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FCC PART 15.231 AND IC RSS-210
TEST REPORT
LOW POWER UNLICENSED TRANSMITTER

Applicant	LEDWELL & SON ENTERPRISES
Address	3300 WACO STREET TEXARCANA TX 75501 USA
FCC ID	YS5-LEDWELL-TX1
IC	9257A-JA1
Model	TX1
Product Description	UNIVERSAL WIRELESS RADIO CONTROL TX
Date Sample Received	11/16/2010
Date Tested	11/18/2010
Tested By	Joe Scoglio
Approved By	Richard Block
Timco Report No.	2612UT10TestReport.doc
Test Results	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

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



Certificate # 0955-01

TABLE OF CONTENTS

GENERAL REMARKS	3
REPORT SUMMARY	4
TEST ENVIRONMENT.....	4
TEST SETUP	4
DUT SPECIFICATION	5
MANUFACTURE DECLARATION OF COMPLIANCE WITH PART 15.231(A).....	6
TEST EQUIPMENT LIST	7
TEST PROCEDURES	8
RADIATION INTERFERENCE.....	9
CALCULATION OF DUTY CYCLE	11
OCCUPIED BANDWIDTH.....	15
POWER LINE CONDUCTED INTERFERENCE	16

APPLICANT: LEDWELL & SON ENTERPRISES
FCC ID: YS5-LEDWELL-TX1
IC: 9257A-JA1
REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc

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.



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:

Richard Block
Compliance Engineer

Date: 12/22/2010

APPLICANT: LEDWELL & SON ENTERPRISES
FCC ID: YS5-LEDWELL-TX1
IC: 9257A-JA1
REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc

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, RSS-210, RSS-GEN

Receiver

The receiver portion of this system has been tested and meets all of the FCC requirements per FCC rules Part 15.109. An application for certification is in process.

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.

APPLICANT: LEDWELL & SON ENTERPRISES
FCC ID: YS5-LEDWELL-TX1
IC: 9257A-JA1
REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc

DUT SPECIFICATION

Applicant	LEDWELL & SON ENTERPRISES		
Description	UNIVERSAL WIRELESS RADIO CONTROL TX		
FCC ID	YS5-LEDWELL-TX1		
IC	9257A-JA1		
Model Number	TX1		
Frequency Range	433.92		
DUT 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

APPLICANT: LEDWELL & SON ENTERPRISES
FCC ID: YS5-LEDWELL-TX1
IC: 9257A-JA1
REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc

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?		N/A
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?		X
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?		7.2
	If YES, on-time in 100 ms? If Other, please specify here		15.12ms
	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	

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 FCC ID: YS5-LEDWELL-TX1
 IC: 9257A-JA1
 REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc

TEST EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 3/10/10	3/10/12
AC Voltmeter	HP	400FL	2213A14499	CAL 3/23/09	3/23/11
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	153	CHAR 6/10/09	6/10/11
Frequency Counter	HP	5385A	3242A07460	CAL 5/26/09	5/26/11
Hygro-Thermometer	Extech	445703	0602	CAL 1/30/09	1/30/11
Modulation Analyzer	HP	8901A	3435A06868	CAL 5/26/09	5/26/11
Digital Multimeter	Fluke	FLUKE-77-3	79510405	CAL 5/18/09	5/18/11
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 11/21/09	11/21/11
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 11/22/09	11/22/11
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 11/21/09	11/21/11
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 11/24/09	11/24/11
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 4/25/10	4/25/12

APPLICANT: LEDWELL & SON ENTERPRISES
 FCC ID: YS5-LEDWELL-TX1
 IC: 9257A-JA1
 REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc

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 dBuV	ACF dB/m	Cable Loss dB	Field Strength dBuV/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.

APPLICANT: LEDWELL & SON ENTERPRISES
FCC ID: YS5-LEDWELL-TX1
IC: 9257A-JA1
REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc

RADIATION INTERFERENCE

Rules Part No.: 15.231, RSS-210, ANNEX A1.1

Requirements:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dB μ V/m)	Field Strength of Harmonics and Spurious Emissions (dB μ V/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 dB μ V/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:

$$41.6667 (315) - 7083.3333 = 6041.68 \text{ uV/m}$$
$$20\log(6041.68) = 75.62 \text{ dBuV/m limit @ 315 MHz}$$

Sample calculation of limit @ 433.92 MHz:

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

APPLICANT: LEDWELL & SON ENTERPRISES
FCC ID: YS5-LEDWELL-TX1
IC: 9257A-JA1
REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc

RADIATION INTERFERENCE CONTD.

FOR THIS DUT:

The limit for average field strength in dBuV/m for the fundamental frequency is 80.82 dBuV/m.

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

Test Data:

Tuned Frequency MHz	Emission Frequency MHz	*	Meter Reading dBuV	Ant. Pol	Coax Loss dB	Correction Factor dB	Duty Cycle Factor dB	Field Strength dBuV/m	Margin dB
433.9	433.90		52.2	H	3.05	17.33	7.20	65.38	15.44
433.9	433.90		66.2	V	3.05	16.96	7.20	79.01	1.82
433.9	1,301.90	**	15.7	V	4.20	27.86	7.20	40.56	20.26
433.9	1,735.60		17.6	H	2.65	29.94	7.20	42.99	17.83
433.9	1,735.60		19.6	V	2.65	29.94	7.20	44.99	15.83
433.9	2,169.60		16.9	H	1.77	32.20	7.20	43.67	17.15
433.9	2,169.60		19.9	V	1.77	32.20	7.20	46.67	14.15
433.9	2,603.50		15.6	V	1.94	32.74	7.20	43.08	17.74
433.9	2,603.50		16.8	H	1.94	32.74	7.20	44.28	16.54
433.9	3,037.40		14.0	H	2.11	33.29	7.20	42.20	18.62
433.9	3,037.40		16.2	V	2.11	33.29	7.20	44.40	16.42
433.9	3,471.30		11.3	V	2.24	33.11	7.20	39.45	21.37
433.9	3,471.30		11.4	H	2.24	33.11	7.20	39.55	21.27
433.9	3,905.20	**	10.6	H	2.37	33.75	7.20	39.52	14.48
433.9	3,905.20	**	11.0	V	2.37	33.75	7.20	39.92	14.08
433.9	4,399.20	**	12.9	V	2.52	33.90	7.20	42.12	11.88
433.9	4,399.20	**	14.0	H	2.52	33.90	7.20	43.22	10.78

** -Denotes restricted bands

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

APPLICANT: LEDWELL & SON ENTERPRISES
FCC ID: YS5-LEDWELL-TX1
IC: 9257A-JA1
REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc

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	11@ .20msec
Short Pulse	44@ .10msec
On Time	6.6msec
Length of Pulse Train	15.12msec
Total	.436507

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

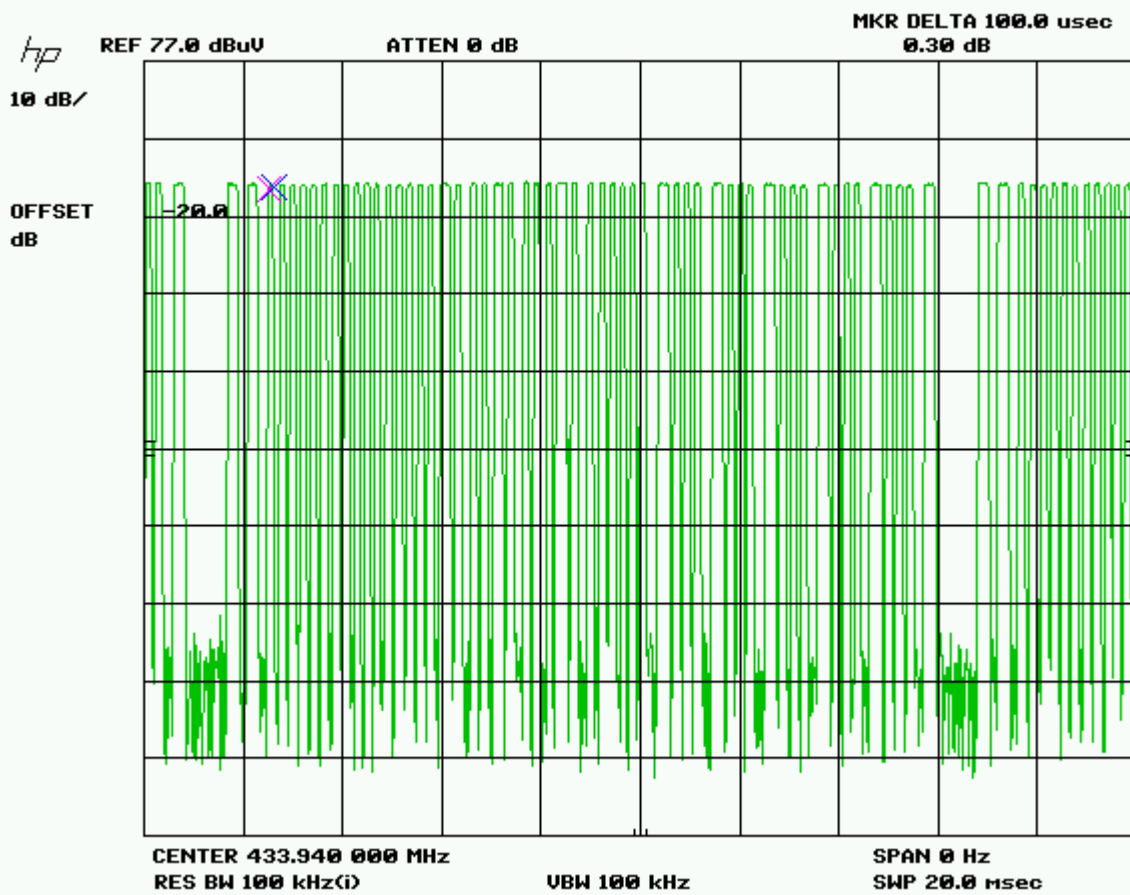
$$\text{dB} = 20 \cdot \log(4.58 / 100)$$

$$\text{dB} = 20 \cdot \log(0.0458)$$

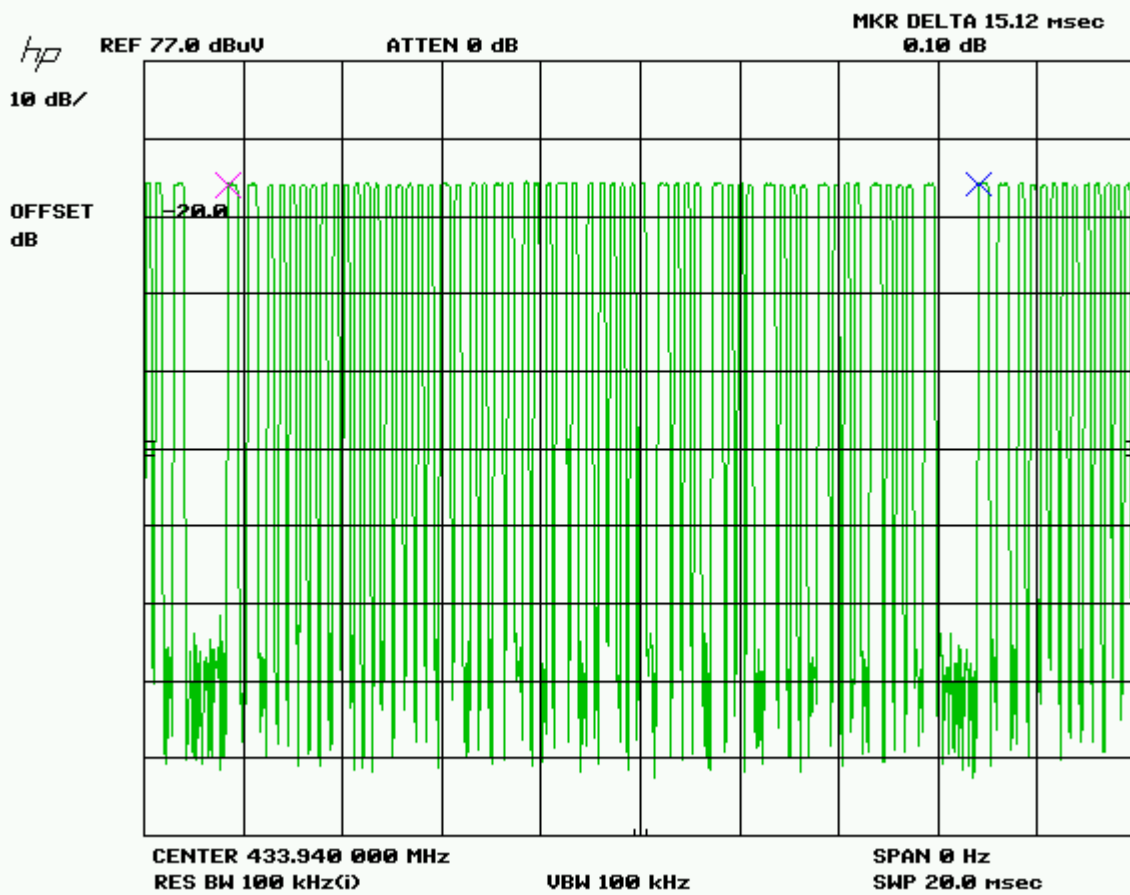
$$\text{dB} = -7.2$$

See the following plots.

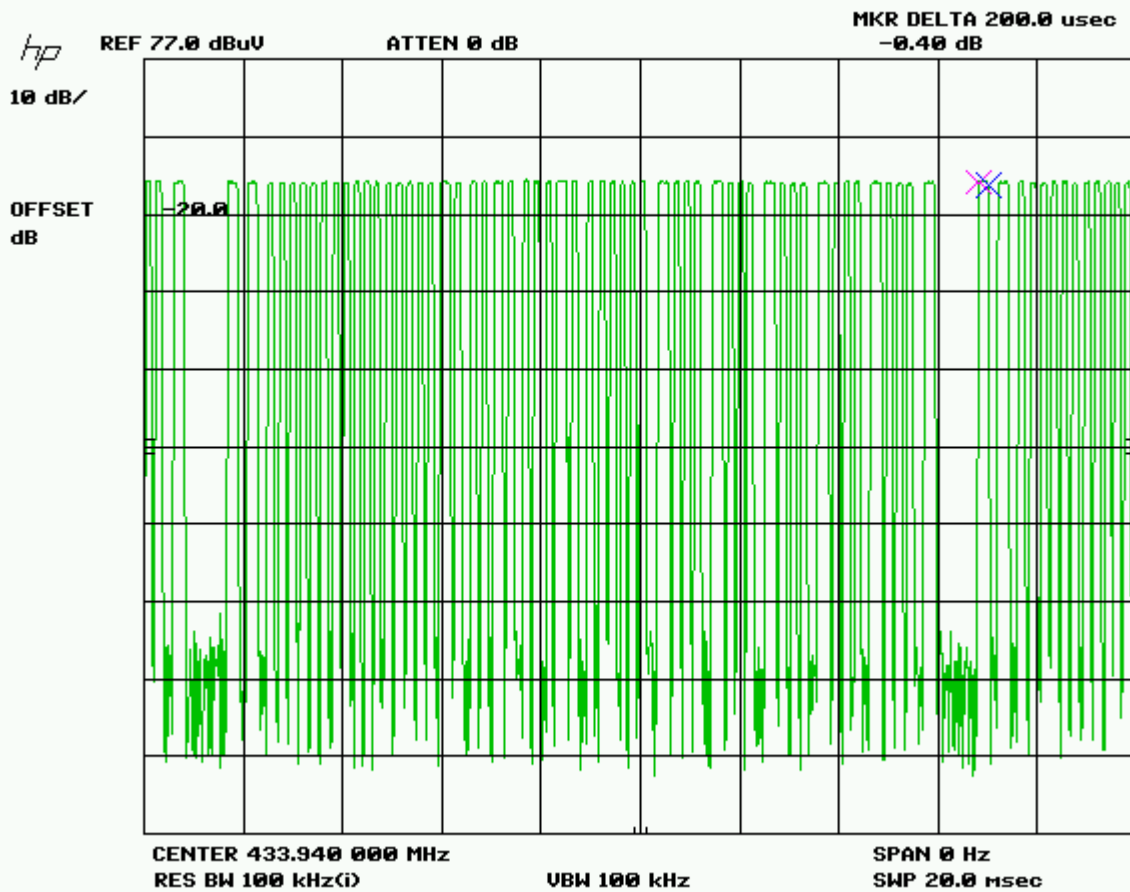
APPLICANT: LEDWELL & SON ENTERPRISES
FCC ID: YS5-LEDWELL-TX1
IC: 9257A-JA1
REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc



APPLICANT: LEDWELL & SON ENTERPRISES
FCC ID: YS5-LEDWELL-TX1
IC: 9257A-JA1
REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc



APPLICANT: LEDWELL & SON ENTERPRISES
FCC ID: YS5-LEDWELL-TX1
IC: 9257A-JA1
REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc



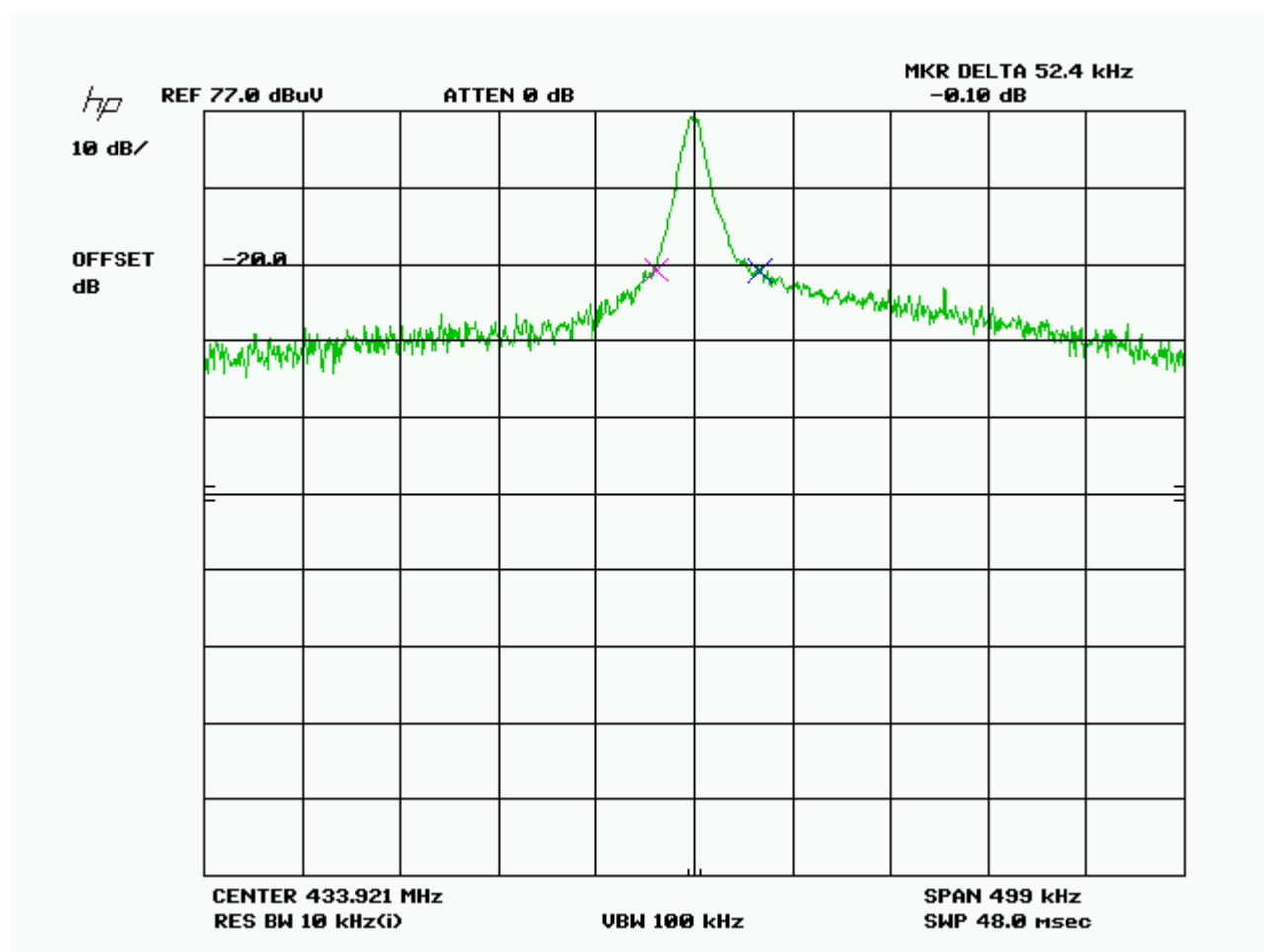
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FCC ID: YS5-LEDWELL-TX1
IC: 9257A-JA1
REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc

OCCUPIED BANDWIDTH

Rules Part No.: 15.231(C), RSS-210 ANNEX A.1.1.3

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.



APPLICANT: LEDWELL & SON ENTERPRISES
FCC ID: YS5-LEDWELL-TX1
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REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc

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.

APPLICANT: LEDWELL & SON ENTERPRISES
FCC ID: YS5-LEDWELL-TX1
IC: 9257A-JA1
REPORT: L\LEDWELL\2612UT10\2612UT10TestReport.doc