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FCC PART 15.231(a) TEST REPORT

LOW POWER UNLICENSED TRANSMITTER

Applicant	SHENZHEN CONSTANT ELECTRONICS CO., LTD.
Address	F5, NO. 2 BLDG., EAST BRIGHT INDUSTRY REGION NO. 83 DABAO ROAD BAO'AN 33 DISTRICT SHENZHEN, GUANGDONG China
FCC ID	WH2-2610S
Product Description	5 KEY BUTTON TRANSMITTER
Date Sample Received	3/9/2015
Date Tested	8/10/2015
Tested By	Tim Royer
Approved By	Cory Leverett
Test Results	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Report Number	Version Number	Description	Issue Date
465UT15TestReport	Rev1	Initial Issue	8/12/2015

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**

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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

A blue ink signature is written over a circular purple stamp. The stamp contains the text "TIMCO ENGINEERING, INC." around the perimeter and a small logo in the center. Below the signature and stamp is a horizontal line.

Tim Royer

Engineering Project Manager
Date: 8/11/2015

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GENERAL INFORMATION

EUT Specification

The test results only relate to the item tested.			
Regulatory Standards	FCC Title 47 CFR Part 15.231		
FCC ID	WH2-2610S		
Model	2610S		
EUT Description	5 KEY BUTTON TRANSMITTER		
Operating Frequency	TX: 433.5MHz		RX: N/A
EUT Power Source	<input type="checkbox"/> 110–120Vac/50– 60Hz		
	<input type="checkbox"/> DC Power		
	<input checked="" type="checkbox"/> Battery Operated Exclusively		
Test Item	<input type="checkbox"/> Prototype	<input checked="" type="checkbox"/> Pre-Production	<input type="checkbox"/> Production
Type of Equipment	<input type="checkbox"/> Fixed	<input type="checkbox"/> Mobile	<input checked="" type="checkbox"/> Portable
Antenna Connector	None		
Antenna	Integral		
Test Facility	Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.		
Test Conditions	Temperature: 24-26°C Relative humidity: 50-65%		
Measurement Standard	ANSI C63.10-2013 ANSI C63.4-2009 (Radiated Site Validation)		
Test Exercise	An engineering sample capable of continuous transmission was used.		
Deviation from the standard(s)	No deviation from the standard(s)		
Modifications to EUT:	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (explanation below)		
Test Mode Description	Transmitting Continuously		

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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?	NA	
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?	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?	NA	
10	Duty cycle: Maximum on-time?	34.84ms	
	If YES, on-time in 100 ms? If Other, please specify here	X	
	On time in	NA	
11	Modulation technique: Please specify the modulation of the test sample, FM, or AFSK, or FSK, or on-off keying, or others?	FSK	

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TEST PROCEDURES

Spurious Emissions: The test procedure used was ANSI C63.10 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: The test procedure used was ANSI C63.10 using a spectrum analyzer with a preselector.

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 dB μ V	ACF dB/m	Cable Loss dB	Field Strength dB μ V/m @ 3 m
33	20	+10.36	+1.2	= 31.56

ANSI C63.4-2003 Measurement: The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT 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.

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RADIATION INTERFERENCE

Rules Part No.: 15.231(a)

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(12500)	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, $\mu\text{V/m}$ at 3 meters = $56.81818(F) - 6136.3636$;

2) for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$.

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

Sample calculation of limit @ 315 MHz:

$41.6667(315) - 7083.3333 = 6041.68 \mu\text{V/m}$

$20\log(6041.68) = 75.62\text{dB}\mu\text{V/m}$ limit @ 315 MHz

Sample calculation of limit @ 433.92 MHz:

$41.6667(433.9) - 7083.3333 = 10,995.85 \mu\text{V/m}$

$20\log(10,995.85) = 80.82 \text{dB}\mu\text{V/m}$ limit @ 433.9 MHz

FOR THIS EUT:

The limit for average field strength in dBμV/m for the fundamental frequency is 80.81 dBμV/m.

The limit for average field strength in dBμV/m for the harmonics and other spurious frequencies is 61.94 dBμV/m unless it is in a restricted band.

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Test Data:

Tuned Freq MHz		Emission Freq MHz	Meter Reading dBu V	Ant Pol	Coax Loss dB	Correction Factor dB/M	Field Strength dBu V/M	Margin
433.46		433.46	58.77	V	1.44	15.83	67.83	12.98
433.46		433.46	65.03	H	1.44	15.83	74.09	6.72
433.46		866.94	41.83	H	2.20	23.04	58.86	23.08
433.46		866.94	34.96	V	2.20	23.04	51.99	29.95
433.46	**	1300.58	29.71	H	3.26	27.61	52.37	21.63
433.46	**	1300.58	22.26	V	3.26	27.61	44.92	29.08
433.46	**	1300.58	21.43*	V	3.26	27.61	44.09	9.91
433.46	**	1300.58	25.0*	H	3.26	27.61	47.66	6.34
433.46		1733.96	23.01	V	2.91	29.58	47.29	14.65
433.46		1734.03	24.28	H	2.91	29.58	48.56	13.38
433.46		2137.45	22.14	V	3.00	31.62	48.55	13.39
433.46		2167.45	22.05	H	3.02	31.68	48.54	13.40
433.46		2600.95	22.03	V	3.32	32.41	49.55	12.39
433.46		2600.95	22.93	H	3.32	32.41	50.45	11.49
433.46		3034.40	22.95	V	3.63	32.72	51.09	10.85
433.46		3034.44	22.86	H	3.63	32.72	51.00	10.94
433.46		3467.93	22.01	V	4.02	32.86	50.68	11.26
433.46		3467.99	23.12	H	4.02	32.86	51.79	10.15
433.46	**	3901.42	23.15	V	4.41	33.25	52.60	21.40
433.46	**	3901.42	22.94	H	4.41	33.25	52.39	21.60
433.46	**	3901.42	10.4*	V	4.41	33.25	39.86	14.14
433.46	**	3901.42	10.4*	H	4.41	33.25	39.86	14.14
433.46	**	4334.91	23.14	V	4.67	33.82	53.42	20.58
433.46	**	4334.91	22.76	H	4.67	33.82	53.04	20.96
433.46	**	4334.91	8.48*	H	4.67	33.82	38.76	15.24
433.46	**	4334.91	8.48*	V	4.67	33.82	38.76	15.24
433.46	**	4768.41	24.00	V	4.88	34.12	54.79	19.21
433.46	**	4768.41	23.10	H	4.88	34.12	53.89	20.11
433.46	**	4768.41	8.48*	V	4.88	34.12	39.28	14.72
433.46	**	4768.41	8.48*	H	4.88	34.12	39.28	14.72
433.46		5201.90	24.72	V	5.06	34.32	55.89	6.05
433.46		5201.90	25.24	H	5.06	34.32	56.41	5.53

* -Denotes Average measurement

** -Denotes restricted bands

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

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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 EUT is on within 100 ms.

	Length of Pulse (ms)	Number of Pulses	On Time per 100 ms
Long Pulse	2.89	1	2.89
Medium Pulse	1.44	16	23.04
Short Pulse	.461	28	12.91
On Time of Pulse Train (ms)			34.84
Length of Pulse Train (ms)			100
Duty Cycle Correction (dB)			8.21

$$\text{dB} = 20 \cdot \log(\text{ON TIME}) / \text{PERIOD}$$

$$\text{dB} = 20 \cdot \log(34.84 / 100)$$

$$\text{dB} = 20 \cdot \log(0.3484)$$

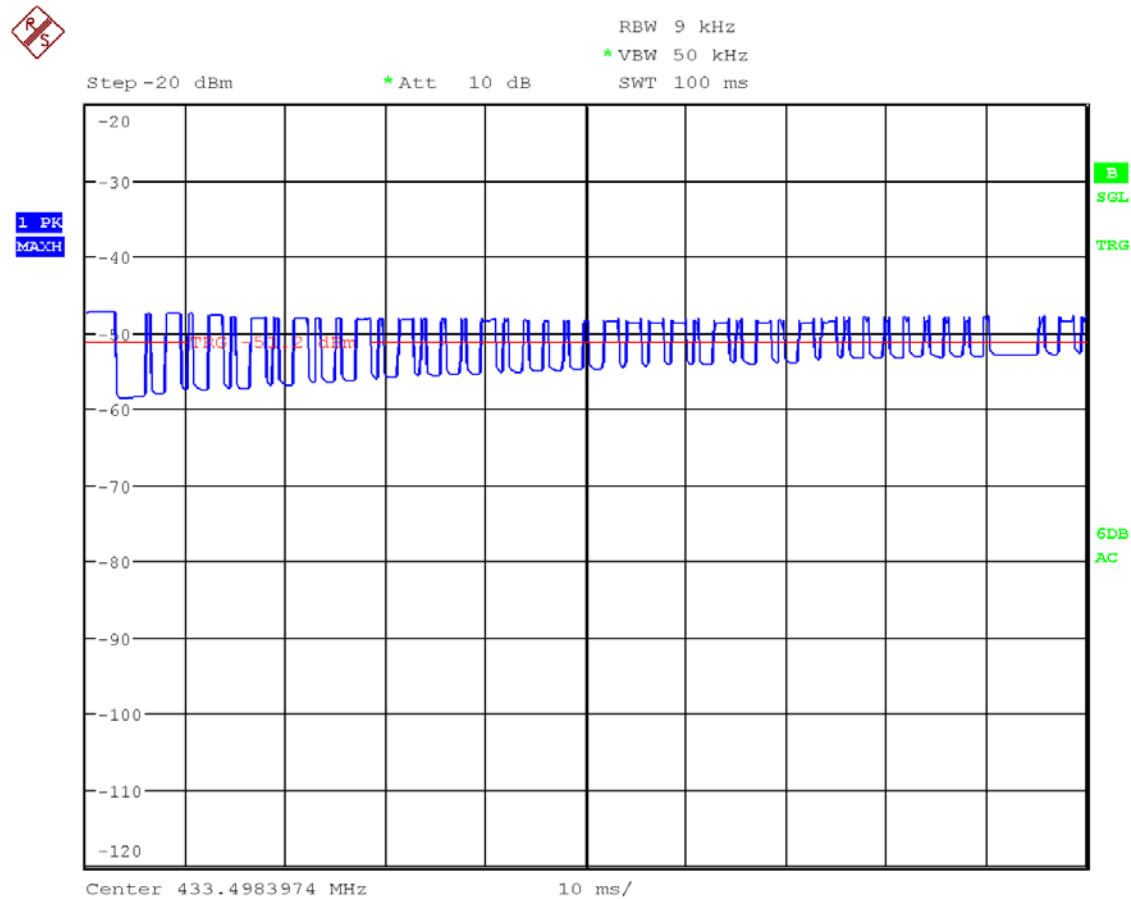
$$\text{dB} = -8.21$$

See the following plots.

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DUTY CYCLE PLOTS

PULSE TRAIN



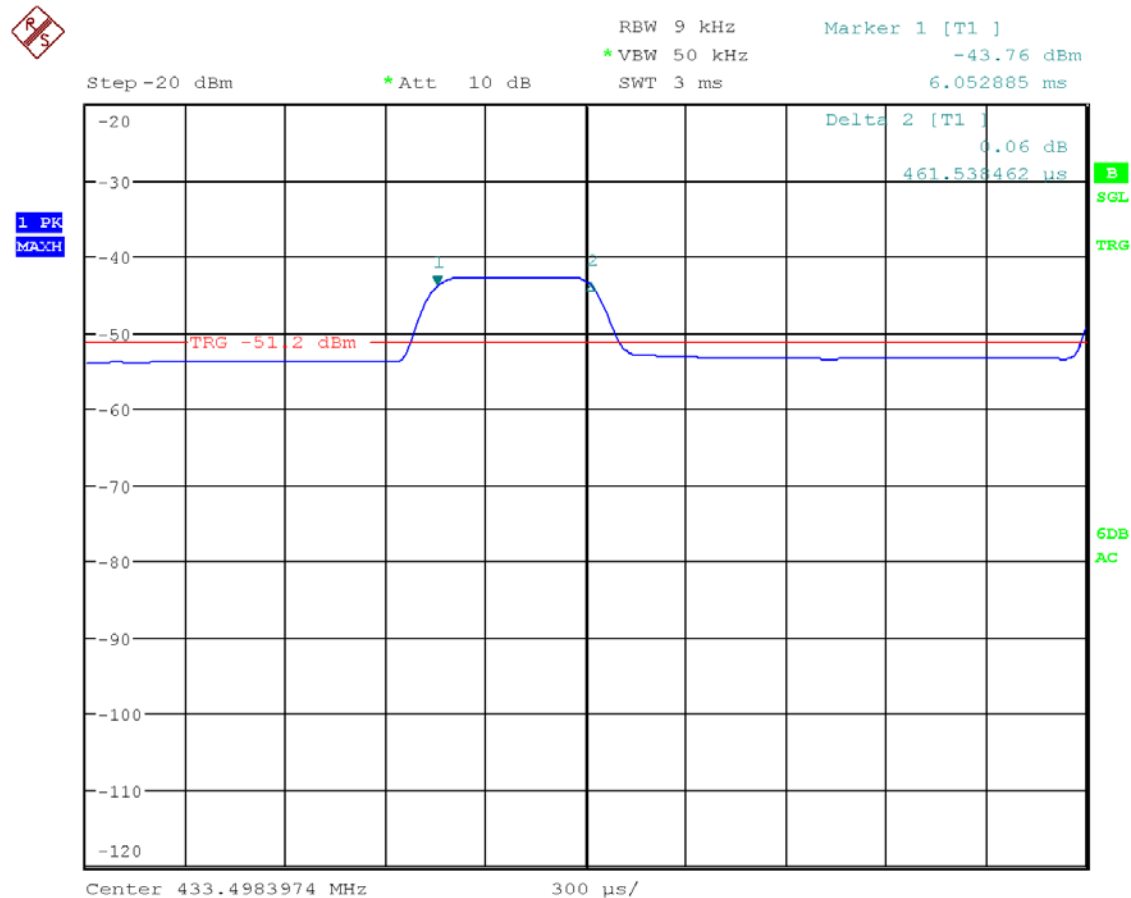
Date: 10.AUG.2015 11:53:50

Results - Meets Requirements

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DUTY CYCLE PLOTS

SHORT PULSE



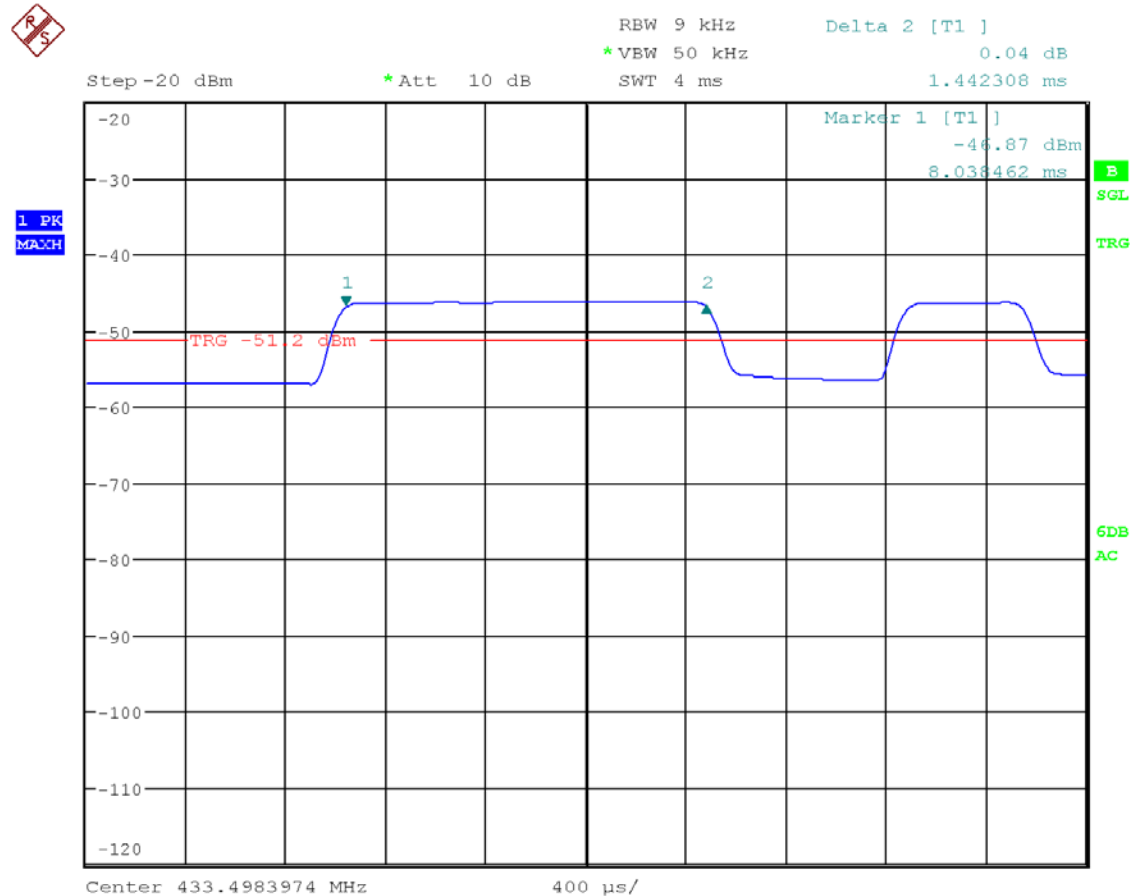
Date: 10.AUG.2015 11:50:14

Results - Meets Requirements

APPLICANT: SHENZHEN CONSTANT ELECTRONICS CO., LTD.
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DUTY CYCLE PLOTS

MEDIUM PULSE



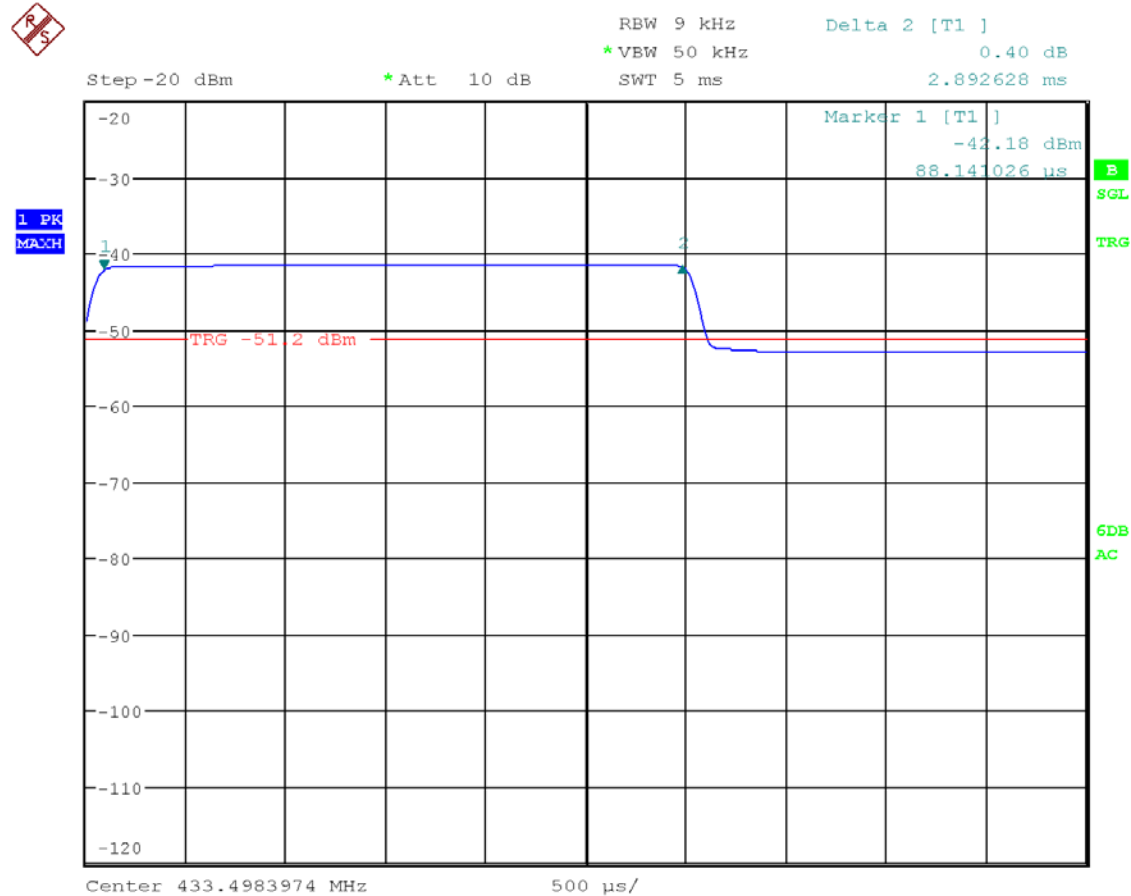
Date: 10.AUG.2015 11:52:44

Results - Meets Requirements

APPLICANT: SHENZHEN CONSTANT ELECTRONICS CO., LTD.
 FCC ID: WH2-2610S
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DUTY CYCLE PLOTS

LONG PULSE



Date: 10.AUG.2015 11:47:58

Results - Meets Requirements

APPLICANT: SHENZHEN CONSTANT ELECTRONICS CO., LTD.
 FCC ID: WH2-2610S
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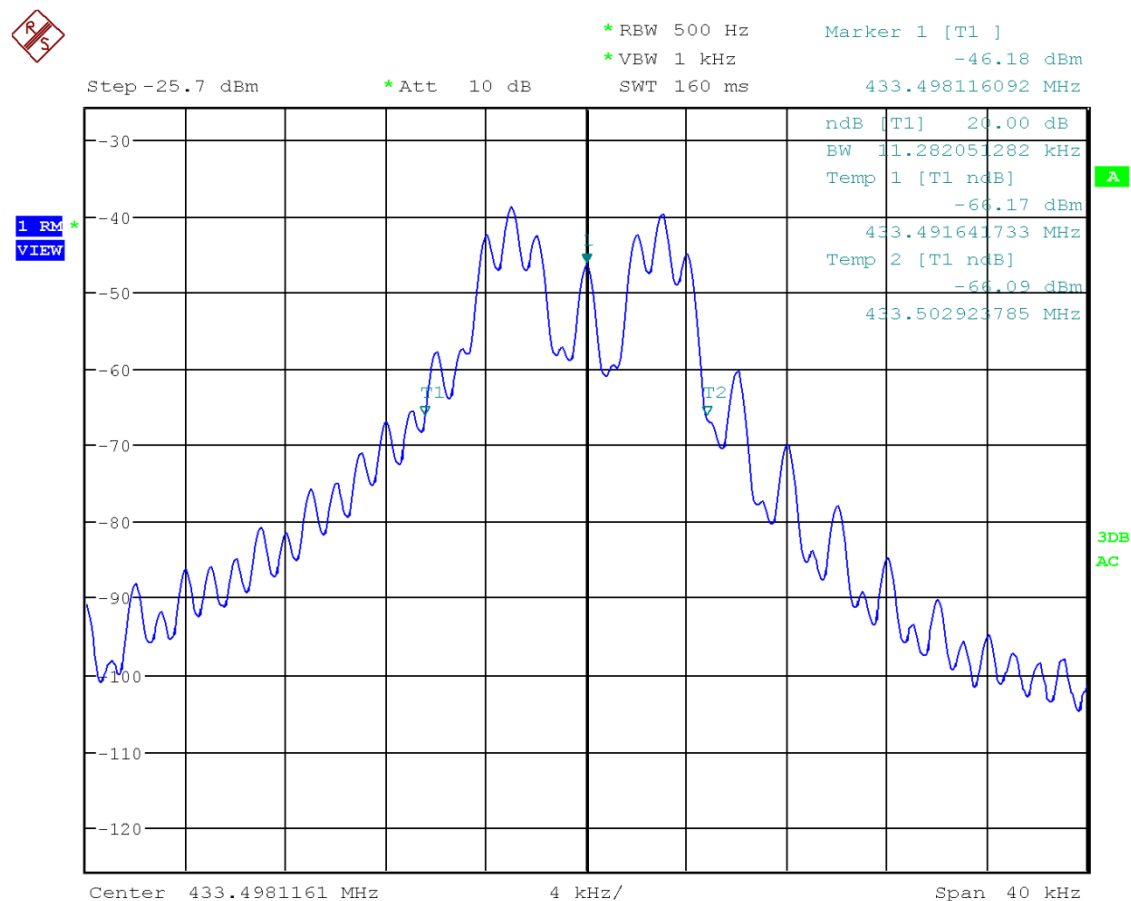
OCCUPIED BANDWIDTH

Rules Part No.: 15.231(c)

Requirements: The 20 dB bandwidth of the emission shall be no wider than .25% of the center frequency for devices operating between 70 and 900 MHz. For this EUT operating at 433.36 MHz the 20 dB bandwidth must be ≤ 1.08 MHz

Test Data:

OCCUPIED BANDWIDTH = 11.28 KHz



Date: 10.AUG.2015 15:25:35

Results - Meets Requirements

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TEST EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconnical Chamber	Eaton Chamber	94455-1	1057	06/14/13	12/14/15
Antenna: Log-Periodic Chamber	Eaton	96005	1243	05/31/13	11/30/15
Antenna: Passive	EMC Test Systems	EMCO 6512	9706-1211	07/09/15	07/09/17
LISN (Primary)	Electro-Metrics	EM-7820	2682	05/08/15	05/08/17
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15
Ant: Double-Ridged Horn/ETS Horn 1 Ch	ETS-Lindgren Chamber	3117	00035923	06/13/14	06/13/16
EMI Test Receiver R & S ESIB 40 Screen Room	Rohde & Schwarz	ESIB 40	100274	08/12/14	08/12/16
Software: EMI Test Receiver	Rohde & Schwarz	EMC 32	Version 4.30.0	NA	NA
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	03/11/14	03/11/16