849 NW STATE ROAD 45
NEWBERRY, FL 32669 USA
PH: 888.472.2424 OR 352.472.5500
FAX: 352.472.2030
EMAIL: INFO@TIMCOENGR.COM
HTTP://WWW.TIMCOENGR.COM

FCC PART 15.231 TEST REPORT

LOW POWER UNLICENSED TRANSMITTER

Applicant	JL MARINE SYSTEMS INC.
Address	9010 PALM RIVER RD TAMPA FL 33619
FCC ID	A7FEA018B
Product Description	DASH SWITCH
Date Sample Received	4/1/2013
Date Tested	4/2/2013
Tested By	Nam Nguyen
Approved By	Mario de Aranzeta
Timco Report No.	553UT13TestReport.doc
Test Results	☒ Pass ☐ Fail

ACCREDITED

Certificate # 0955-01

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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.

ACCREDITED
Certificate # 0955-01

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:

Nam Nguyen
Testing Technician

Date: 4/5/2013

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

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 radio.

DUT SPECIFICATION

Applicant	JL MARINE SYSTEMS INC.		
Description	DASH SWITCH		
FCC ID	A7FEA018B		
Frequency Range	433.9 MHz		
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?		x
	If yes does it do a system integrity check? How often?		
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?		
10	Duty cycle: Maximum on-time?	x	
	If YES, on-time in 100 ms? If Other, please specify here	50%	
	On time in		
11	Modulation technique: Please specify the modulation of the test sample, FM, or AFSK, or FSK, or on-off keying, or others?	OOK	

TEST EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3/10-Meter OATS	TEI	N/A	N/A	12/31/11	12/31/13
3-Meter OATS	TEI	N/A	N/A	12/31/11	12/31/13
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/11	12/31/13
Analyzer Silver Tower Quasi-Peak Adapter	HP	85650A	3303A01844	01/02/13	01/02/15
Analyzer Silver Tower RF Preselector	HP	85685A	2926A00983	01/02/13	01/02/15
Analyzer Silver Tower Spectrum Analyzer	HP	8566B Opt 462	3552A22064 3638A08608	01/02/13	01/02/15
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	10/28/11	10/28/13
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	10/28/11	10/28/13
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	10/28/11	10/28/13
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	10/28/11	10/28/13
Antenna: Biconnical	Eaton	94455-1	1057	05/31/11	05/31/13
Antenna: Biconnical	Eaton	94455-1	1096	05/04/11	05/04/13
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/04/11	05/04/13

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 plot 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 30 MHz to the 10th harmonic of the fundamental.

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 dBμV/m for the fundamental frequency is 80.82 dBμV/m.

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

Test Data:

Tuned Frequency MHz	Emission Frequency MHz	*	Meter Reading dBµV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle Factor dB	Field Strength dBµV/m	Margin dB
434	433.96		63	H	1.23	17.48	6.0	75.71	5.11
434	433.96		67.4	V	1.23	17.48	6.0	80.11	0.71
434	867.92		27	H	1.93	23.18	6.0	46.11	14.71
434	867.92		29.6	V	1.93	23.18	6.0	48.71	12.11
434	1,301.88	**	16.5	V	2.34	28.18	6.0	41.02	12.98
434	1,301.88	**	19.1	H	2.34	28.18	6.0	43.62	10.38
434	1,735.84		19.8	V	2.69	30.07	6.0	46.56	14.27
434	1,735.84		25.9	H	2.69	30.07	6.0	52.66	8.17
434	2,169.80		13.4	V	3.02	31.94	6.0	42.36	18.47
434	2,169.80		14.7	H	3.02	31.94	6.0	43.66	17.17
434	2,603.76		13	V	3.32	32.68	6.0	43	17.82
434	3,037.72		12.4	V	3.63	33.01	6.0	43.04	17.78
434	3,037.72		16	H	3.63	33.01	6.0	46.64	14.18
434	3,471.68		13.4	H	4.02	33.09	6.0	44.51	16.31
434	3,471.68		14.2	V	4.02	33.09	6.0	45.31	15.51
434	4,339.60	**	13.7	V	4.67	34.01	6.0	46.38	7.62

** -Denotes restricted bands

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

Measurements were made from 9 kHz or the lowest frequency generated to the tenth harmonic.

CALCULATION OF DUTY CYCLE

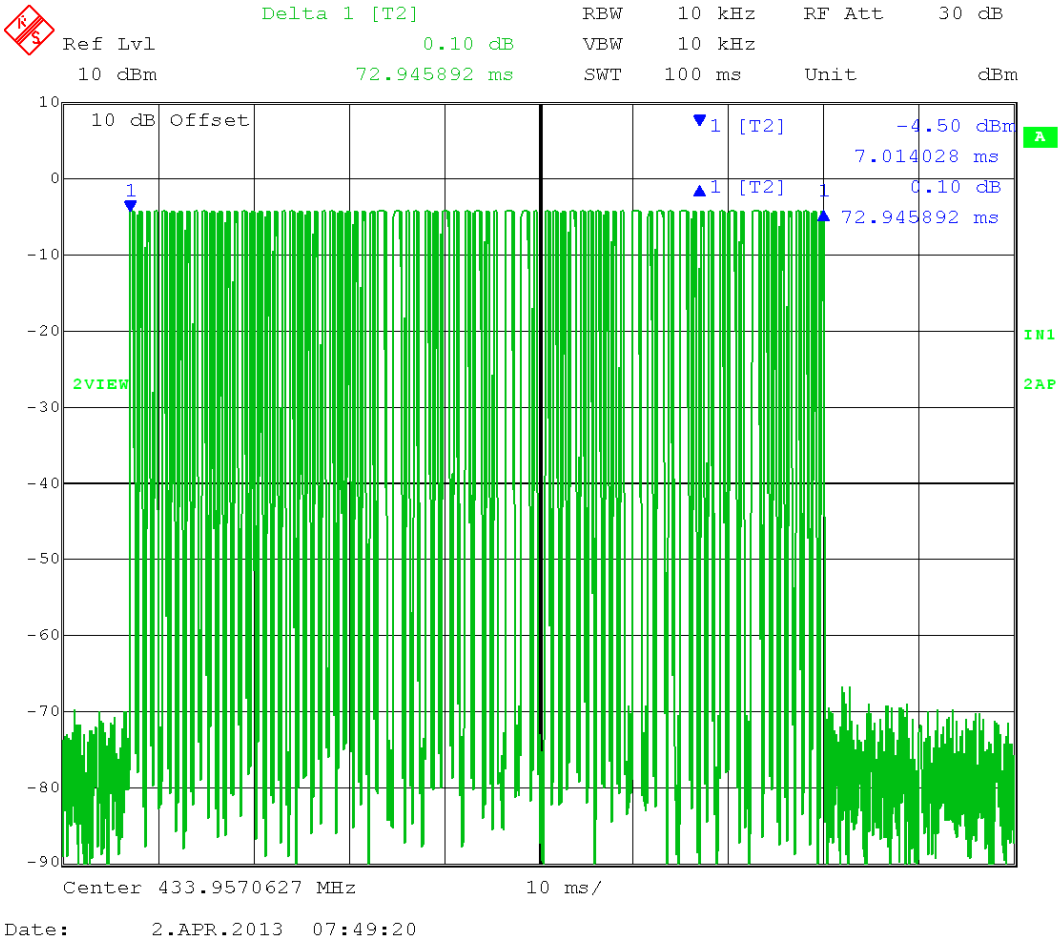
The period of the pulse train is determined by observing it on an oscilloscope or a spectrum analyzer with zero (0) frequency span. A plot is then made of the pulse train with a sweep time of 100 milliseconds. This sweep determines the duration of the pulse train. This sweep allows the determination 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	9 * 1.000 = 9.0 ms
Short Pulse	42 * 0.601 = 25.2 ms
On Time	34.2/50 ms
Length of Pulse Train	72.9/100 ms
Total	49.9/100 ms

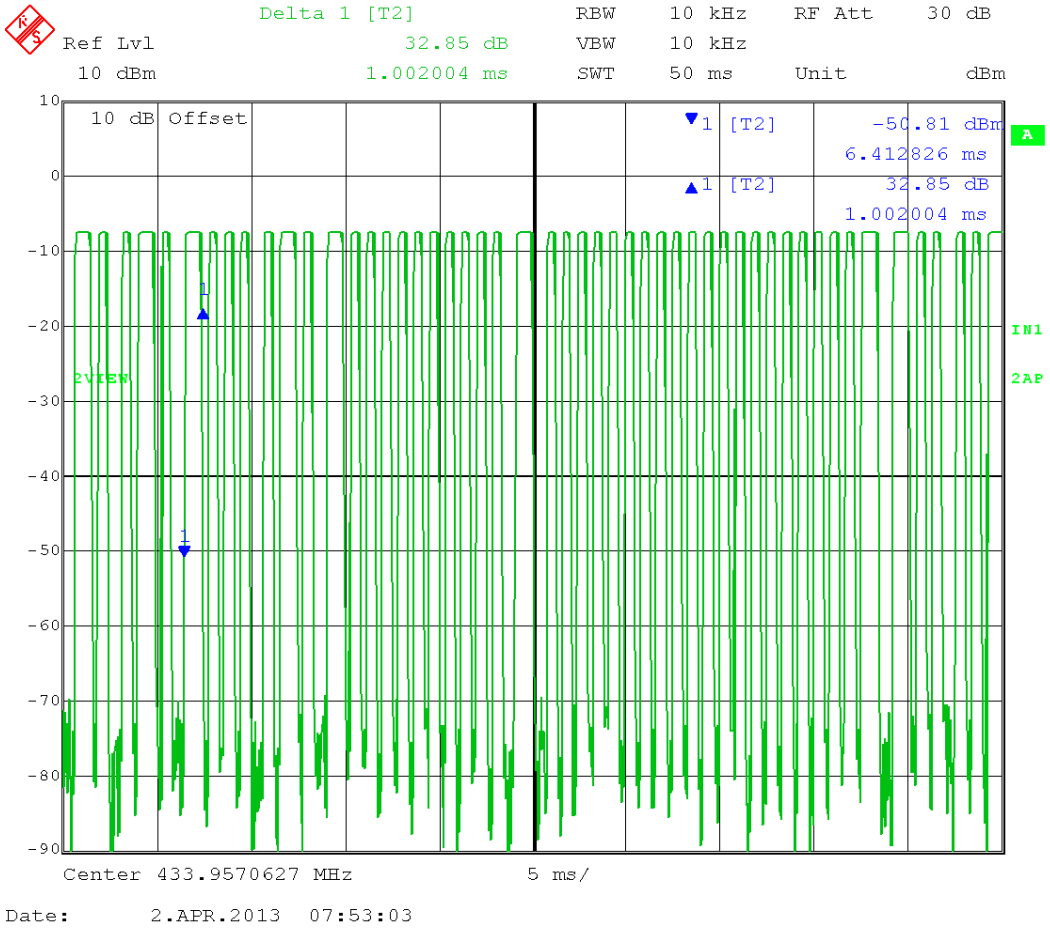
dB = 20*log(ON TIME)/PERIOD
dB = 20*log(49.9/100)
dB = 20*log(0.499)
dB = -6.04

See the following plots.

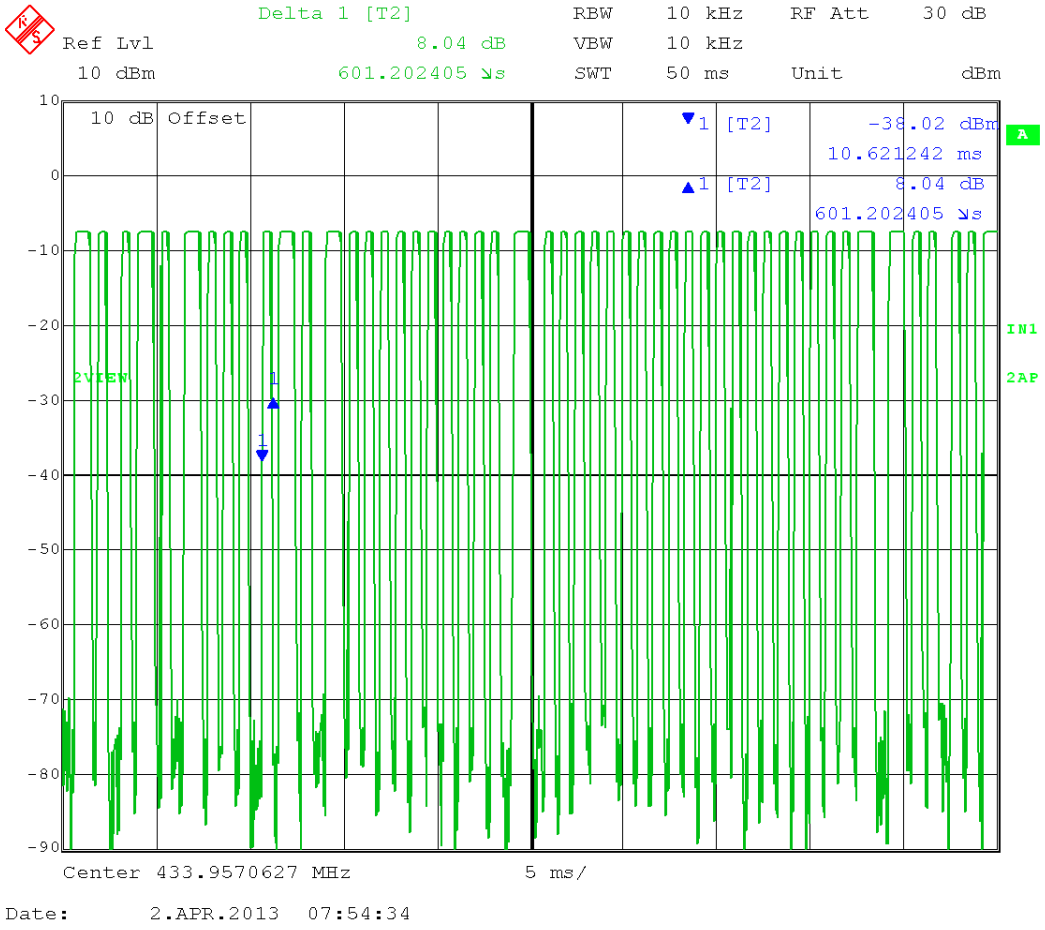
Length of Pulse Train



Long Pulse


Delta 1 [T2]
RBW 10 kHz
RF Att 30 dB
Ref Lvl
32.85 dB
VBW 10 kHz
10 dBm
1.002004 ms
SWT 50 ms
Unit dBm
10 dB Offset
1 [T2]
-50.81 dBm
6.412826 ms
1 [T2]
32.85 dB
1.002004 ms
A
IN1
2AP
2VIEW
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 433.9570627 MHz
5 ms/
Date: 2.APR.2013 07:53:03

Short Pulse

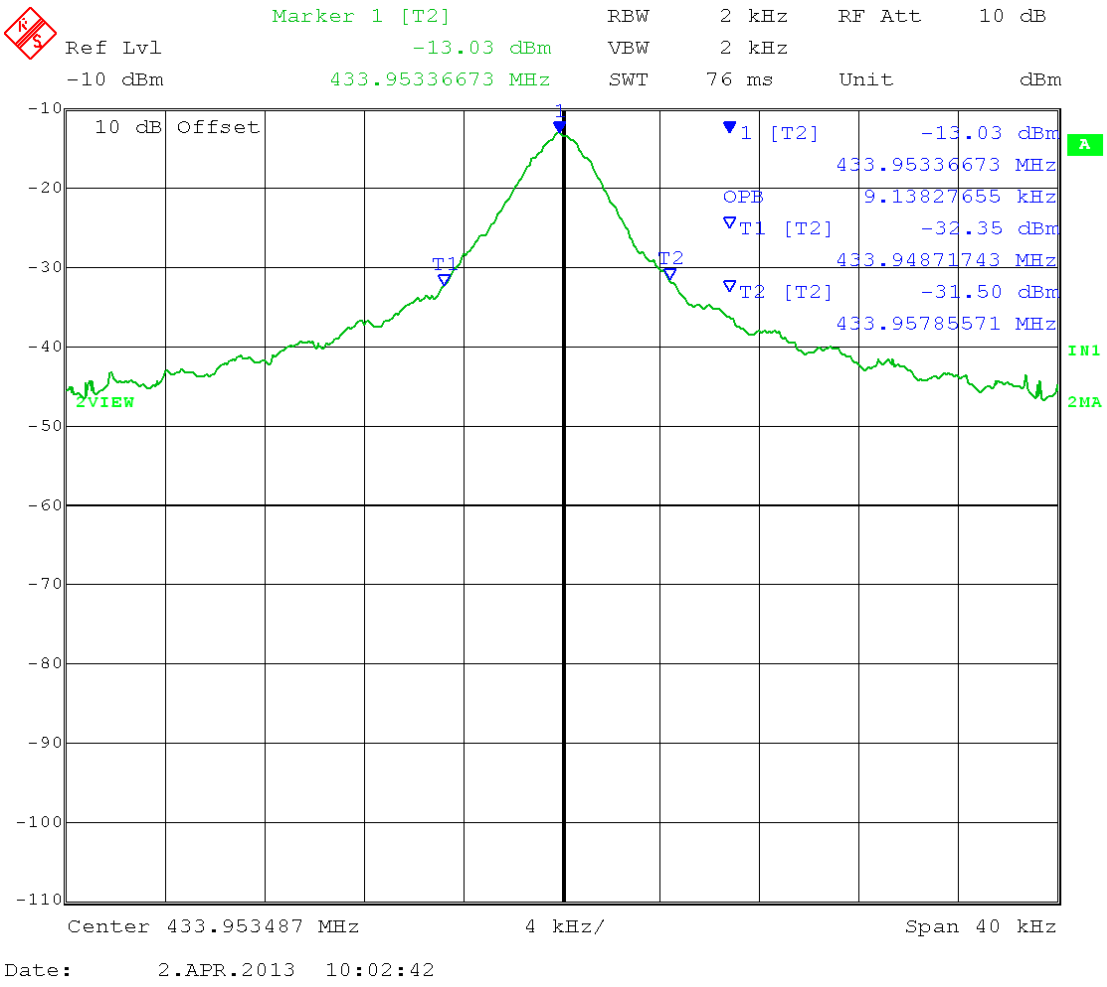

Delta 1 [T2]
RBW 10 kHz
RF Att 30 dB
Ref Lvl
8.04 dB
VBW 10 kHz
10 dBm
601.202405 µs
SWT 50 ms
Unit dBm
10 dB Offset
1 [T2] -38.02 dBm
10.621242 ms
1 [T2] 8.04 dB
601.202405 µs
A
IN1
2AP
2VIEW
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 433.9570627 MHz
5 ms/
Date: 2.APR.2013 07:54:34

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.



20 dB OCCUPIED BANDWIDTH = 9.1 kHz

POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: Pt 15.207

Requirements:

Frequency (MHz)	Quasi Peak Limits (dBµV)	Average Limits (dBµV)
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.