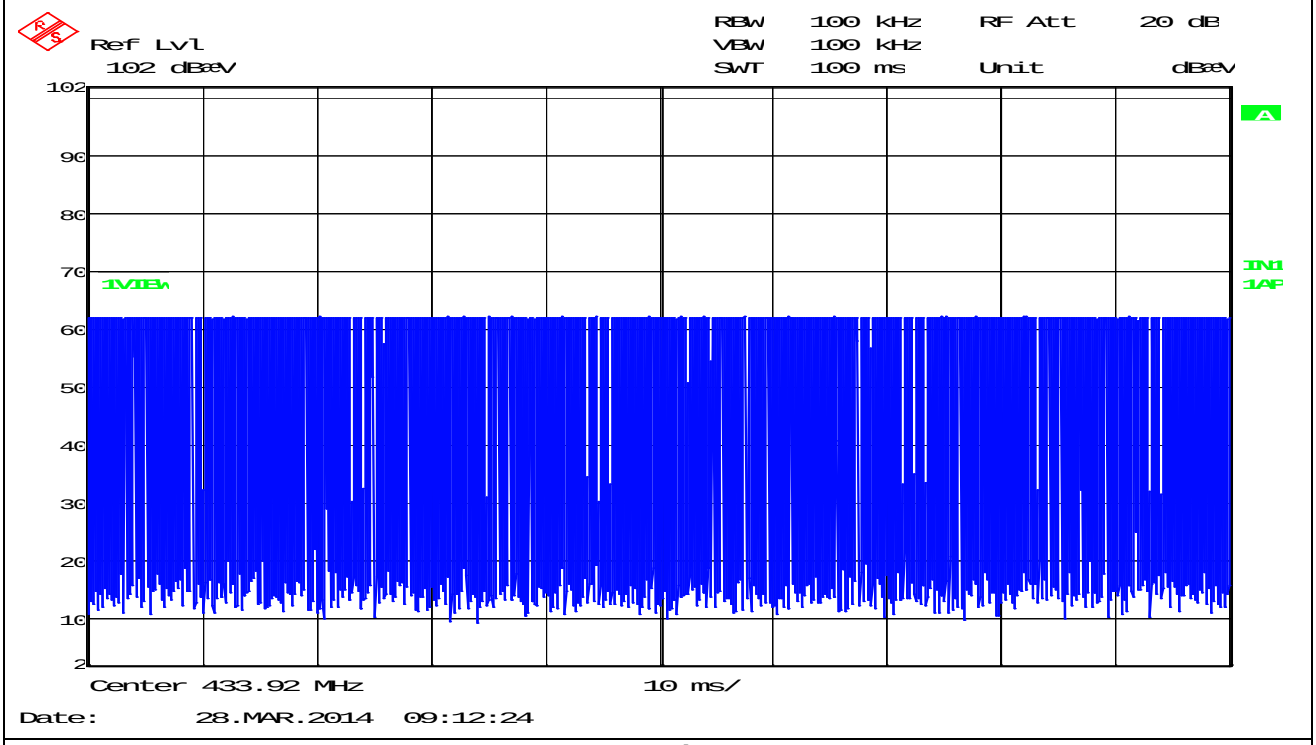
dB = 20*log(50ms)/100ms
dB = 20*log(0.5)
dB = -6.02

An accurate representation of the duty cycle could not be captured. See the following Manufacturers Statement of Duty Cycle:

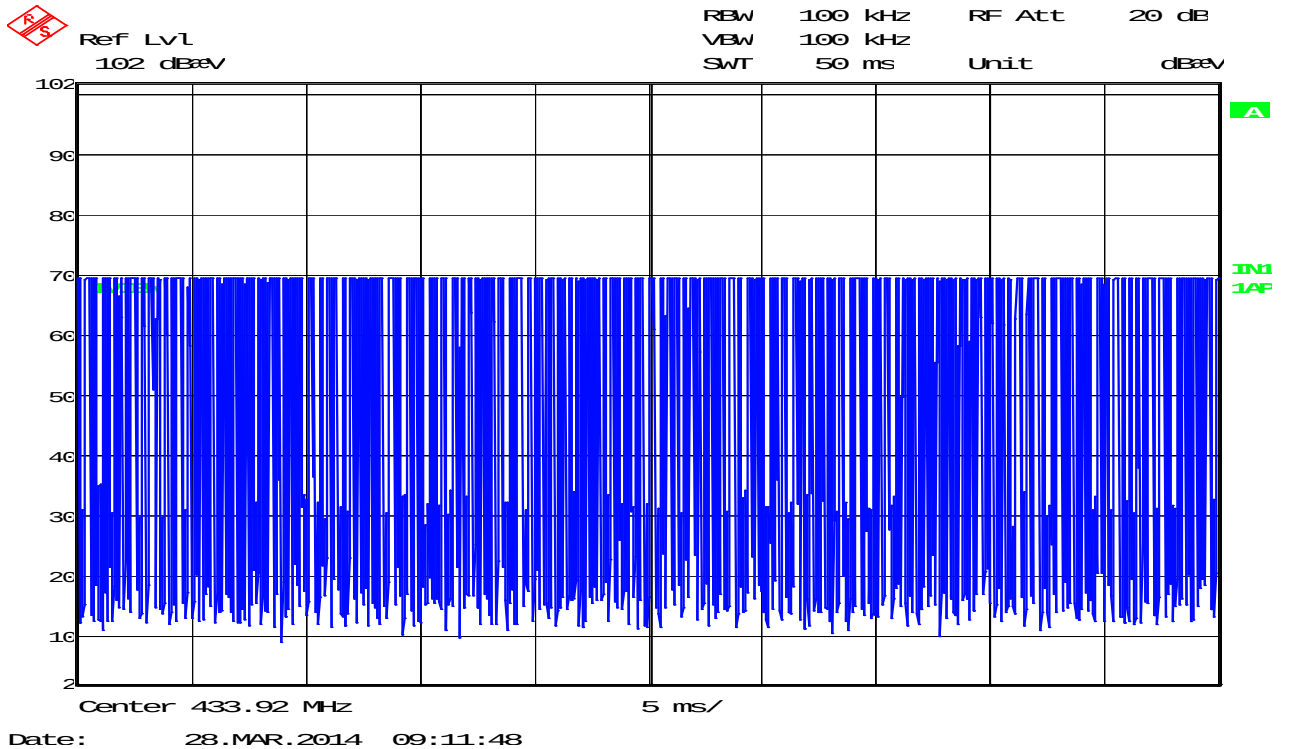
The shade will transmit a control signal having the embodiment of a 16ms packet (8 bits times 8 bytes times 250us). There are 12 packets transmitted with in inner packet delay of approximately 20us. This is very small to see across the 100ms window for FCC duty cycle determination. Moreover, the 250us bit time (2 pulses at approximately 125us each) is impossible to resolve with such a wide window. It is necessary, therefore, to reduce the window or "time span" in order to resolve the bits. Upon doing do it is clear that bits are represented by a HI and LOW or a LOW and HI. This data stream is Manchester encoded. So regardless of any combination of 1's or 0's there will always be a HI and a LOW level. Therefore, the data is 50% duty cycle because of bit symmetry and the fact that the entire transmission spans across the entire 100ms timeframe. If consideration is given to the small inner packet delay then the duty cycle is even less. However, this small amount is really insignificant.

DUTY CYCLE PLOTS

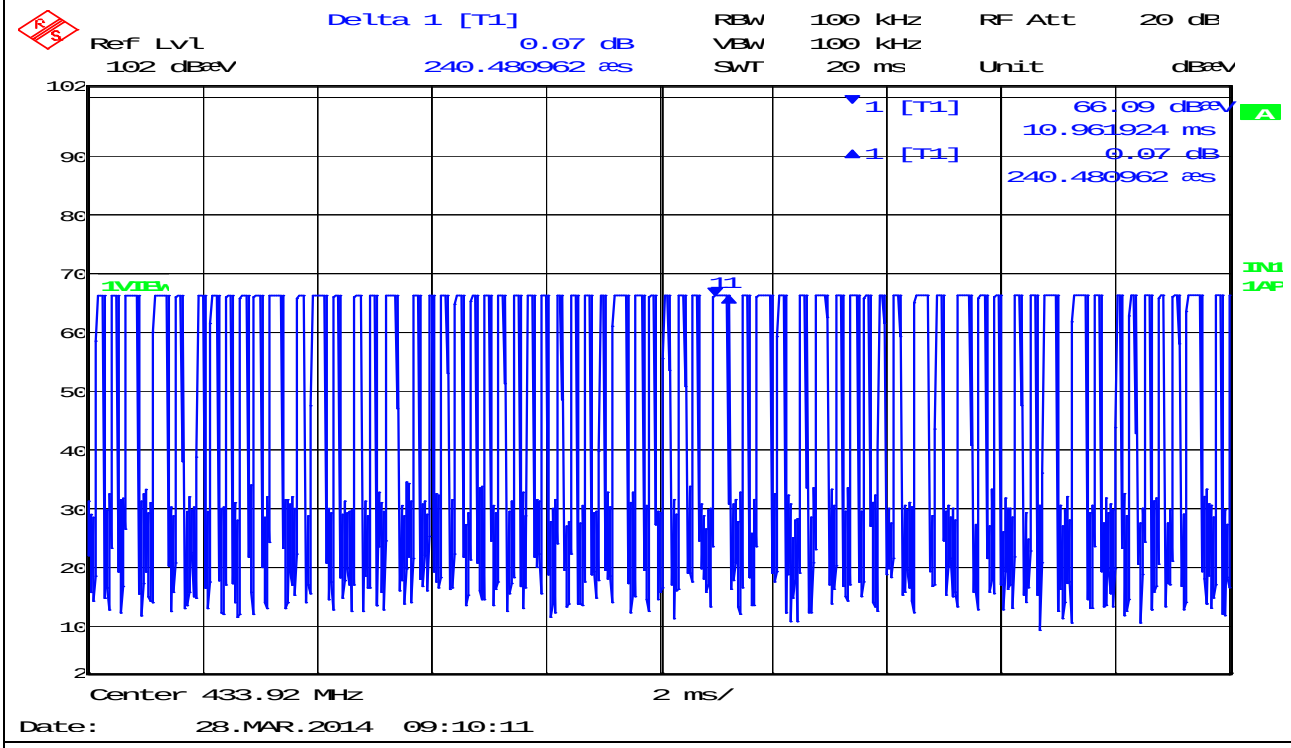
100ms Plot



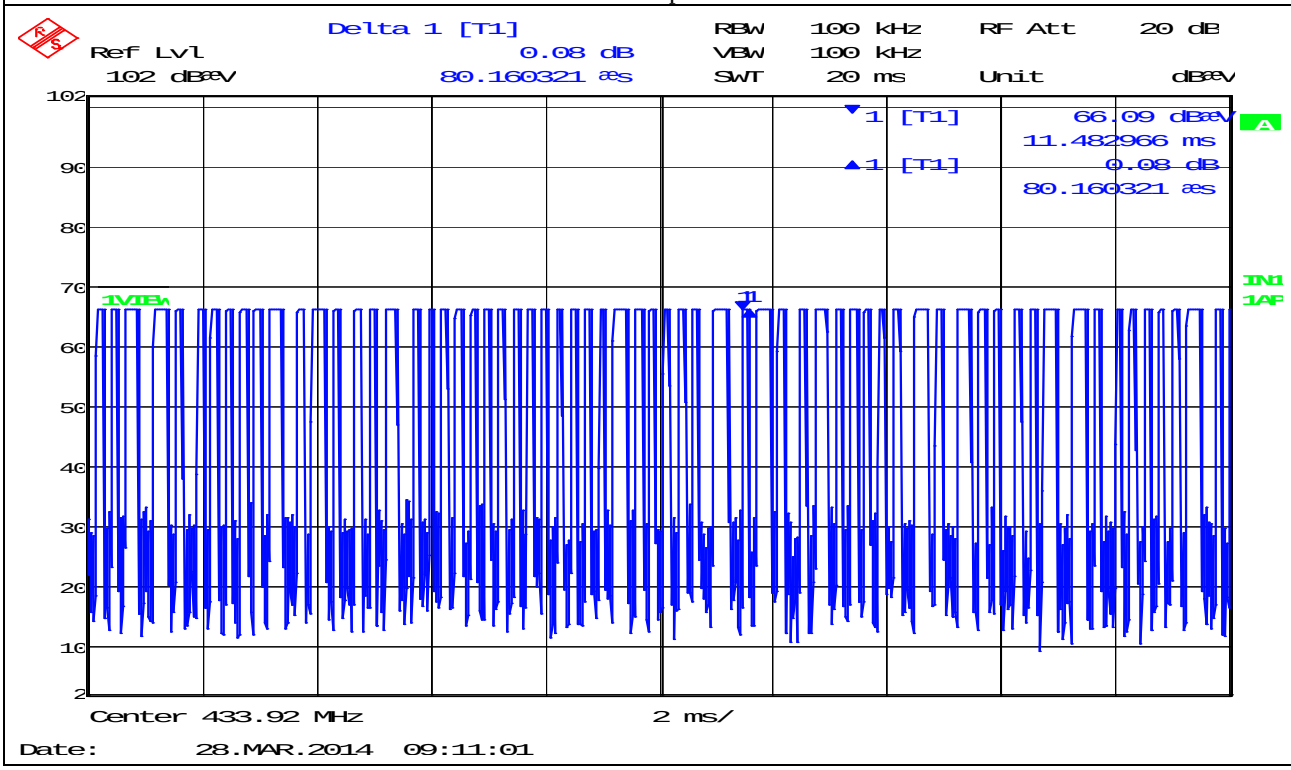
50ms Plot



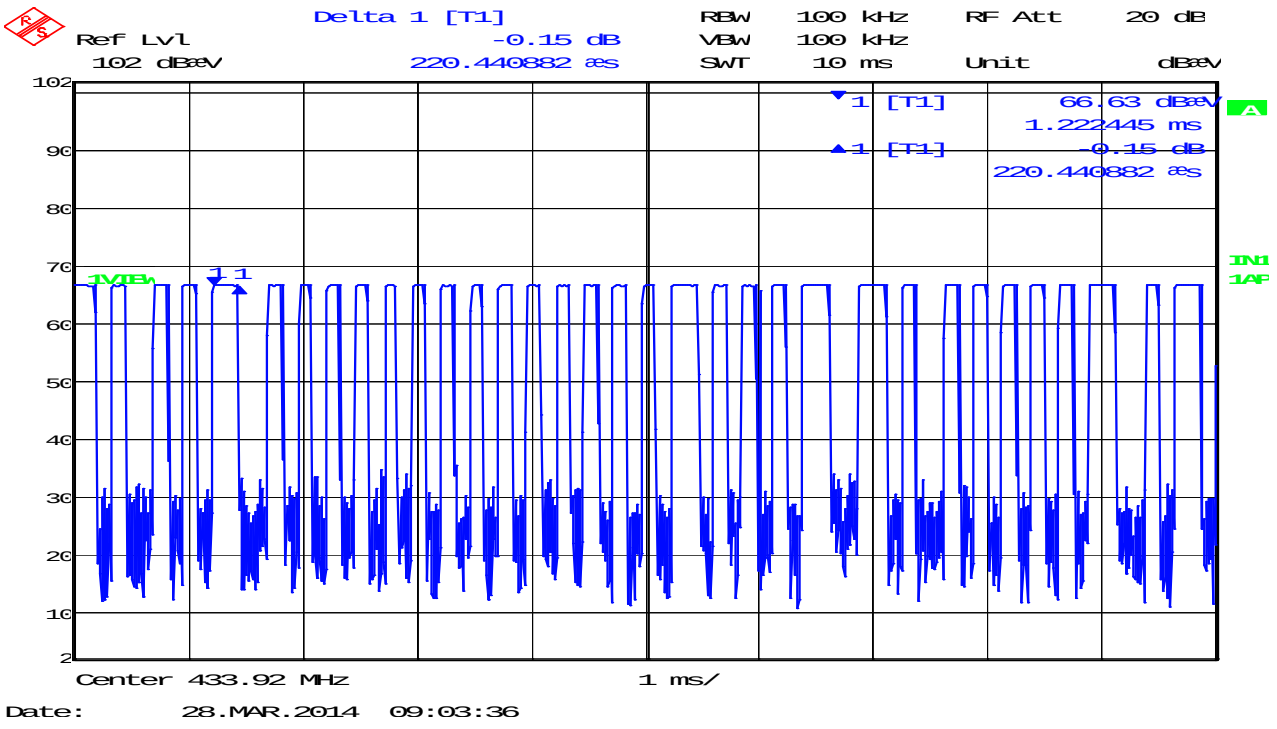
20ms Long pulse Plot



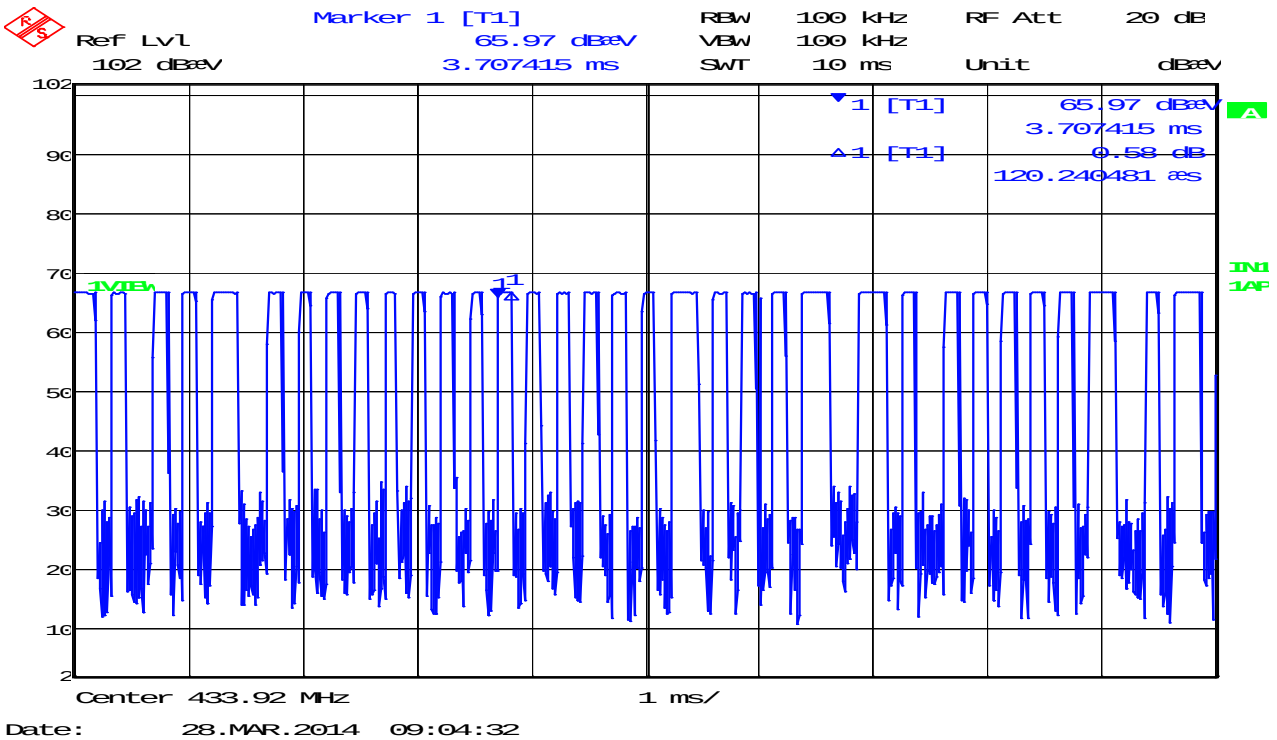
20ms Short pulse Plot



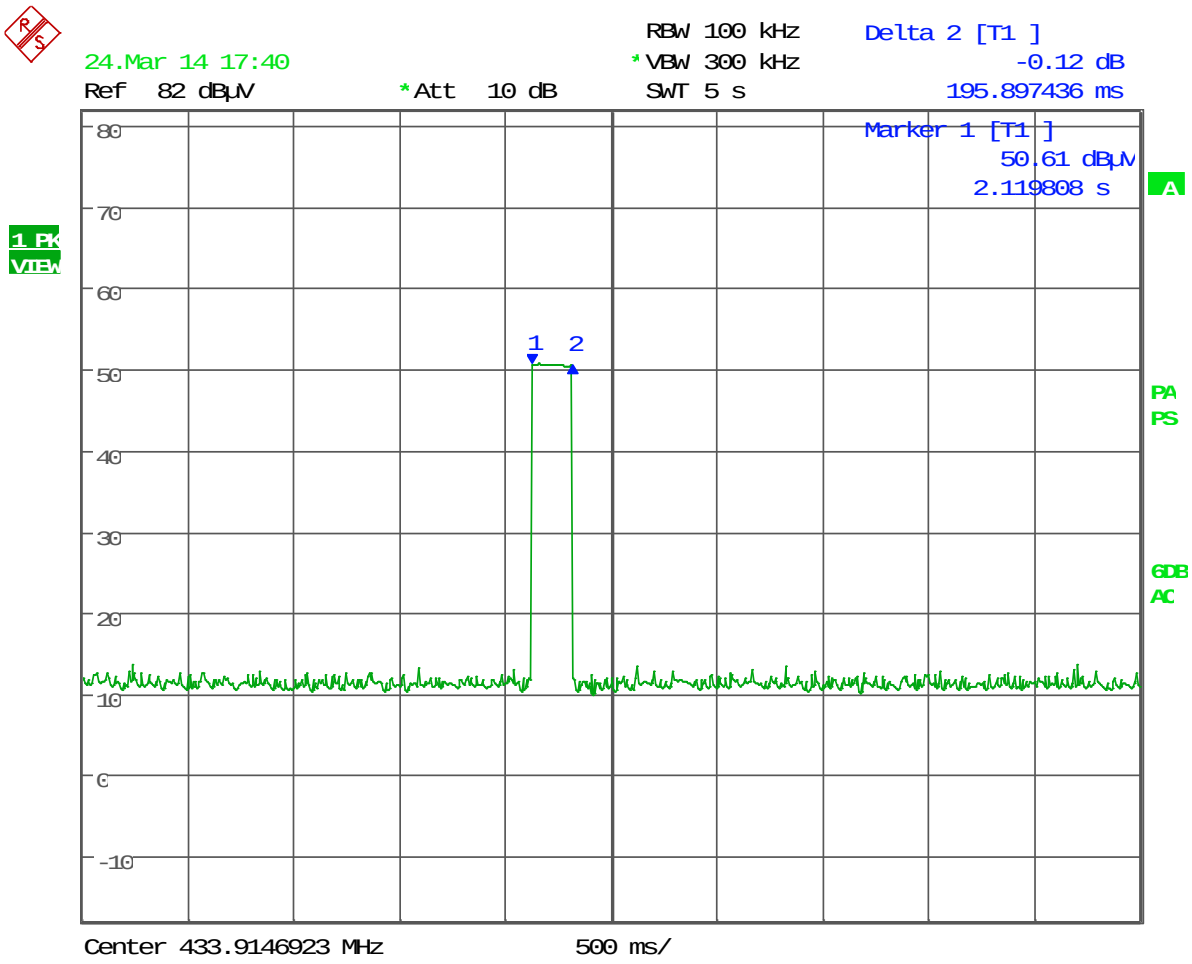
10ms Long pulse Plot



10ms Short pulse Plot



TRANSMITTER HOLD OFF TIME



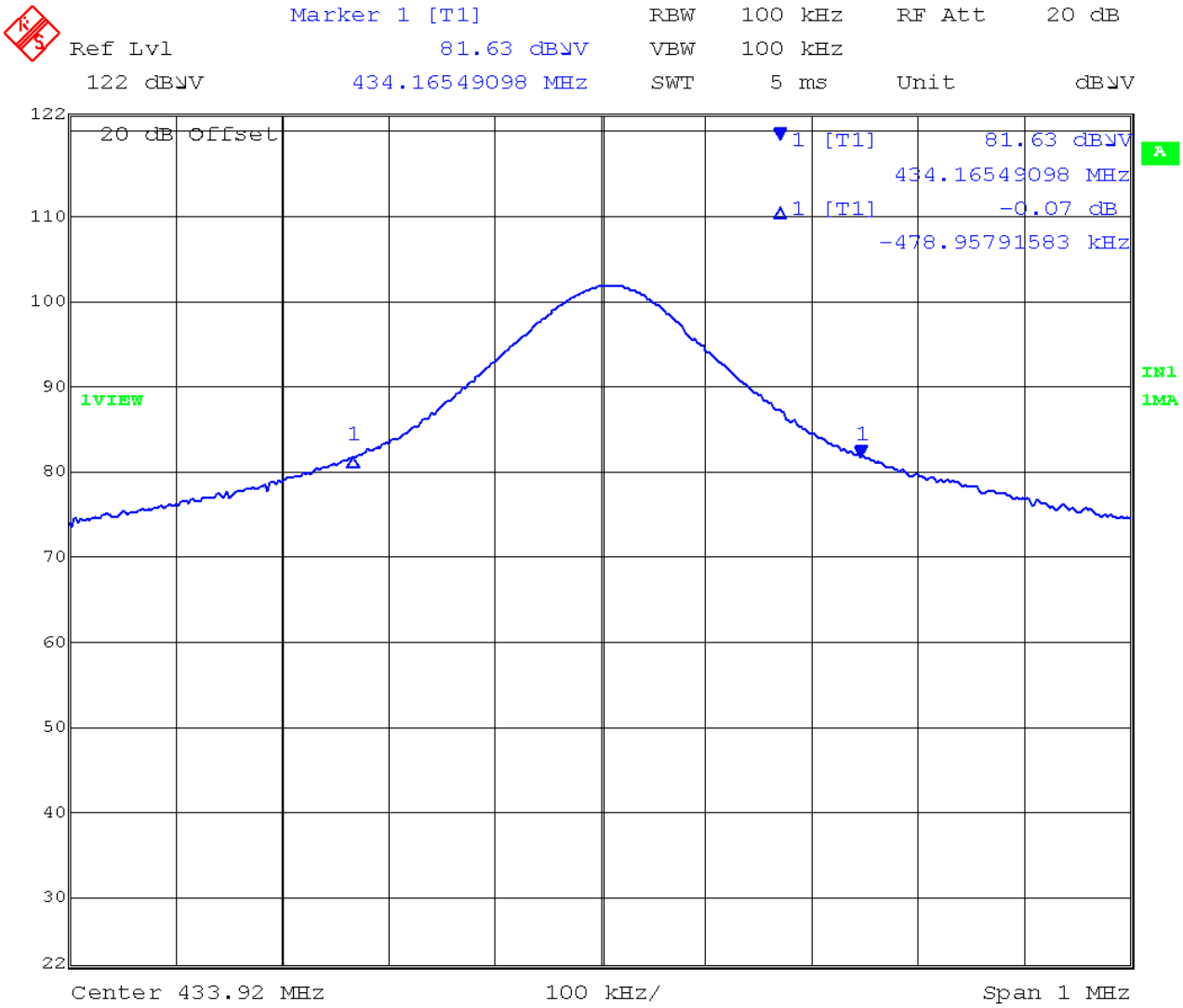
Date: 24.MAR.2014 17:40:03

OCCUPIED BANDWIDTH

Rules Part No.: 15.231(C)

Requirements: The bandwidth of the emission shall be no wider than .25% of the center frequency for devices operating between 70 and 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Data: Please refer to the following plots.



POWER LINE CONDUCTED INTERFERENCE

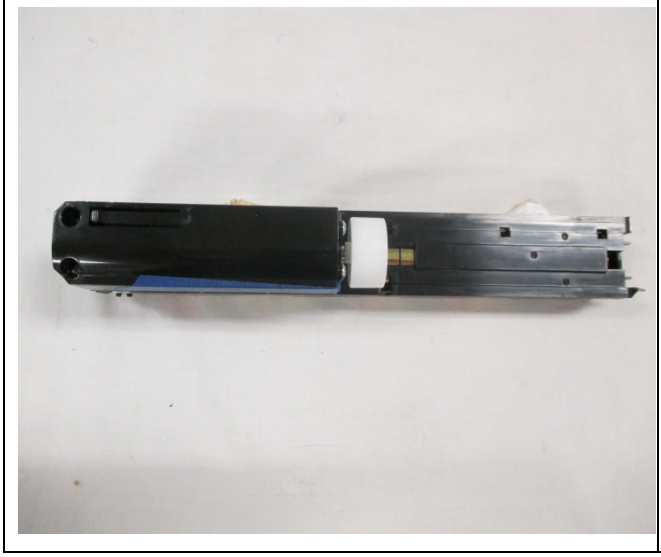
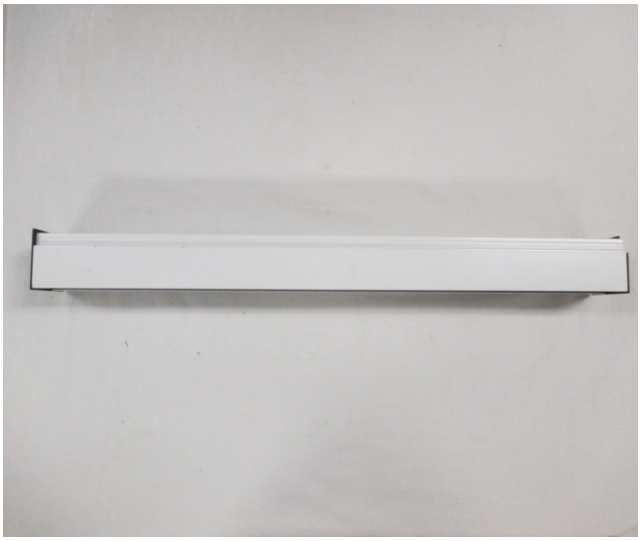
Rules Part No.: Pt 15.207

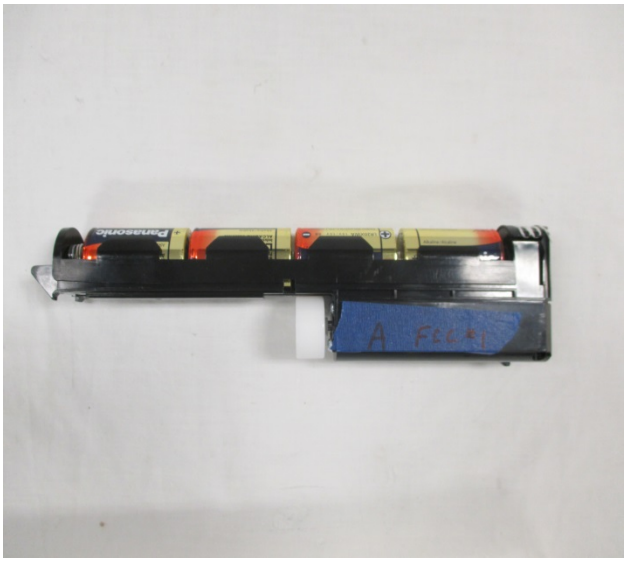
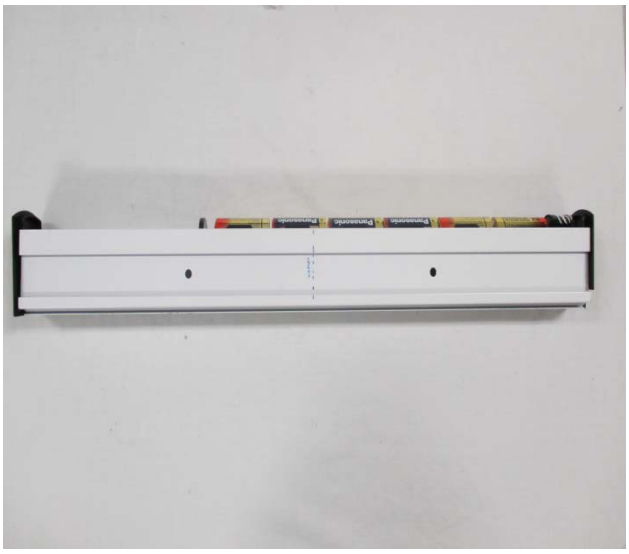
Requirements:

Frequency (MHz)	Quasi Peak Limits (dBuV)	Average Limits (dBuV)
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5.0	56	46
5.0 – 30	60	50

Test Data: Not applicable because the DUT is battery operated exclusively.

EXTERNAL PHOTOS

Sample A Top	Sample B Top Shown in Case
	
Sample A Bottom	Sample B Bottom Shown in Case
	

Sample A Side 1	Sample B Side 1 Shown in Case
	
Sample A Side 2	**Sample B Side 2 Shown in Case**
	

TEST SETUP PHOTO

Turntable Placement	Semi Anechoic Chamber