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**FCC**  
**UHF PORTABLE PART 90**  
**TEST REPORT**

|                             |                                                                        |
|-----------------------------|------------------------------------------------------------------------|
| <b>APPLICANT</b>            | DELUXE TELEPHONE SYSTEMS LTD.                                          |
|                             | 311 Consumer Road<br>Toronto Ontario M2J 4G8 CANADA                    |
| <b>FCC ID</b>               | 2ACZRDTM25                                                             |
| <b>MODEL NUMBER</b>         | DTM-25                                                                 |
| <b>PRODUCT DESCRIPTION</b>  | 220-222 MHZ TRANSCEIVER                                                |
| <b>STANDARD APPLIED</b>     | CFR 47 Part 90                                                         |
| <b>DATE SAMPLE RECEIVED</b> | 9/22/2014                                                              |
| <b>DATE TESTED</b>          | 9/22/2014                                                              |
| <b>REPORT ISSUE DATE</b>    | 12/22/2014                                                             |
| <b>TESTED BY</b>            | Nam Nguyen                                                             |
| <b>APPROVED BY</b>          | Sid Sanders                                                            |
| <b>TIMCO REPORT NO.</b>     | 1706UT14TestReport.docx                                                |
| <b>TEST RESULTS</b>         | <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.

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## GENERAL REMARKS

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## 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: 2005 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:**

A handwritten signature in blue ink, appearing to read 'Sid Sanders', is written over a circular purple stamp. The stamp contains the text 'TIMCO ENGINEERING, INC.' around the perimeter.

Sid Sanders  
Engineering Project Manager

**Date:** 12/22/2014

Applicant: Deluxe Telephone Systems Ltd.  
FCC ID: 2ACZRDTM25  
Report: D\DELUXE\1706UT14\1706UT14TestReport.doc

## GENERAL INFORMATION

### EUT Specification

|                                    |                                                                           |
|------------------------------------|---------------------------------------------------------------------------|
| <b>EUT Description</b>             | 220-222 MHZ TRANSCEIVER                                                   |
| <b>FCC ID</b>                      | 2ACZRDTM25                                                                |
| <b>Model Number</b>                | DTM-25                                                                    |
| <b>Operating Frequency</b>         | 220-222MHz                                                                |
| <b>Test Frequencies</b>            | 220.607 & 221.607MHz                                                      |
| <b>Type of Emission</b>            | 8K10F1D                                                                   |
| <b>Modulation</b>                  | 3FSK                                                                      |
| <b>EUT Power Source</b>            | <input type="checkbox"/> 110–120Vac/50– 60Hz                              |
|                                    | <input checked="" type="checkbox"/> DC Power 12V                          |
|                                    | <input type="checkbox"/> Battery Operated Exclusively                     |
| <b>Test Item</b>                   | <input type="checkbox"/> Prototype                                        |
|                                    | <input checked="" type="checkbox"/> Pre-Production                        |
|                                    | <input type="checkbox"/> Production                                       |
| <b>Type of Equipment</b>           | <input checked="" type="checkbox"/> Fixed                                 |
|                                    | <input type="checkbox"/> Mobile                                           |
|                                    | <input type="checkbox"/> Portable                                         |
| <b>Test Conditions</b>             | The temperature was 24-26°C with a relative humidity of 50-65%.           |
| <b>Revision History to the EUT</b> | None                                                                      |
| <b>Test Exercise</b>               | The EUT was placed in continuous transmit mode.                           |
| <b>Applicable Standards</b>        | ANSI/TIA 603-C:2004, FCC CFR 47 Part 90                                   |
| <b>Test Facility</b>               | Timco Engineering Inc.<br>849 NW State Road 45<br>Newberry, FL 32669 USA. |

## TEST PROCEDURE

**Power Line Conducted Interference:** The procedure used was ANSI/TIA 603-D:2010, using a 50uH LISN. Both lines were observed with the EUT transmitting. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

**Bandwidth 20 dB:** The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

**Power Output:** The RF power output was measured at the antenna feed point using a peak power meter.

**Antenna Conducted Emissions:** The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10<sup>th</sup> harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

**Radiation Interference:** The test procedure used was ANSI/TIA 603-D:2010, using an Rohde & Schwarz – EMI test receiver. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

## RF POWER OUTPUT

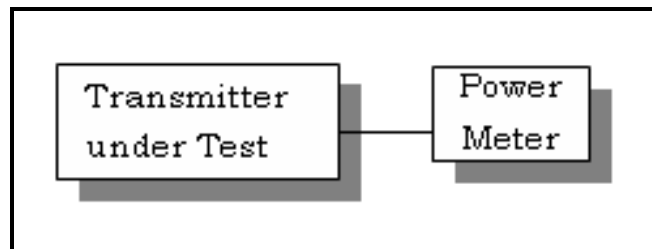
**Rule Part No.:** Part 2.1046(a), Part 90

**Test Requirements:** Manufacturer's Specification

**Method of Measurement:** RF power is measured by using a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage (if battery operated), or a properly adjusted power supply (if not battery operated), and the transmitter properly adjusted the RF output measures:

For the device with a fixed or integral antenna, the RF power is measured as ERP. The substitution method was used. The RF output measures:

**Test Setup Diagram:**



**Test Data:** RF power of the EUT can be set at 5W to 25W.

OUTPUT POWER:

| Tuned Frequency (MHz) | RF POWER High |       | RF POWER Low |       |
|-----------------------|---------------|-------|--------------|-------|
|                       | dBm           | Watts | dBm          | Watts |
| 220.607               | 43.84         | 24.21 | 37.45        | 5.5   |
| 221.607               | 44.00         | 25.10 | 37.07        | 5.1   |

### Part 2.1033 (C)(8) DC Input into the final amplifier

FOR LOW POWER SETTING INPUT POWER:  $(12.0V)(0.95A) = 11.4 \text{ Watts}$

FOR HIGH POWER SETTING INPUT POWER:  $(12.0V)(2.50A) = 30.0\text{Watts}$

## OCCUPIED BANDWIDTH

### **Part 2.1049(c) EMISSION BANDWIDTH:**

#### **Part 90.210(b) 25kHz Channel Spacing**

Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least  $43 + 10\log(P)$  dB.

#### **Part 90.210(c) 25 kHz Channel Spacing Not Equipped with a Low Pass Filter**

For transmitters that are not equipped with an audio low pass filter pursuant to S90.211 (b), the power of any emission must be attenuated below the un-modulated carrier output power as follows; (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5 kHz but not more than 10 kHz: At least  $83 \log(f_d/5)$  dB; (2) ON any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least  $29 \log(f_d^2/11)$  dB or 50 dB, whichever is the lesser attenuation; (3) On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: At least  $43 + 10 \log(P_o)$  dB.

#### **Part 90.210(d) Emission Mask D - 12.5 kHz channel BW equipment.**

For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth  $f_0$  to 5.625 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least  $7.27 (f_d - 2.88 \text{ kHz})$  dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 12.5 kHz: At least  $50 + 10\log(P)$  dB or 70 dB, whichever is the lesser attenuation.

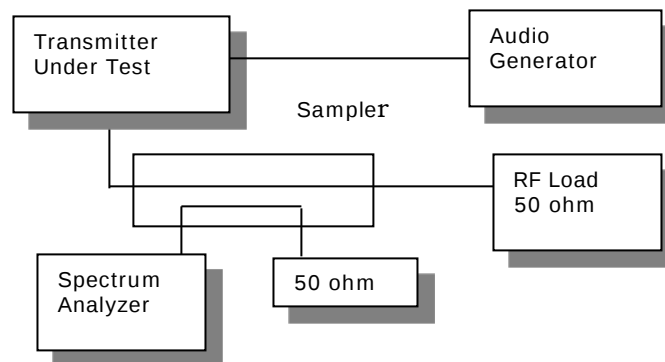
**Part 90.210(e) Emission Mask E – 6.25 kHz channel BW equipment.**

For transmitters designed to operate with a 6.25 kHz bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth  $f_0$  to 3.0 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least  $30 + 16.67(f_d - 3.0 \text{ kHz})$  or  $55 + 10 \log(P)$  or 65, whichever is the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least  $55 + 10 \log(P)$  dB or 65 dB, whichever is the lesser attenuation.

**Method of Measurement: ANSI/TIA 603-D: 2010**

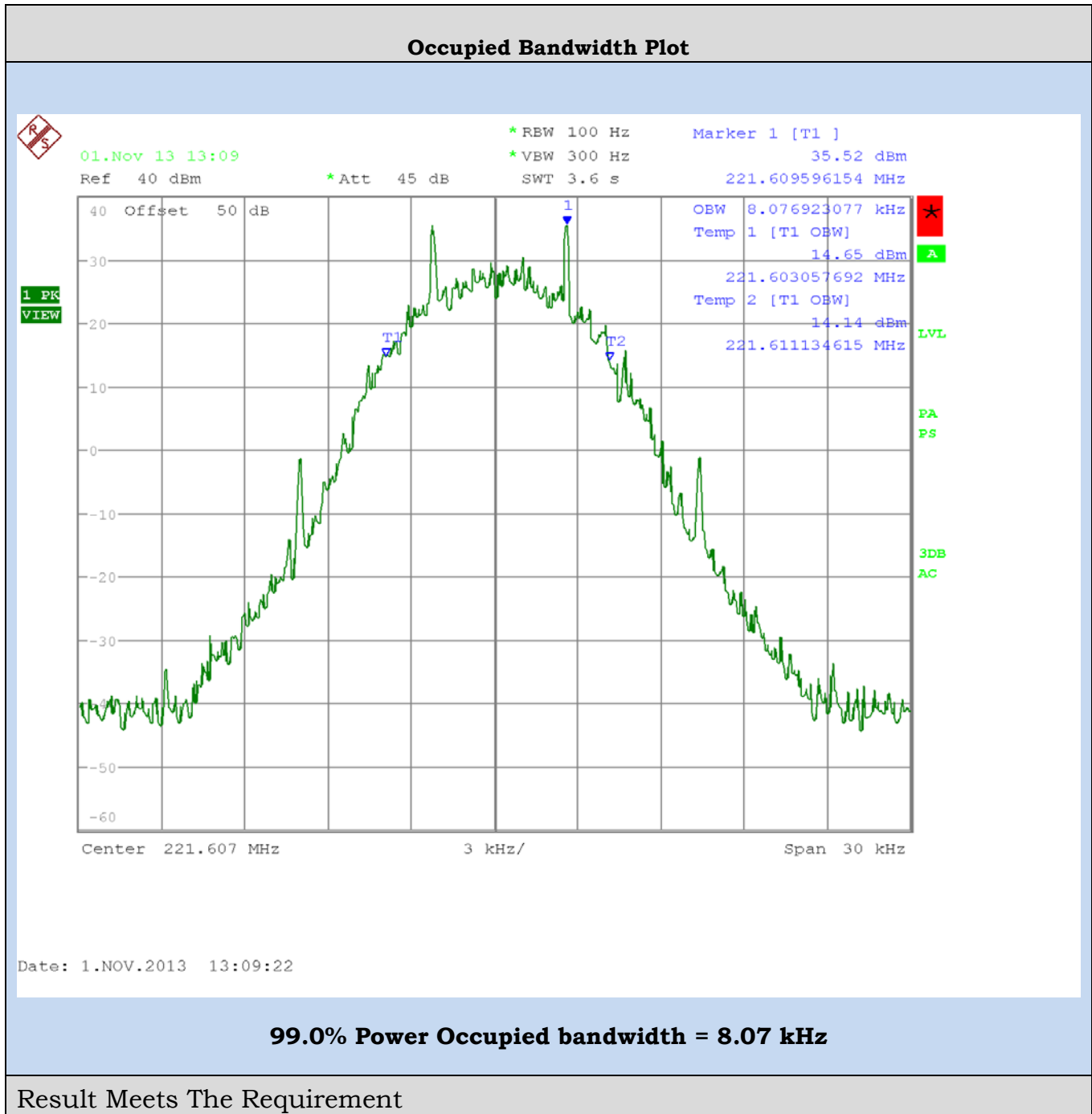
**Test Setup Diagram:**



**Test Data:** See the plots below

## OCCUPIED BANDWIDTH PLOTS: ANALOG

Part 90.210(d) Emission Mask D - 12.5 kHz channel bandwidth - ANALOG



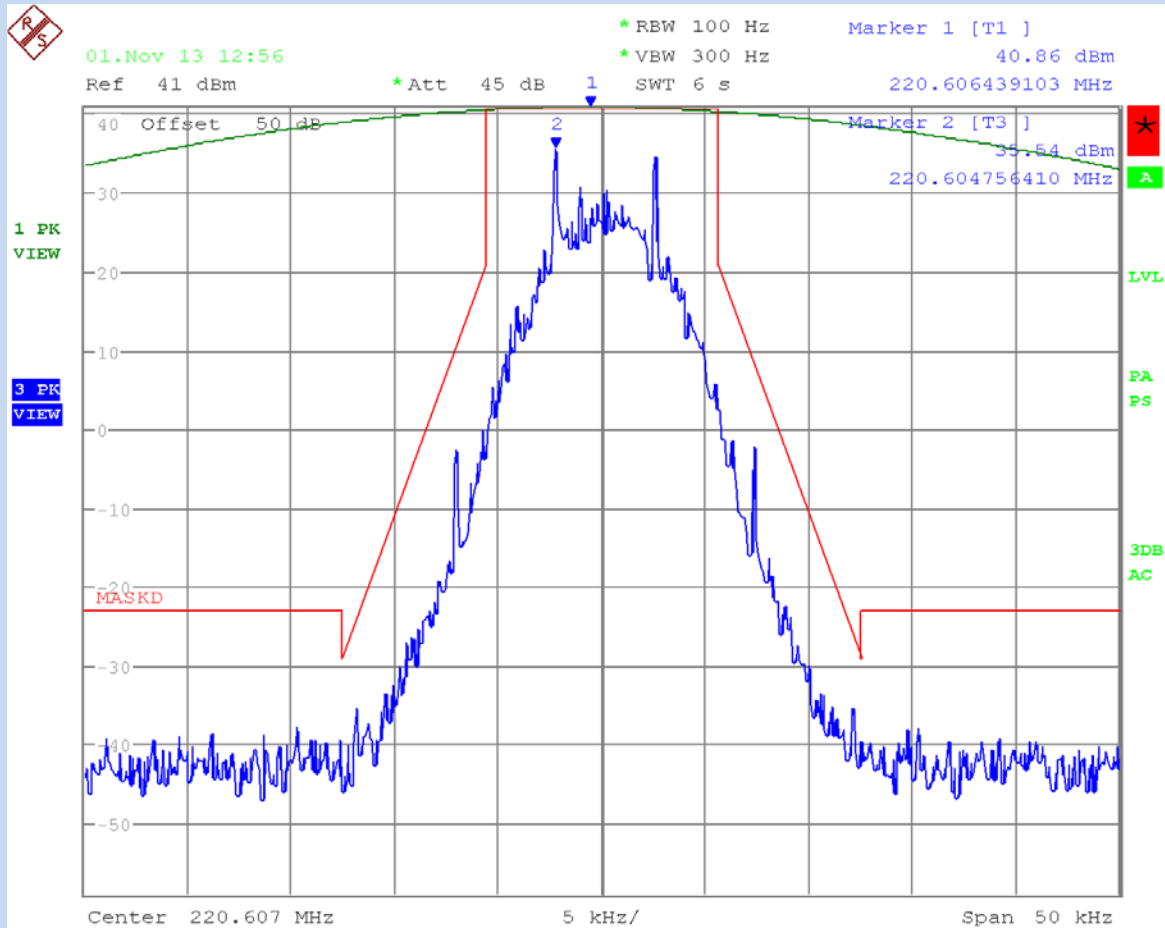
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## OCCUPIED BANDWIDTH PLOTS: ANALOG

Part 90.210(d) Emission Mask D - 12.5 kHz channel bandwidth - ANALOG

### Occupied Bandwidth Plot

#### 12.5kHz: DIGITAL



Date: 1.NOV.2013 12:56:41

Result Meets The Requirement

Applicant: Deluxe Telephone Systems Ltd.  
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## SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

**Rule Part No.:** Part 2.1051(a)

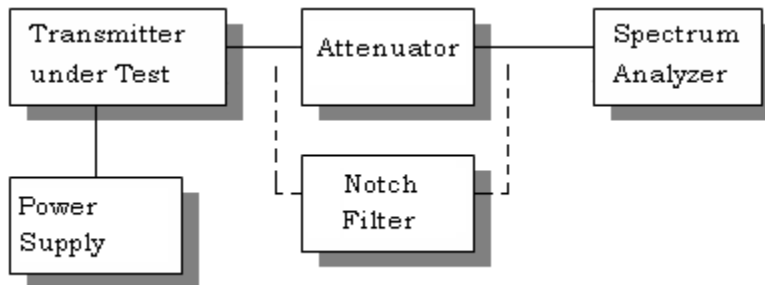
**Requirements:**

12.5 kHz Channel Spacing =  $50 + 10 \log (25.0) = 64.0$  dBc (high power)

12.5 kHz Channel Spacing =  $50 + 10 \log (5.0) = 57.0$  dBc (low power)

**Method of Measurement:** The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from the lowest frequency generated to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA 603-D: 2010.

### Method of Measuring Conducted Spurious Emissions



### Test Data: High Power Low end of Band

**Test Data:**

| TF<br>HIGH<br>POWER | EF      | dB below<br>carrier |  | TF<br>LOW POWER | EF      | dB below<br>carrier |
|---------------------|---------|---------------------|--|-----------------|---------|---------------------|
| 220.61              | 441.21  | 69.8                |  | 220.61          | 441.21  | 70.1                |
|                     | 661.82  | 65.1                |  |                 | 661.82  | 64.5                |
|                     | 882.43  | 69.3                |  |                 | 882.43  | 69.2                |
|                     | 1103.04 | 79.9                |  |                 | 1103.04 | 80.7                |
|                     | 1323.64 | 85.4                |  |                 | 1323.64 | 82.1                |
|                     | 1544.25 | 80.7                |  |                 | 1544.25 | 80.4                |
|                     | 1764.86 | 83.9                |  |                 | 1764.86 | 80.1                |
|                     | 1985.46 | 82.9                |  |                 | 1985.46 | 81.6                |
|                     | 2206.07 | 84.4                |  |                 | 2206.07 | 80.7                |

## RESULTS: MEET REQUIREMENTS

Applicant: Deluxe Telephone Systems Ltd.  
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## SPURIOUS EMISSIONS AT ANTENNA TERMINALS

### Test Data: High Power Middle of Band

| <b>TF<br/>HIGH<br/>POWER</b> | <b>EF</b> | <b>dB below<br/>carrier</b> |  | <b>TF<br/>LOW POWER</b> | <b>EF</b> | <b>dB below<br/>carrier</b> |
|------------------------------|-----------|-----------------------------|--|-------------------------|-----------|-----------------------------|
| 221.61                       | 443.21    | 65.4                        |  | 221.61                  | 443.21    | 70.3                        |
|                              | 664.82    | 66.1                        |  |                         | 664.82    | 64.5                        |
|                              | 886.43    | 69.8                        |  |                         | 886.43    | 69.7                        |
|                              | 1108.04   | 79.73                       |  |                         | 1108.04   | 82.5                        |
|                              | 1329.64   | 84.18                       |  |                         | 1329.64   | 82.3                        |
|                              | 1551.25   | 80.17                       |  |                         | 1551.25   | 79.9                        |
|                              | 1772.86   | 83.22                       |  |                         | 1772.86   | 82                          |
|                              | 1994.46   | 82.18                       |  |                         | 1994.46   | 82.9                        |
|                              | 2216.07   | 83.72                       |  |                         | 2216.07   | 82.7                        |

### RESULTS: MEET REQUIREMENTS

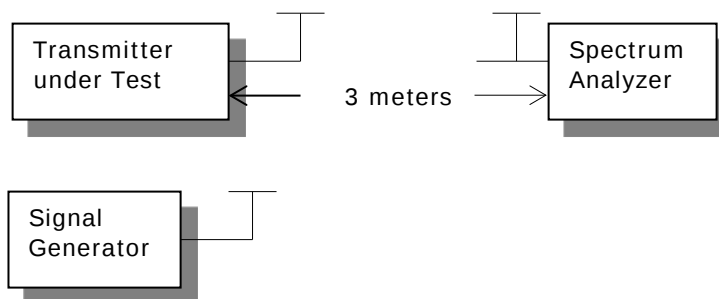
## FIELD STRENGTH OF SPURIOUS EMISSIONS

**Rule Parts. No.:** Part 2.1053

**Requirements:** 12.5kHz Channel Spacing =  $50 + 10\log(OP) = 64.0$  dBc

**METHOD OF MEASUREMENT:** The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per ANSI/TIA 603-D: 2010 using the substitution method. Measurements were made at the test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.

**Test Setup Diagram:**



**Test Data:**  $50 + 10\log(25W) = 64$  dB

| High Power             |               |                        | Low Power              |               |                        |
|------------------------|---------------|------------------------|------------------------|---------------|------------------------|
| Emission Frequency MHz | Ant. Polarity | dB Below Carrier (dBc) | Emission Frequency MHz | Ant. Polarity | dB Below Carrier (dBc) |
| 220.61                 | 0             | 0                      | 220.61                 | 0             | 0                      |
| 441.21                 | V             | 88.9                   | 441.21                 | V             | 90.2                   |
| 661.82                 | V             | 98.9                   | 661.82                 | V             | 79.2                   |
| 882.43                 | V             | 70.0                   | 882.43                 | V             | 71.4                   |
| 1103.04                | H             | 85.8                   | 1103.04                | H             | 79.3                   |
| 1323.64                | H             | 93.6                   | 1323.64                | V             | 75.6                   |
| 1544.25                | V             | 94.5                   | 1544.25                | V             | 80.3                   |
| 1764.86                | V             | 89.8                   | 1764.86                | H             | 85.5                   |
| 1985.46                | V             | 96.4                   | 1985.46                | H             | 91.0                   |
| 2206.07                | V             | 95.1                   | 2206.07                | V             | 83.7                   |

## RESULTS: MEET REQUIREMENTS

Applicant: Deluxe Telephone Systems Ltd.  
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## FIELD STRENGTH OF SPURIOUS EMISSIONS

### High Power

| Emission Frequency MHz | Ant. Polarity | dB Below Carrier (dBc) |
|------------------------|---------------|------------------------|
| 221.61                 | 0             | 0                      |
| 443.21                 | V             | 88.1                   |
| 664.82                 | V             | 98.2                   |
| 886.43                 | V             | 69.8                   |
| 1108.04                | H             | 80.4                   |
| 1329.64                | H             | 99.1                   |
| 1551.25                | H             | 96.6                   |
| 1772.86                | H             | 93.4                   |
| 1994.46                | H             | 94.3                   |
| 2216.07                | H             | 93.0                   |

### Low Power

| Emission Frequency MHz | Ant. Polarity | dB Below Carrier (dBc) |
|------------------------|---------------|------------------------|
| 221.61                 | 0             | 0                      |
| 443.21                 | V             | 88.6                   |
| 664.82                 | V             | 78.5                   |
| 886.43                 | V             | 70.5                   |
| 1108.04                | H             | 83.2                   |
| 1329.64                | V             | 92.7                   |
| 1551.25                | H             | 93.0                   |
| 1772.86                | H             | 88.4                   |
| 1994.46                | H             | 90.5                   |
| 2216.07                | V             | 84.3                   |

## RESULTS: MEET REQUIREMENTS

## FREQUENCY STABILITY

**Rule Parts. No.:** Part 2.1055, Part 90.213

**Requirements:** Temperature range requirements: -30 to +50° C.  
Voltage Variation +, -15%  
±2.5 PPM

**Method of Measurements:** ANSI/TIA 603-D: 2010.

**Test Data:**

**Test Data:**

| <b>Assigned Frequency (Ref. Frequency) (MHz)</b> |                        | 221.607651                       |
|--------------------------------------------------|------------------------|----------------------------------|
| <b>Temperature (°C)</b>                          | <b>Frequency (MHz)</b> | <b>Frequency Stability (PPM)</b> |
| -30                                              | 221.607545             | -0.48                            |
| -20                                              | 221.607548             | -0.46                            |
| -10                                              | 221.607568             | -0.37                            |
| 0                                                | 221.607595             | -0.25                            |
| +10                                              | 221.607564             | -0.39                            |
| +20                                              | 221.607642             | -0.04                            |
| +30                                              | 221.607632             | -0.09                            |
| +40                                              | 221.607581             | -0.32                            |
| +50                                              | 221.607551             | -0.45                            |

| <b>Assigned Frequency (Ref. Frequency) (MHz)</b> |                        |                                  |
|--------------------------------------------------|------------------------|----------------------------------|
| <b>% Battery (%)</b>                             | <b>Frequency (MHz)</b> | <b>Frequency Stability (PPM)</b> |
| -15%                                             | 221.607648             | -0.01                            |
|                                                  | 221.607651             | 0.00                             |
| +15%                                             | 221.607656             | 0.02                             |

**RESULTS: MEET REQUIREMENTS**

## EMC EQUIPMENT LIST

| Device                                   | Manufacturer        | Model         | Serial Number            | Cal/Char Date | Due Date |
|------------------------------------------|---------------------|---------------|--------------------------|---------------|----------|
| Analyzer Silver Tower Spectrum Analyzer  | HP                  | 8566B Opt 462 | 3552A22064<br>3638A08608 | 06/05/13      | 06/05/15 |
| Analyzer Silver Tower Preamplifier       | HP                  | 8449B         | 3008A00372               | 06/05/13      | 06/05/15 |
| Analyzer Silver Tower RF Preselector     | HP                  | 85685A        | 2926A00983               | 06/05/13      | 06/05/15 |
| Analyzer Silver Tower Quasi-Peak Adapter | HP                  | 85650A        | 2811A01175               | 06/05/13      | 06/05/15 |
| Power Meter                              | Boonton Electronics | 4531          | 11793                    | 1/9/13        | 1/9/15   |
| Sensor                                   | Boonton             | 51072A        | 34647                    | 01/19/13      | 01/19/15 |
| Antenna: Biconnical                      | Eaton               | 94455-1       | 1096                     | 05/10/13      | 05/10/15 |
| Antenna: Log-Periodic                    | Electro-Metrics     | LPA-25        | 1122                     | 05/09/13      | 05/09/15 |
| Horn Antenna                             | ETS                 | 3117          | 35923                    | 12/7/11       | 12/7/13  |
| Antenna: Dipole Kit                      | Electro-Metrics     | TDA-30/1-4    | 152                      | 11/01/13      | 11/01/15 |
| DC Power Supply                          | HP                  | 6264B         | 2032A04119               | 05/6/13       | 05/6/15  |
| Hygro-Thermometer                        | Extech              | 445703        | 0602                     | 06/15/13      | 06/15/15 |
| Digital Multimeter                       | Fluke               | 77            | 35053830                 | 06/20/13      | 06/20/15 |
| EMI Receiver                             | Rohde & Schwarz     | ESIB40        | 100274                   | 8/12/14       | 8/12/16  |
| Directional Coupler                      | HP                  | 778D          | 1144A08107               | 5/6/13        | 5/6/15   |
| Oscilloscope                             | Lecroy              | LT364L        | 00543                    | 6/15/13       | 6/15/15  |
| Temperature Chamber                      | Tenney Engineering  | TTRC          | 11717-7                  | 8/19/14       | 8/19/16  |
| Notch Filter                             | Microlab            | HA-10N        |                          | 5/7/13        | 5/7/15   |
| 3-Meter Semi-Anechoic Chamber            | Panashield          | N/A           | N/A                      | 12/31/13      | 12/31/15 |