



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](mailto:INFO@TIMCOENGR.COM)  
[HTTP://WWW.TIMCOENGR.COM](http://WWW.TIMCOENGR.COM)

## FCC PART 15.231 TEST REPORT

### LOW POWER UNLICENSED TRANSMITTER

|                      |                                                                           |
|----------------------|---------------------------------------------------------------------------|
| Applicant            | DELTA SYSTEMS INC.                                                        |
| Address              | 10036 AURORA - HUDSON ROAD<br>1734 FROST ROAD<br>STREETSBORO OH 44241 USA |
| FCC ID               | R932051010                                                                |
| Product Description  | 433.92 MHZ TX                                                             |
| Date Sample Received | 9/15/2008                                                                 |
| Date Tested          | 10/1/2008                                                                 |
| Tested By            | Richard Block                                                             |
| Approved By          | Mario de Aranzeta                                                         |
| Timco Report No.     | 2161AUT8TestReport.pdf                                                    |
| 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

|                                                                 |    |
|-----------------------------------------------------------------|----|
| ATTESTATIONS .....                                              | 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 .....                                        | 12 |
| POWER LINE CONDUCTED INTERFERENCE .....                         | 13 |



## 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:** *Mario de Aranzeta*

Mario de Aranzeta C.E.T.  
Compliance Engineer/ Lab. Supervisor

**Date:** October 15, 2008

## 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) | No Related Test Report                                |

## TEST ENVIRONMENT

|                 |                                                                            |
|-----------------|----------------------------------------------------------------------------|
| Test Facility   | The test sites are located at 849 NW State Road 45 Newberry, FL 32669 USA. |
| Test Condition: | Temperature: 26°C<br>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         | DELTA SYSTEMS INC.                                               |                                                    |                                              |
| Description       | 433.92 MHZ TX                                                    |                                                    |                                              |
| FCC ID            | R932051010                                                       |                                                    |                                              |
| Model Number      | 205-1010                                                         |                                                    |                                              |
| Frequency Range   | 433.92 MHz                                                       |                                                    |                                              |
| 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: DELTA SYSTEMS INC.

FCC ID: R932051010

REPORT: D\DELTA SYSTEMS\2161AUT8\2161AUT8TestReport.doc Page 5 of 13

# **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?                                                                    | N/A           |    |
| 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?                                          | N/A           |    |
| 10   | Duty cycle: Maximum on-time?                                                                                              |               |    |
|      | If YES, on-time in 100 ms? If Other, please specify here<br>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? | On-off Keying |    |

APPLICANT: DELTA SYSTEMS INC.

FCC ID: R932051010

REPORT: D\DELTA SYSTEMS\2161AUT8\2161AUT8TestReport.doc Page 6 of 13

## TEST EQUIPMENT LIST

| Device                                   | Manufacturer    | Model         | Serial Number            | Cal/Char Date     | Due Date |
|------------------------------------------|-----------------|---------------|--------------------------|-------------------|----------|
| 3-Meter OATS                             | TEI             | N/A           | N/A                      | Listed<br>1/11/06 | 1/10/09  |
| 3/10-Meter OATS                          | TEI             | N/A           | N/A                      | Listed<br>3/20/07 | 3/19/10  |
| Analyzer Tan Tower Spectrum Analyzer     | HP              | 8566B Opt 462 | 3138A07786<br>3144A20661 | CAL<br>12/7/07    | 12/7/09  |
| Analyzer Tan Tower RF Preselector        | HP              | 85685A        | 3221A01400               | CAL<br>12/7/07    | 12/7/09  |
| Analyzer Tan Tower Quasi-Peak Adapter    | HP              | 85650A        | 3303A01690               | CAL<br>12/8/07    | 12/8/09  |
| Analyzer Tan Tower Preamplifier          | HP              | 8449B-H02     | 3008A00372               | CAL<br>12/8/07    | 12/8/09  |
| Analyzer Silver Tower Spectrum Analyzer  | HP              | 8566B Opt 462 | 3552A22064<br>3638A08608 | CAL<br>10/30/06   | 10/30/08 |
| Analyzer Silver Tower RF Preselector     | HP              | 85685A        | 2620A00294               | CAL 3/6/07        | 3/6/09   |
| Analyzer Silver Tower Quasi-Peak Adapter | HP              | 85650A        | 3303A01844               | CAL<br>10/30/06   | 10/30/08 |
| Analyzer Open-Frame Tower Preamplifier   | HP              | 8449B         | 3008A01075               | CAL<br>6/20/07    | 6/20/09  |
| Antenna: Biconnical                      | Electro-Metrics | BIA-25        | 1171                     | CAL<br>7/18/07    | 7/18/09  |
| Antenna: Biconnical                      | Eaton           | 94455-1       | 1096                     | CAL<br>10/11/06   | 10/11/08 |
| Antenna: Biconnical                      | Eaton           | 94455-1       | 1057                     | CAL<br>12/12/07   | 12/12/09 |
| Antenna: Log-Periodic                    | Electro-Metrics | LPA-25        | 1122                     | CAL<br>12/1/06    | 12/1/08  |

APPLICANT: DELTA SYSTEMS INC.

FCC ID: R932051010

REPORT: D\DELTA SYSTEMS\2161AUT8\2161AUT8TestReport.doc Page 7 of 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 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<br>MHz | Meter Reading<br>dB $\mu$ V | ACF<br>dB/m | Cable Loss<br>dB | Field Strength<br>dB $\mu$ V/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 (dB $\mu$ V/m) | Field Strength of Harmonics and Spurious Emissions (dB $\mu$ 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 $\mu$ 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:

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

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

### FOR THIS DUT:

The limit for average field strength in dB $\mu$ V/m for the fundamental frequency is 80.82 dB $\mu$ V/m.

The limit for average field strength in dB $\mu$ V/m for the harmonics and other spurious frequencies is 60.82 dB $\mu$ V/m unless it is in a restricted band.

APPLICANT: DELTA SYSTEMS INC.

FCC ID: R932051010

REPORT: D\DELTA SYSTEMS\2161AUT8\2161AUT8TestReport.doc Page 9 of 13

# **Test Data:**

| Tuned Frequency MHz | Emission Frequency MHz | *  | Meter Reading dBμV | Ant. Polarity | Coax Loss dB | Correction Factor dB | Duty Cycle Factor dB | Field Strength dBμV/m | Margin dB |    |
|---------------------|------------------------|----|--------------------|---------------|--------------|----------------------|----------------------|-----------------------|-----------|----|
| 433.9               | 433.92                 |    | 56.7               | H             | 1.23         | 16.62                | 3.30                 | 71.25                 | 9.57      |    |
| 433.9               | 433.92                 |    | 62.9               | V             | 1.23         | 16.18                | 3.30                 | 77.01                 | 3.81      |    |
| 433.9               | 867.80                 |    | 36.2               | V             | 1.93         | 22.40                | 3.30                 | 57.23                 | 3.59      |    |
| 433.9               | 867.80                 |    | 36.7               | H             | 1.93         | 22.96                | 3.30                 | 58.29                 | 2.53      |    |
| 433.9               | 1,301.70               | ** | 18.1               | V             | 2.34         | 27.84                | 3.30                 | 44.98                 | 9.02      |    |
| 433.9               | 1,301.70               | ** | 26.9               | H             | 2.34         | 27.84                | 3.30                 | 53.78                 | 0.22      |    |
| 433.9               | 1,301.70               | ** | 29.6               | V             | 2.34         | 27.84                | 3.30                 | 56.48                 | 17.52     | PK |
| 433.9               | 1,735.60               |    | 21.0               | V             | 2.69         | 29.51                | 3.30                 | 49.90                 | 10.93     | AV |
| 433.9               | 1,735.60               |    | 21.4               | H             | 2.69         | 29.51                | 3.30                 | 50.30                 | 10.53     |    |
| 433.9               | 2,169.60               |    | 20.7               | H             | 3.02         | 31.64                | 3.30                 | 52.06                 | 8.77      |    |
| 433.9               | 2,169.60               |    | 23.7               | V             | 3.02         | 31.64                | 3.30                 | 55.06                 | 5.77      |    |
| 433.9               | 2,603.50               |    | 18.6               | H             | 3.32         | 32.52                | 3.30                 | 51.14                 | 9.68      |    |
| 433.9               | 2,603.50               |    | 20.2               | V             | 3.32         | 32.52                | 3.30                 | 52.74                 | 8.08      |    |
| 433.9               | 3,037.40               |    | 15.4               | H             | 3.63         | 32.61                | 3.30                 | 48.34                 | 12.48     |    |
| 433.9               | 3,037.40               |    | 17.4               | V             | 3.63         | 32.61                | 3.30                 | 50.34                 | 10.48     |    |
| 433.9               | 3,471.30               |    | 11.5               | V             | 4.02         | 32.79                | 3.30                 | 45.01                 | 15.81     |    |
| 433.9               | 3,471.30               |    | 11.8               | H             | 4.02         | 32.79                | 3.30                 | 45.31                 | 15.51     |    |
| 433.9               | 3,905.20               | ** | 13.6               | H             | 4.41         | 33.45                | 3.30                 | 48.16                 | 5.84      |    |
| 433.9               | 3,905.20               | ** | 14.0               | V             | 4.41         | 33.45                | 3.30                 | 48.56                 | 5.44      |    |
| 433.9               | 4,339.20               | ** | 9.2                | H             | 4.67         | 33.94                | 3.30                 | 44.51                 | 9.49      |    |
| 433.9               | 4,339.20               | ** | 10.0               | V             | 4.67         | 33.94                | 3.30                 | 45.31                 | 8.69      |    |

\*\* -Denotes restricted bands

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

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

$$\text{dB} = 20 \cdot \log(68 / 100)$$

$$\text{dB} = 20 \cdot \log(0.68)$$

$$\text{dB} = -3.3$$

From the manufacturer:

This transmitter consists of nine buttons and will be used exclusively for control of a searchlight used mostly in the marine industry. The transmitter incorporates a Microprocessor Pic 16F630 manufactured by microchip and a RF transmitter chip TDK 5100 manufactured Infineon. The transmitter will continue to transmit as long as a button is pushed and will cease transmission 2 seconds after the button is released. The fundamental frequency of the transmitter is 433.92 MHz which is crystal controlled. The data is a hybrid of the Microchip rolling code written by Delta Systems, it has a maximum duty cycle of around 68%.

APPLICANT: DELTA SYSTEMS INC.

FCC ID: R932051010

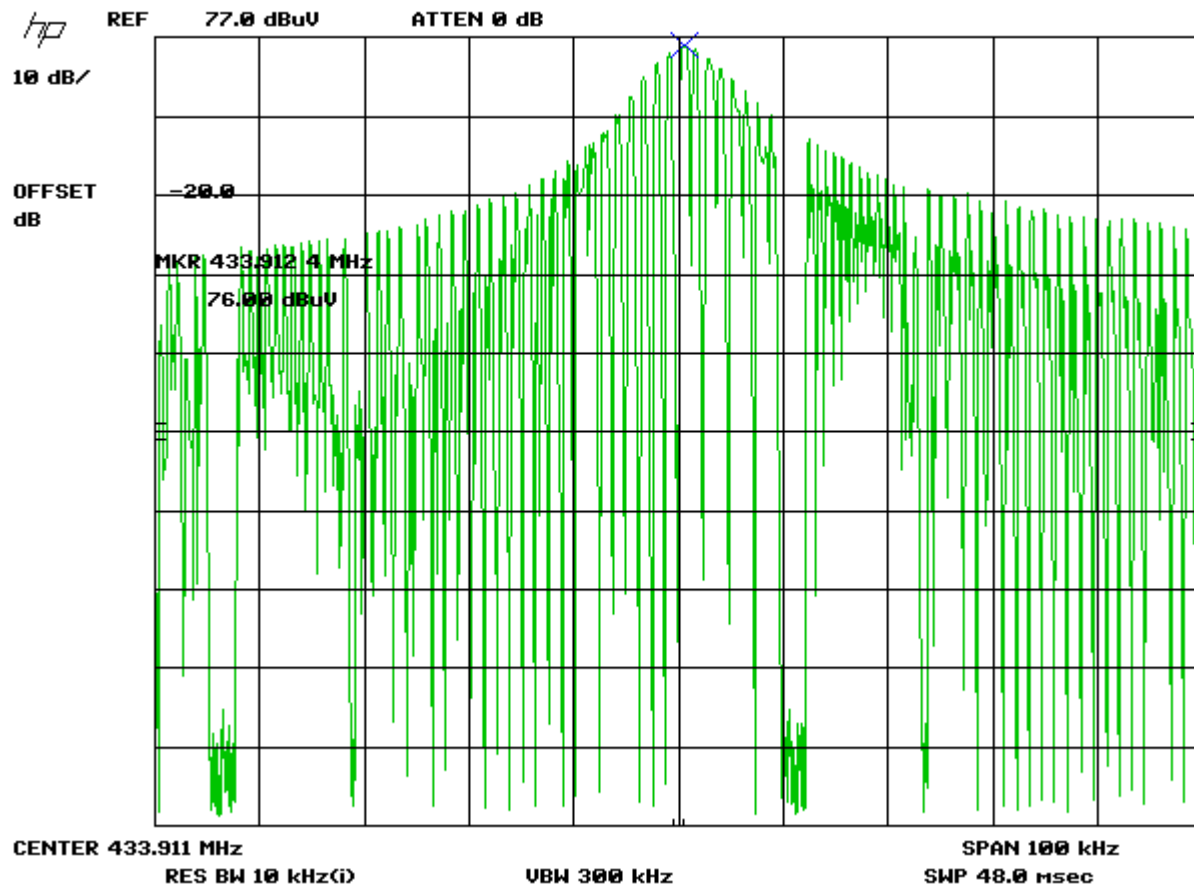
REPORT: D\DELTA SYSTEMS\2161AUT8\2161AUT8TestReport.doc Page 11 of 13

## 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<br>(MHz) | Quasi Peak Limits<br>(dBuV) | Average Limits<br>(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 DC operated exclusively.