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## FCC PART 73.801 AND IC BETS-6 LOW POWER FM BROADCAST STATIONS (LPFM) TEST REPORT

|                             |  |
|-----------------------------|--|
| <b>APPLICANT</b>            | WORLDCAST SYSTEMS, INC.  |
|                             | 19595 NE 10TH AVENUE<br>SUITE A  |
|                             | MIAMI FL 33179 USA   |
| <b>FCC ID</b>               | O35-HFM0350W   |
| <b>IC CERTIFICATION</b>     | 10552A-HFM0350W  |
| <b>MODEL NUMBER</b>         | HFM0350W   |
| <b>PRODUCT DESCRIPTION</b>  | HELIOS FM 350W TRANSMITTER   |
| <b>DATE SAMPLE RECEIVED</b> | 9/3/2012   |
| <b>DATE TESTED</b>          | 9/7/2012   |
| <b>TESTED BY</b>            | Sushant Kadimdivan   |
| <b>APPROVED BY</b>          | Mario de Aranzeta  |
| <b>TIMCO REPORT NO.</b>     | 2253AUT12TestReport  |
| <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.



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.



Testing 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 C.E.T.  
Compliance Engineer/ Lab. Supervisor

**Date:** October/15/2012

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## GENERAL INFORMATION

### DUT Specification

|                                |   |
|--------------------------------|---|
| <b>DUT Description</b>         | HELIOS FM 350W TRANSMITTER  |
| <b>FCC ID</b>                  | O35-HFM0350W  |
| <b>IC</b>                      | 10552A-HFM0350W   |
| <b>Model Number</b>            | HFM0350W  |
| <b>Operating Frequency</b>     | 88-108 MHz  |
| <b>Type of Emission</b>        | 200KF3E   |
| <b>Modulation</b>              | FM  |
| <b>Output power</b>            | 350 W   |
| <b>DUT Power Source</b>        | <input checked="" type="checkbox"/> 184–264 VAC/47– 63 Hz<br><input type="checkbox"/> DC Power 12V<br><input type="checkbox"/> Battery Operated Exclusively |
| <b>Test Item</b>               | <input type="checkbox"/> Prototype<br><input type="checkbox"/> Pre-Production<br><input checked="" type="checkbox"/> Production                             |
| <b>Type of Equipment</b>       | <input checked="" type="checkbox"/> Fixed<br><input type="checkbox"/> Mobile<br><input type="checkbox"/> Portable   |
| <b>Test Conditions</b>         | The temperature was 26°C<br>Relative humidity of 50%.   |
| <b>Modification to the DUT</b> | None  |
| <b>Test Exercise</b>           | The DUT 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.   |

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## 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 |
| AC Voltmeter                           | HP                 | 400FL         | 2213A14499               | 06/12/11      | 06/12/13 |
| Frequency Counter                      | HP                 | 5385A         | 2730A03025               | 08/17/11      | 08/17/13 |
| Antenna: Log-Periodic                  | Electro-Metrics    | LPA-25        | 1122                     | 05/04/11      | 05/04/13 |
| Measuring Tape-7.5M                    | Kraftixx           | 7.5M PROFI    |                          | 06/13/11      | 06/13/13 |
| Modulation Analyzer                    | HP                 | 8901A         | 3435A06868               | 07/18/11      | 07/18/13 |
| Digital Multimeter                     | Fluke              | FLUKE-77-3    | 79510405                 | 06/13/11      | 06/13/13 |
| Analyzer Open-Frame Tower Preamplifier | HP                 | 8449B         | 3008A01075               | 07/22/09      | 09/15/13 |
| Analyzer Tan Tower Preamplifier        | HP                 | 8449B-H02     | 3008A00372               | 11/21/09      | 10/28/13 |
| Analyzer Tan Tower Quasi-Peak Adapter  | HP                 | 85650A        | 3303A01690               | 11/22/09      | 10/28/13 |
| Analyzer Tan Tower RF Preselector      | HP                 | 85685A        | 3221A01400               | 11/21/09      | 10/28/13 |
| Analyzer Tan Tower Spectrum Analyzer   | HP                 | 8566B Opt 462 | 3138A07786<br>3144A20661 | 11/24/09      | 10/28/13 |
| Temperature Chamber                    | Tenney Engineering | TTRC          | 11717-7                  | 06/18/12      | 06/18/14 |
| 3-Meter Semi-Anechoic Chamber          | Panashield         | N/A           | N/A                      | 12/31/11      | 12/31/13 |

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## TEST PROCEDURES

**Power Line Conducted Interference:** The procedure used was ANSI/TIA 603-C: 2004, using a 50uH LISN. Both lines were observed with the DUT 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-C: 2004, using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum ANSI/TIA 603-C: 2004, 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.

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## RF POWER OUTPUT

**Rule Part No.:** Part 2.1046, Part 73.267 (b)(2), BETS-6 Section 6

### Test Requirements:

**Method of Measurement:** RF power is measured by direct method power using ANSI/TIA 603-C: 2004

### Test Setup Diagram:



### Test Data:

#### MEASURED OUTPUT POWER:

Frequency: 98.1 MHz

|      | <b>209 V (-5%)</b> | <b>220 V</b> | <b>231 V(+5%)</b> |
|------|--------------------|--------------|-------------------|
| Low  | 49.4               | 49.2         | 49.3              |
| High | 348                | 347          | 348.4             |

## Part 2.1033 (C)(8), BETS-6 DC Input into the final amplifier

### POWER SETTING INPUT POWER:

@ 350W Output Power

DC Voltage = 29.5 V

DC Current = 20 A

Power = 29.5 V x 20 A = 590 W

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## MODULATION CHARACTERISTICS

**Rule Part No.:** Part 2.1047(a)(b)

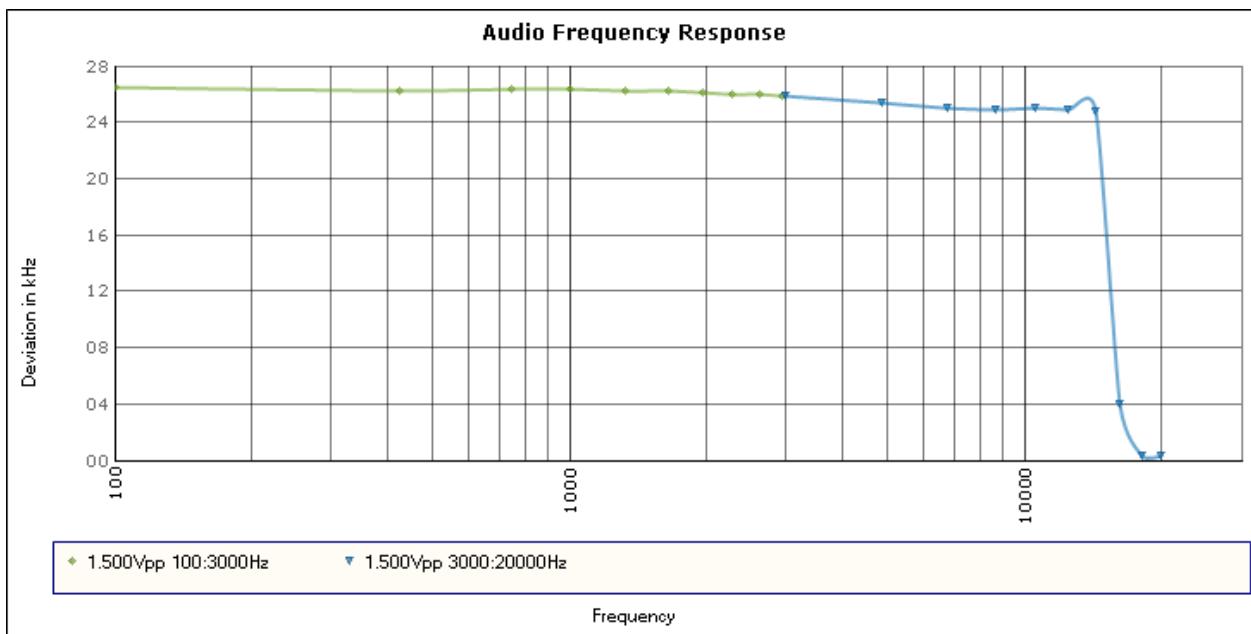
**Test Requirements:**

**Method of Measurement:**

**Audio frequency response**

The audio frequency response was measured in accordance with ANSI/TIA 603-C: 2004. The audio frequency response curve is shown below.

**AUDIO FREQUENCY RESPONSE PLOT**



**Result: The product meets the requirements**

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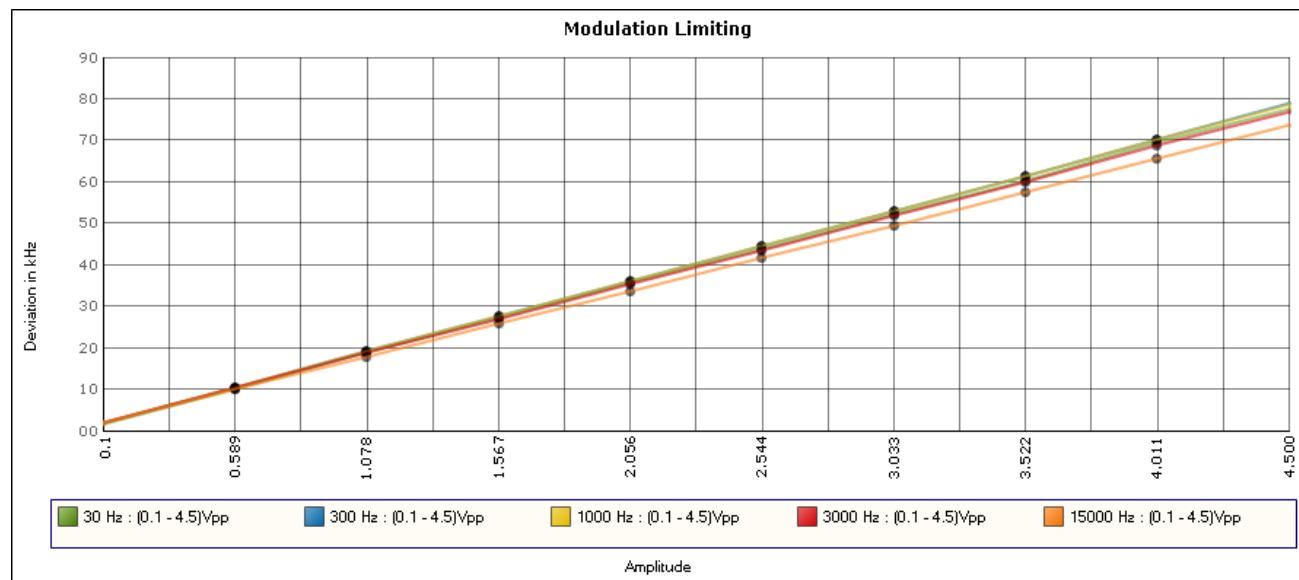
## AUDIO INPUT VERSUS MODULATION

**Rule Part No.:** Part 2.1047(b) & 90

### Test Requirements:

**Method of Measurement:** **Modulation cannot exceed 100%**. The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA 603-C: 2004. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1000, and 3000 Hz.

### Test data:



**Result: The product meets the requirements**

Applicant: WORLDCAST SYSTEMS, INC.

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## OTHER MODULATION CHARACTERISTICS

**Part 2.1033(c) (4), BETS-6**      Type of Emission:      180KF3E

$$B_n = 2M + 2DK$$

$$M = 15000$$

$$D = 75 \text{ kHz (Peak Deviation)}$$

$$K = 1$$

$$B_n = 2(15k) + 2(75k)(1) = 180K$$

ALLOWED AUTHORIZED BANDWIDTH = 200 kHz.

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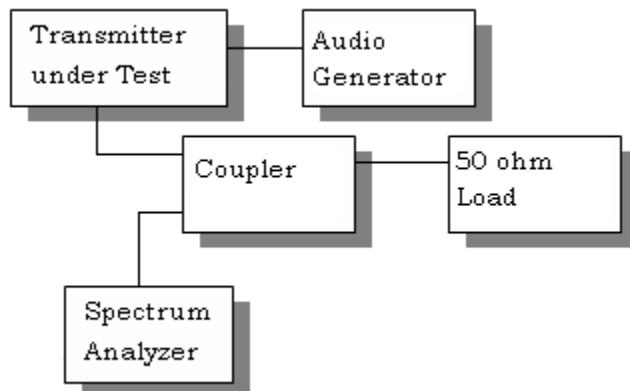
## OCCUPIED BANDWIDTH

**Part 2.1049(c)**      EMISSION BANDWIDTH:  
**Part 73.317(b-d)**

Any emission appearing on the frequency removed from the carrier between 120 kHz and 240 kHz inclusive must be attenuated at least 25 dB below the level of the un-modulated carrier. Compliance with this requirement will be deemed to show occupied bandwidth to be 240 kHz or less. Any emission appearing on the frequency removed from the carrier by more than 240 kHz and up to and including 600 kHz must be attenuated at least 35 dB below the level of the un-modulated carrier. Any emission appearing on the frequency removed from the carrier by more than 600 kHz must be attenuated at least  $43 + 10 \log(P)$  dB below the level of the un-modulated carrier, or 80 dB, whichever is the lesser attenuation.

**Method of Measurement: ANSI/TIA 603-C: 2004**

**Test Setup Diagram:**



REQUIREMENT: PART 73: 200 kHz EMISSION BANDWIDTH.

**Test Data:** See the plots below

Applicant: WORLDCAST SYSTEMS, INC.

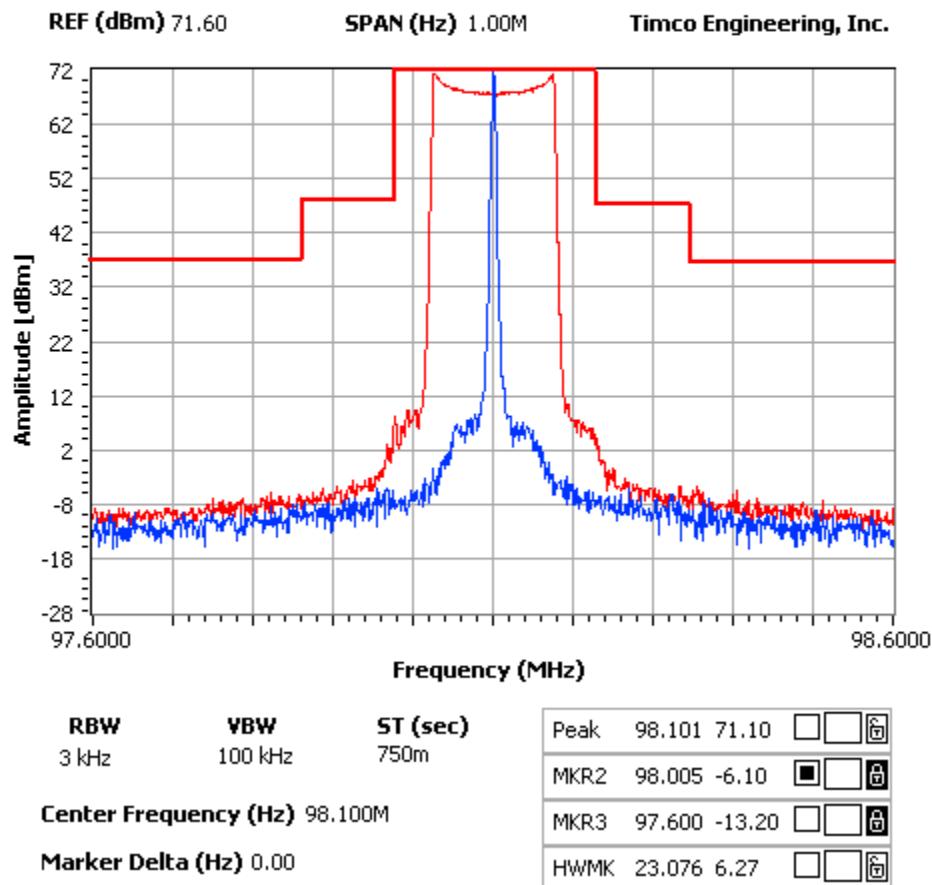
FCC ID: O35-HFM0350W

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**OCCUPIED BANDWIDTH PLOT (50 Hz)**
**NOTES:**

50 Hz



Applicant: WORLDCAST SYSTEMS, INC.

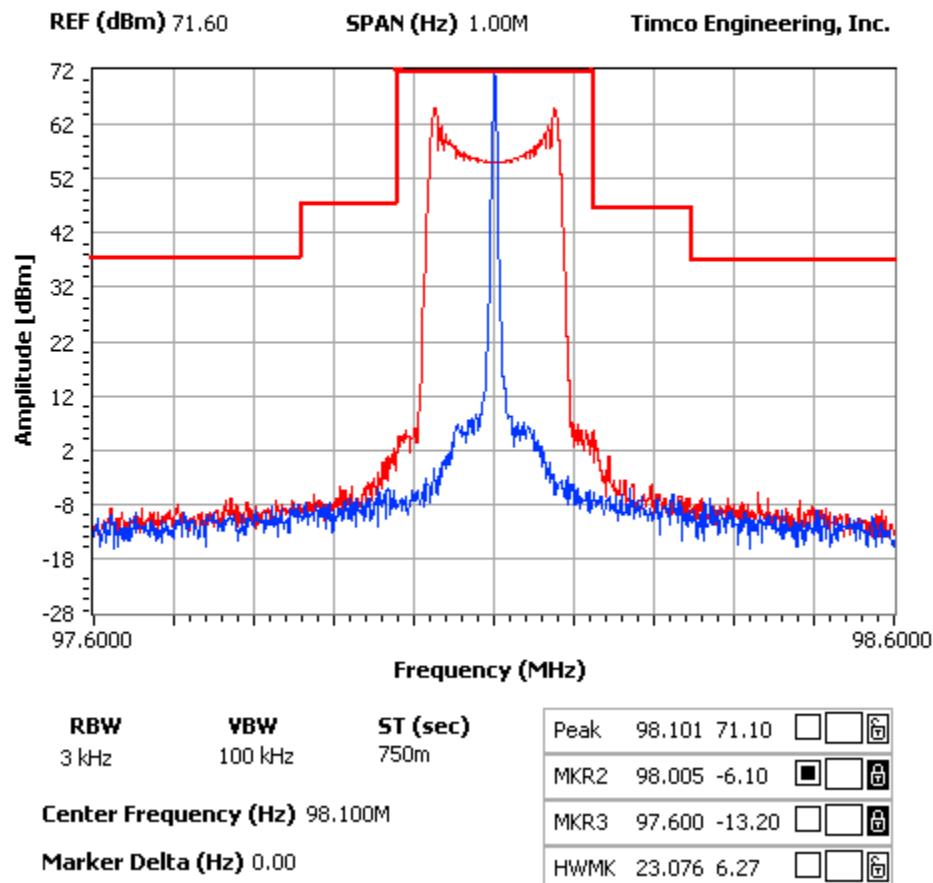
FCC ID: O35-HFM0350W

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**OCCUPIED BANDWIDTH PLOT (1 kHz)**
**NOTES:**

1 kHz



Applicant: WORLDCAST SYSTEMS, INC.

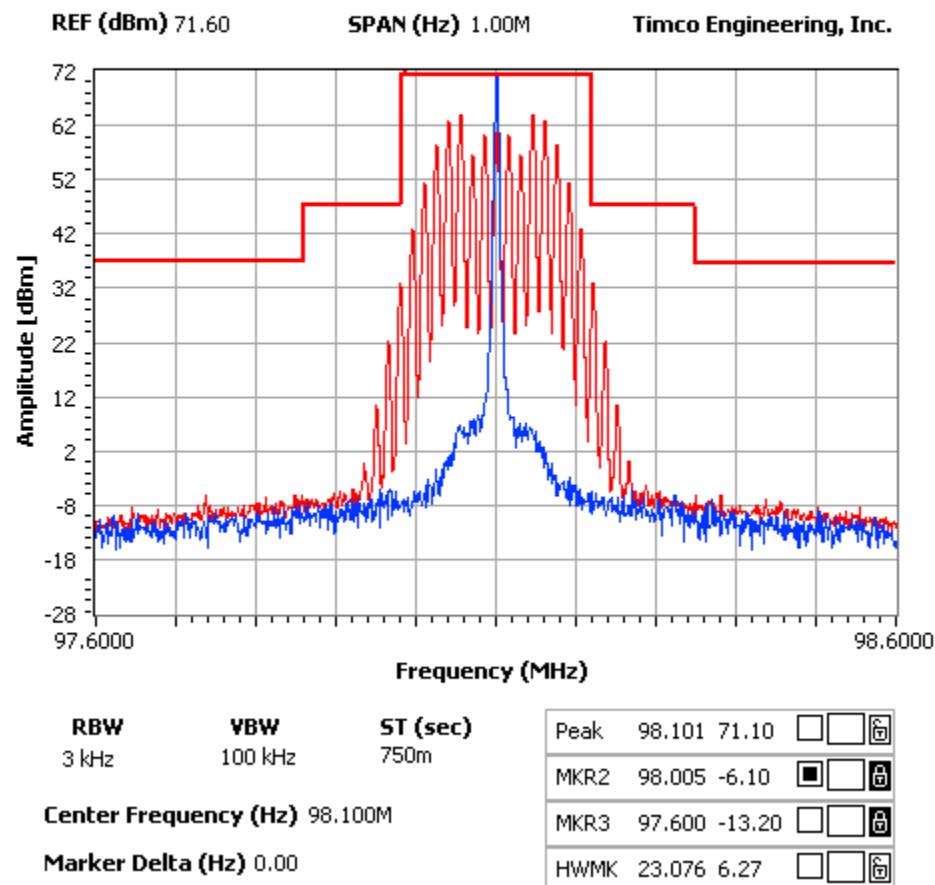
FCC ID: O35-HFM0350W

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**OCCUPIED BANDWIDTH PLOT (15 kHz)**
**NOTES:**

15 kHz



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## SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

**Rule Part No.:** Part 2.1051(a), BETS-6

Data on the following page shows the level of conducted spurious responses. The carrier was modulated 100% using 2500Hz tone. The spectrum was scanned from 9 kHz or the lowest frequency generated to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA-603-C: 2004.

**REQUIREMENTS:** Emissions must be  $43 + 10\log(P_o)$  dB below the mean power output of the transmitter.

$$43 + 10\log(50) = 60 \text{ dB}$$

$$43 + 10\log(350) = 68 \text{ dB}$$

### Test Data:

Low Power = 50 W

High Power = 350 W

| TF<br><b>LOW POWER</b> | EF<br>MHz | dB below<br>carrier |  | TF<br><b>HIGH POWER</b> | EF<br>MHz | dB below<br>carrier |
|------------------------|-----------|---------------------|--|-------------------------|-----------|---------------------|
| 88.1 MHz               | 88.1      |                     |  | 88.1 MHz                | 88.1      |                     |
|                        | 176.2     | 85.2                |  |                         | 176.2     | 81                  |
|                        | 264.3     | 82.9                |  |                         | -         | -                   |

| TF<br><b>LOW POWER</b> | EF<br>MHz | dB below<br>carrier |  | TF<br><b>HIGH POWER</b> | EF<br>MHz | dB below<br>carrier |
|------------------------|-----------|---------------------|--|-------------------------|-----------|---------------------|
| 98.1 MHz               | 98.1      |                     |  | 98.1 MHz                | 98.1      |                     |
|                        | 196.2     | 83.6                |  |                         | 196.2     | 84                  |
|                        | -         | -                   |  |                         | 294.3     | 89                  |
|                        | -         | -                   |  |                         | 113       | 81                  |
|                        | -         | -                   |  |                         | 82.94     | 79                  |

| TF<br><b>LOW POWER</b> | EF<br>MHz | dB below<br>carrier |  | TF<br><b>HIGH POWER</b> | EF<br>MHz | dB below<br>carrier |
|------------------------|-----------|---------------------|--|-------------------------|-----------|---------------------|
| 107.9 MHz              | 107.9     |                     |  | 107.9 MHz               | 107.9     |                     |
|                        | 215.8     | 78.5                |  |                         | 215.8     | 78.8                |
|                        | -         | -                   |  |                         | 323.7     | 90.9                |
|                        | -         | -                   |  |                         | 123.7     | 82                  |
|                        | -         | -                   |  |                         | 92.03     | 79                  |

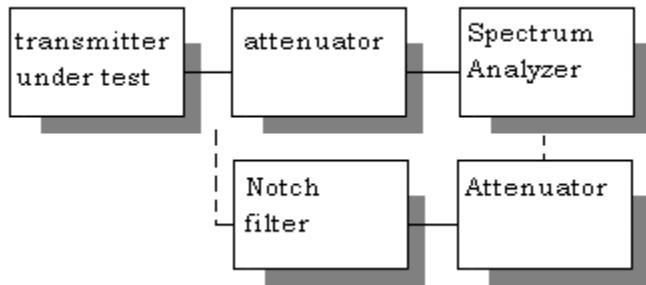
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### **Method of Measuring Conducted Spurious Emissions**



Applicant: WORLDCAST SYSTEMS, INC.

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## FIELD STRENGTH OF SPURIOUS EMISSIONS

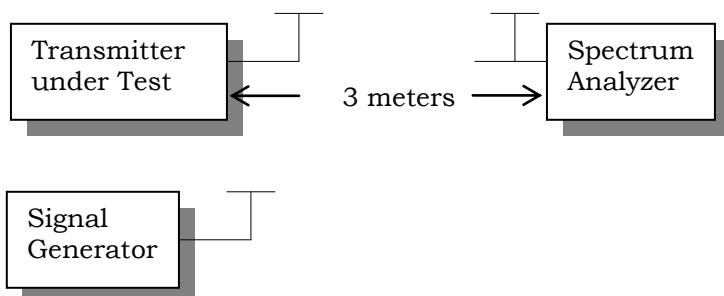
**Rule Parts. No.:** Part 2.1053

**Requirements:** Any emission appearing on a frequency removed from the carrier by more than 600 kHz must be attenuated at least  $43 + 10\log(P)$  dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

$$\text{Low Power, } 43 + 10 \log (50) = 60 \text{ dB}$$

$$\text{High Power, } 43 + 10 \log (350) = 68 \text{ dB}$$

### Test Setup Diagram:



### Test Data:

| Low Power |        |              |                      | High Power |        |              |                      |
|-----------|--------|--------------|----------------------|------------|--------|--------------|----------------------|
| TF        | EF     | ANT Polarity | dB below carrier dBc | TF         | EF     | ANT Polarity | dB below carrier dBc |
| 88.1      | 88.10  | V            | 0                    | 88.1       | 88.10  | V            | 0                    |
|           | 176.20 | H            | 106.7                |            | 176.20 | H            | 108.6                |
|           | 264.30 | V            | 105.3                |            | 264.30 | V            | 103.3                |
|           | 352.40 | H            | 86.9                 |            | 352.40 | H            | 89.6                 |
|           | 440.50 | V            | 83.7                 |            | 440.50 | V            | 91.5                 |
|           | 528.60 | V            | 98.8                 |            | 528.60 | V            | 103.4                |
|           | 616.70 | V            | 99.1                 |            | 616.70 | V            | 103.6                |
|           | 704.80 | V            | -                    |            | 704.80 | V            | 116.3                |
|           | 792.90 | V            | 100.3                |            | 792.90 | V            | 108.7                |
|           | 881.00 | V            | -                    |            | 881.00 | V            | 103.7                |

Applicant: WORLDCAST SYSTEMS, INC.

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**TEST DATA CONT'D.**

| Low Power |        |              |                      | High Power |        |              |                      |
|-----------|--------|--------------|----------------------|------------|--------|--------------|----------------------|
| TF        | EF     | ANT Polarity | dB below carrier dBc | TF         | EF     | ANT Polarity | dB below carrier dBc |
| 98.1      | 98.10  |              |                      | 98.1       | 98.10  |              |                      |
|           | 196.20 | H            | 102.7                |            | 196.20 | V            | 107.0                |
|           | 294.30 | H            | 101.2                |            | 294.30 | H            | 97.7                 |
|           | 392.40 | V            | 77.5                 |            | 392.40 | V            | 98.7                 |
|           | 490.50 | V            | 71.7                 |            | 490.50 | V            | 79.7                 |
|           | 588.60 | V            | 107.2                |            | 588.60 | V            | 111.4                |
|           | 686.70 | V            | 107.4                |            | 686.70 | V            | -                    |
|           | 882.90 | V            | 97.7                 |            | 882.90 | V            | 106.2                |
|           | 981.00 | H            | 98.0                 |            | 981.00 | V            | 109.6                |

| Low Power |         |              |                      | High Power |         |              |                      |
|-----------|---------|--------------|----------------------|------------|---------|--------------|----------------------|
| TF        | EF      | ANT Polarity | dB below carrier dBc | TF         | EF      | ANT Polarity | dB below carrier dBc |
| 107.9     | 107.90  | 0            | 0                    | 107.9      | 107.90  | H            | 0                    |
|           | 215.80  | V            | 96.3                 |            | 215.80  | V            | 97.5                 |
|           | 323.70  | V            | 91.4                 |            | 323.70  | V            | 92.7                 |
|           | 431.60  | V            | 82.6                 |            | 431.60  | V            | 99.5                 |
|           | 539.50  | V            | 92.8                 |            | 539.50  | V            | 106.1                |
|           | 647.40  | V            | -                    |            | 647.40  | V            | 115.5                |
|           | 755.30  | V            | 94.1                 |            | 755.30  | V            | -                    |
|           | 863.20  | V            | 90.4                 |            | 863.20  | V            | 95.2                 |
|           | 971.10  | V            | 91.3                 |            | 971.10  | V            | 91.0                 |
|           | 1079.00 | V            | 103.2                |            | 1079.00 | V            | 89.4                 |

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## BETS-6, CABINET RADIATION

Rule Parts. No.: BETS-6

**Requirements::** ALL emissions should be more than 54 dB below reference.

**Reference Field Strength (3 m), Lo Power, 50 W BETS-6 = 144 dB $\mu$ V/m  
Reference Field Strength (3 m), Hi Power, 350 W BETS-6 = 153 dB $\mu$ V/m**

### 1) Low Power

| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dB $\mu$ V | Ant. Polarity | Coax Loss dB | Correction Factor dB/m | Field Strength dB $\mu$ V/m | dB below Reference |
|---------------------|------------------------|--------------------------|---------------|--------------|------------------------|-----------------------------|--------------------|
| 88.1                | 88.10                  | 63.9                     | V             | 0.62         | 9.96                   | 74.48                       | 69.5               |
| 88.1                | 352.40                 | 44.3                     | H             | 1.15         | 15.02                  | 60.47                       | 83.6               |
| 98.1                | 98.10                  | 63.6                     | V             | 0.65         | 10.72                  | 74.97                       | 69.1               |
| 98.1                | 490.50                 | 53.3                     | V             | 1.29         | 18.11                  | 72.70                       | 71.3               |
| 107.9               | 107.90                 | 65.2                     | V             | 0.66         | 10.37                  | 76.23                       | 67.7               |
| 107.9               | 431.60                 | 44.9                     | V             | 1.23         | 17.43                  | 63.56                       | 80.5               |

### 2) High Power

| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dB $\mu$ V | Ant. Polarity | Coax Loss dB | Correction Factor dB/m | Field Strength dB $\mu$ V/m | dB below Reference |
|---------------------|------------------------|--------------------------|---------------|--------------|------------------------|-----------------------------|--------------------|
| 88.1                | 88.10                  | 70.3                     | V             | 0.62         | 9.96                   | 80.88                       | 72.2               |
| 88.1                | 352.40                 | 49.6                     | H             | 1.15         | 15.02                  | 65.77                       | 87.2               |
| 98.1                | 98.10                  | 73.0                     | V             | 0.65         | 10.72                  | 84.37                       | 68.7               |
| 98.1                | 490.50                 | 53.3                     | V             | 1.29         | 18.11                  | 72.70                       | 80.3               |
| 107.9               | 107.90                 | 74.8                     | V             | 0.66         | 10.37                  | 85.83                       | 67.2               |
| 107.9               | 323.70                 | 45.3                     | V             | 1.12         | 14.37                  | 60.79                       | 92.2               |

Applicant: WORLDCAST SYSTEMS, INC.

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## FREQUENCY STABILITY

**Rule Parts. No.:** Part 2.1055, BETS-6

**Requirements:** Temperature and voltage tests were performed to verify that the frequency remains within the 2000Hz, specification limit. The test was conducted as follows: The transmitter was placed in the temperature chamber at 25° C and allowed to stabilize for one hour. The temperature was then reduced to -30° C after which the transmitter was again allowed to stabilize for one hour. The transmitter was ON continuously because that is how it is used and again frequency readings were noted at 15-second intervals. The worst-case number was recorded for temperature plotting. This procedure was repeated in 10 degree increments up to + 50° C.

**Method of Measurements:** ANSI/TIA 603-C: 2004.

### Test Data:

Nominal Frequency: 98.1 MHz

| Assigned Frequency (Ref. Frequency) (MHz) |                 | Frequency Stability (PPM) |
|---|-----------------|---------------------------|
| Temperature (°C)                          | Frequency (MHz) |                           |
| -30                                       | 98.099980       | -0.36                     |
| -20                                       | 98.100000       | -0.15                     |
| -10                                       | 98.100008       | -0.07                     |
| 0   | 98.100016       | 0.01                      |
| 10  | 98.100032       | 0.17                      |
| 20  | 98.100015       | 0.00                      |
| 30  | 98.100040       | 0.25                      |
| 40  | 98.100042       | 0.28                      |
| 50  | 98.100045       | 0.31                      |

| Assigned Frequency (Ref. Frequency) (MHz) |                 | Frequency Stability (PPM) |
|---|-----------------|---------------------------|
| AC Mains %                                | Frequency (MHz) |                           |
| -15%                                      | 98.100016       | 0.01                      |
| 0   | 98.100015       | 0.00                      |
| +15%                                      | 98.100017       | 0.02                      |

|       | 187 V                   | 220 V                   | 253 V                   |
|-------|-------------------------|-------------------------|-------------------------|
| 5 °C  | 98.100025<br>(0.1 ppm)  | 98.100020<br>(0.05 ppm) | 98.100017<br>(0.02 ppm) |
| 20 °C | 98.100016<br>(0.01 ppm) | 98.100015<br>(0 ppm)    | 98.100017<br>(0.02 ppm) |
| 45 °C | 98.100051<br>(0.37 ppm) | 98.100053<br>(0.39 ppm) | 98.100051<br>(0.37 ppm) |

Applicant: WORLDCAST SYSTEMS, INC.

FCC ID: O35-HFM0350W

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