
Project Number: 02323-10

Prepared for:

TEL-TRON TECHNOLOGIES CORPORATION
220 Fentress Blvd.
Daytona Beach, FL 32114

By

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June 2002

**CERTIFICATION
Electromagnetic Interference
Test Report**

**TEL-TRON TECHNOLOGIES CORPORATION
Transmitter**

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IS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF PROFESSIONAL TESTING (EMI), INC.



Certificate of Compliance

Applicant: Tel-Tron Technologies Corporation

Applicant's Address: 220 Fentress Blvd.
Daytona Beach, FL 32114

Model: Transmitter

Serial Number: None

Project Number: 02323-10

I, Jeffrey A. Lenk, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measured data and this report. I believe them to be true and accurate.

The **Tel-Tron Technologies Corporation Transmitter** was tested to and found to be in compliance with FCC Part 15 Subpart C for an Intentional Radiator.

The highest emissions generated by the above equipment are listed below:

| | <u>Frequency (MHz)</u> | <u>Level (dBμV/m)</u> | <u>Limit (dBμV/m)</u> | <u>Margin (dB)</u> |
|-------------|------------------------|--------------------------------------|--------------------------------------|--------------------|
| Fundamental | 312 | 83.1 | 85.7 | -2.6 |
| Spurious | 1560 | 57.9 | 77.0 | -19.0 |

Jeffrey A. Lenk
President

1.0 EUT Description

The Equipment Under Test (EUT) is the **Tel-Tron Technologies Corporation Transmitter**. The **Transmitter** is a wall-mounted battery powered 312 MHz transmitter. The WECA is a 312 MHz OOK transmitter. Normal transmission is started by manual activation of a “pull cord”. Supervision transmissions occur once per hour.

Normal transmissions consist of a code sequence including the device id, alarm flag, and battery condition flag, which repeat for almost five seconds. Supervision transmissions consist of a code sequence including the device id, supervision flag, and battery condition flag, which repeat for almost one second. The EUT operates at 312 MHz and is designed for compliance with 47 CFR 15.231 of the FCC rules. Specific test requirements for this device include the following:

| | |
|------------------------|--|
| 47 CFR 15.231 | Fundamental Transmit Power |
| 47 CFR 15.231 & 15.205 | Spurious Radiated Power |
| 47 CFR 15.231 & 2.1049 | Occupied Bandwidth (2.989 used as Procedural Reference) |
| 47 CFR 15.203 | Antenna Requirement |

The system tested consisted of the following:

| <u>Manufacturer & Model</u> | <u>Serial #</u> | <u>FCC ID #</u> | <u>Description</u> |
|--|-----------------|-----------------|--------------------|
| Tel-Tron Technologies Corporation, Transmitter | None | QE2-WECA | Transmitter |

1.1 EUT Operation

The **Transmitter** was put in continuous data transmitting mode. Pulling the cord about three times activates this mode as indicated by the LED remaining on. Pulling a fourth time will turn the transmitter off. Other modes allow verifying max 5 seconds on time during normal operation. Setup and operational modes cover worst-case configuration and operational modes for the device. The frequency of the transmitting signal is 312 MHz.

2.0 Electromagnetic Emissions Testing

Professional Testing (EMI), Inc. (PTI), follows the guidelines of NIST for all uncertainty calculations, estimates and expressions thereof for EMC testing.

Radiated emission measurements were made of the Fundamental and Spurious Emission levels for the **Transmitter**. Measurements of the occupied bandwidth were also made for the equipment.

Measurements of the maximum emission levels for the fundamental and the spurious/harmonic emissions of the **Transmitter** were made at the Professional Testing "Open Field" Site 3 located in Round Rock, Texas to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

Tests of the fundamental for the device were performed to determine the worst-case polarization of the devices. The fundamental emissions of the device were measured with the antennas of the devices vertical and horizontal to the ground plane.

2.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable, which allows 360-degree rotation. For measurements of the fundamental signal, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. For spurious/harmonic measurements above 1 GHz, the measurement antenna was placed 1 meter from the EUT. The radiated emissions were maximized by configuring the EUT, by rotating the EUT, and by raising and lowering the antenna from 1 to 4 meters.

A Spectrum Analyzer with peak detection was used to find the maximums of the radiated emissions during the variability testing. A drawing showing the test setup is given as Figure 1.

2.2 Test Criteria

The table below shows FCC Part 15.231 radiated limits for an intentional radiator operating at 312 MHz band. In addition to these requirements, the EUT must meet the restricted emission band requirements of §15.205. The limit of §15.231 was used for the spurious emission test in accord with 15.231 (b) 3 which permits the higher limit to be used. The spurious measurements of the harmonic were performed to the 10th harmonic of the fundamental. The reference distance for each limit is also shown in this table.

| <u>Signal Type</u> | <u>Test Distance (Meters)</u> | <u>Field Strength (μV/m)</u> | <u>(dBμV/m)</u> | <u>30.7% Duty</u> |
|-------------------------------------|-----------------------------------|---|--------------------------------|-------------------|
| Fundamental (312 MHz) | 3 | 5916.67 | 75.4 | 85.7 |
| 2nd Harmonics (624 MHz) | 3 | 591.6 | 55.4 | 65.7 |
| Harmonics (3rd and above) | 1 | 591.6 | 55.4 | 75.2 |
| Harmonics in Restricted Bands | 1 | 500 | 54.0 | 73.8 |

2.3 Test Results

The radiated test data for the fundamental is included in Appendix A. Quasi-Peak detector has been used during the test. The radiated emission test data for the harmonics is included in Appendix B. The emissions were maximized at each frequency and the highest emissions identified were measured using peak detection. The duty cycle plots showing a 37% duty cycle are included in Appendix C. The radiated emissions generated by the **Transmitter** are below the FCC Part 15.231 and FCC Part 15.205 maximum emission criteria.

3.0 Occupied Bandwidth Measurements

Measurements of the occupied bandwidth of the fundamental signal were made at the Professional Testing's Round Rock, Texas laboratory. All measurements were made in a controlled indoor environment in a configuration, which did not present measurement distortion or ambient interference.

3.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the floor. The table was rotated to an angle, which presented the highest signal level. Peak detection was used for all tests. The occupied bandwidth was based on a 20 dB criteria (20 dB down either side of the emission from the nominal center of the emission). A drawing showing the test setup is given as Figure 1.

3.2 Test Criteria

According to FCC Part 15.231, the bandwidth of the emission shall not be wider than 0.25 % of the center frequency for the devices operating above 70 MHz and below 900 MHz. The limit is 780 kHz for the transmitter working at 312 MHz.

Measurement of the occupied bandwidth to verified that the emission bandwidth from the EUT did not exceed 780 kHz criteria.

3.3 Test Results

The occupied bandwidth test data is included in Appendix D. The measured bandwidth was 18.2 kHz.

The intended center frequency for the EUT was centered at 312 MHz. The center frequency is within the allowed band. The fundamental signal generated by the **Transmitter** is within the band allowed under FCC Part 15.231 emission band criteria.

4.0 Antenna Requirement

An analysis of the **Transmitter** was performed to determine compliance with Section 15.203 of the Rules. This section requires specific handling and control of antennas used for devices subject to regulations under the Intentional Radiator portions of Part 15.

4.1 Evaluation Procedure

The structure and application of the **Transmitter** were analyzed with respect to the rules. The antenna for this unit is an external antenna, which is soldered onto the main board and is not accessible by the user. An auxiliary antenna port is not present.

4.2 Evaluation Criteria

Section 15.203 of the rules states that the subject device must meet at least one of the following criteria:

- (a) Antenna be permanently attached to the unit.
- (b) Antenna must use a unique type of connector to attach to the EUT.
- (c) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

4.3 Evaluation Results

The **Transmitter** meets the criteria of this rule by virtue of having an internal antenna permanently attached to the unit. The EUT is therefore compliant with §15.203.

5.0 Modifications to Equipment

There were no modifications made on the **Transmitter** during the performance of the test program in order to meet the FCC criteria.

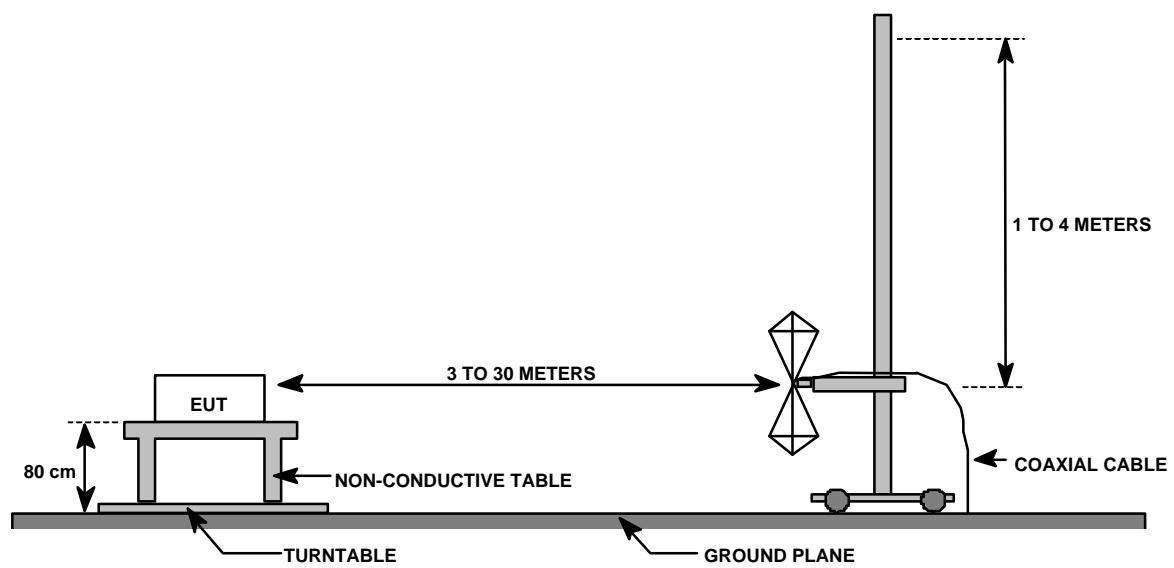
6.0 List of Test Equipment

A list of the test equipment utilized to perform the testing is given below. The date of calibration is given for each.

Electromagnetic Emissions Test Equipment

| <u>Device</u> | <u>Description</u> | <u>Calibration Due</u> |
|-------------------------|--------------------|------------------------|
| Tektronix 2706 | RF Preselector | October 2002 |
| Compliance Design B-100 | Biconical Antenna | November 2002 |
| HP 8447D | Preamplifier | October 2002 |
| EMCO 3146 | Log Antenna | November 2002 |
| EMCO 3115 | Ridge Guide | July 2002 |
| MITEQ | Preamplifier | January 2003 |
| Advantest R3265 | Spectrum Analyzer | October 2002 |
| HP 8566B | Spectrum Analyzer | November 2002 |

FIGURE 1: Radiated Emissions Test Setup



Appendix A

Radiated Emissions Data Sheets

Fundamental Radiated Data Sheet**Tel-Tron Technologies Corporation**
Transmitter sample 1

SERIAL #: None
 DATE: June 4, 2002
 PROJECT #: 02323-10

MEASUREMENT DISTANCE (m): 3
 DETECTOR FUNCTION: Quasi-Peak

Corrected Level = Recorded Level - Amplifier Gain + Antenna Factor + Cable Loss

Antenna Horizontal

| Freq. (MHz) | EUT Dir (Deg.) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Corrected Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|----------------|----------------------|----------------------------------|-----------------------------|---------------------------|-----------------------------|-----------------------|--------------------------------|-------------------|----------------|
| 312 | 190 | 1 | 82.8 | 26.9 | 15.2 | 8.4 | 79.4 | 85.7 | -6.3 |

Antenna Vertical

| Freq. (MHz) | EUT Dir (Deg.) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Corrected Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|----------------|----------------------|----------------------------------|-----------------------------|---------------------------|-----------------------------|-----------------------|--------------------------------|-------------------|----------------|
| 312 | 45 | 2 | 86.5 | 26.9 | 15.2 | 8.4 | 83.1 | 85.7 | -2.6 |

TEST ENGINEER: Bob Ripley

Appendix B

**Spurious Radiated
Emissions Data Sheets**

Spurious Radiated Data Sheet**Tel-Tron Technologies Corporation**
Transmitter sample 1

SERIAL #: None
 DATE: June 4, 2002
 PROJECT #: 02323-10

MEASUREMENT DISTANCE (m): 1
 ANTENNA POLARIZATION:
 Horizontal
 DETECTOR FUNCTION: Peak

Corrected Level = Recorded Level - Amplifier Gain + Antenna Factor + Cable Loss

| Freq. (MHz) | EUT Dir (Deg.) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Corrected Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|----------------|----------------------|----------------------------------|-----------------------------|---------------------------|-----------------------------|-----------------------|--------------------------------|-------------------|----------------|
| 624 | 0 | 1.2 | 55.6 | 27.0 | 19.7 | 11.0 | 59.3 | 65.7 | -6.4 |
| 936 | 0 | 1.2 | 41.8 | 26.5 | 24.2 | 14.9 | 54.3 | 65.7 | -11.4 |
| 1248 | 0 | 1.0 | 51.0 | 20.8 | 25.8 | 2.0 | 58.0 | 75.2 | -17.2 |
| 1560 | 0 | 1.0 | 51.4 | 21.1 | 25.4 | 2.2 | 57.9 | 73.8 | -15.9 |
| 1872 | 0 | 1.0 | 42.7 | 22.1 | 26.9 | 2.4 | 49.9 | 75.2 | -25.3 |
| 2183 | 150 | 1.0 | 41.2 | 22.2 | 27.2 | 2.6 | 48.8 | 75.2 | -26.4 |
| 2496 | 0 | 1.0 | 29.5 | 21.8 | 26.6 | 2.9 | 37.2 | 73.8 | -36.6 |
| 2808 | 0 | 1.0 | 29.4 | 21.7 | 27.4 | 3.1 | 38.1 | 73.8 | -35.7 |
| 3120 | 0 | 1.0 | 37.2 | 22.0 | 28.2 | 3.3 | 46.7 | 75.2 | -28.5 |

Note: 624 and 936 MHz were measured at 3 meters.

TEST ENGINEER: Bob Ripley

Spurious Radiated Data Sheet**Tel-Tron Technologies Corporation**
Transmitter sample 1

SERIAL #: None
 DATE: June 4, 2002
 PROJECT #: 02323-10

MEASUREMENT DISTANCE (m): 1
 ANTENNA POLARIZATION: Vertical
 DETECTOR FUNCTION: Peak

Corrected Level = Recorded Level - Amplifier Gain + Antenna Factor + Cable Loss

| Freq. (MHz) | EUT Dir (Deg.) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Corrected Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|----------------|----------------------|----------------------------------|-----------------------------|---------------------------|-----------------------------|-----------------------|--------------------------------|-------------------|----------------|
| 624 | 120 | 1 | 56.1 | 27.0 | 19.7 | 11.0 | 59.8 | 65.7 | -5.9 |
| 936 | 240 | 1 | 46.3 | 26.5 | 24.2 | 14.9 | 58.8 | 65.7 | -6.9 |
| 1248 | 50 | 1 | 47.7 | 20.8 | 25.8 | 2.0 | 54.7 | 75.2 | -20.5 |
| 1560 | 200 | 1 | 39.0 | 21.1 | 25.4 | 2.2 | 45.5 | 73.8 | -28.3 |
| 1872 | 330 | 1 | 37.7 | 22.1 | 26.9 | 2.4 | 44.9 | 75.2 | -30.3 |
| 2183 | 180 | 1 | 43.6 | 22.2 | 27.2 | 2.6 | 51.2 | 75.2 | -24.0 |
| 2496 | 65 | 1 | 29.6 | 21.8 | 26.6 | 2.9 | 37.3 | 73.8 | -36.5 |
| 2808 | 40 | 1 | 31.9 | 21.7 | 27.4 | 3.1 | 40.6 | 73.8 | -33.2 |
| 3120 | 40 | 1 | 33.0 | 22.0 | 28.2 | 3.3 | 42.5 | 75.2 | -32.7 |

Note: 624 and 936 MHz were measured at 3 meters.

TEST ENGINEER: Bob Ripley

Appendix C

Duty Cycle Plots

Duty Cycle Calculations

Bit times Total X Packets = code time + off time = Total time

$$320 + 600 = 920 \times 13 = 11960 + 13450 = 25410$$

Worst-case code

Long Bit x Packets

$$600 \times 13 = 7800$$

Worst-case Code / Total time Duty Cycle

$$7800 / 25410 = .3069 \quad (30.7\%)$$

Limit Calculations

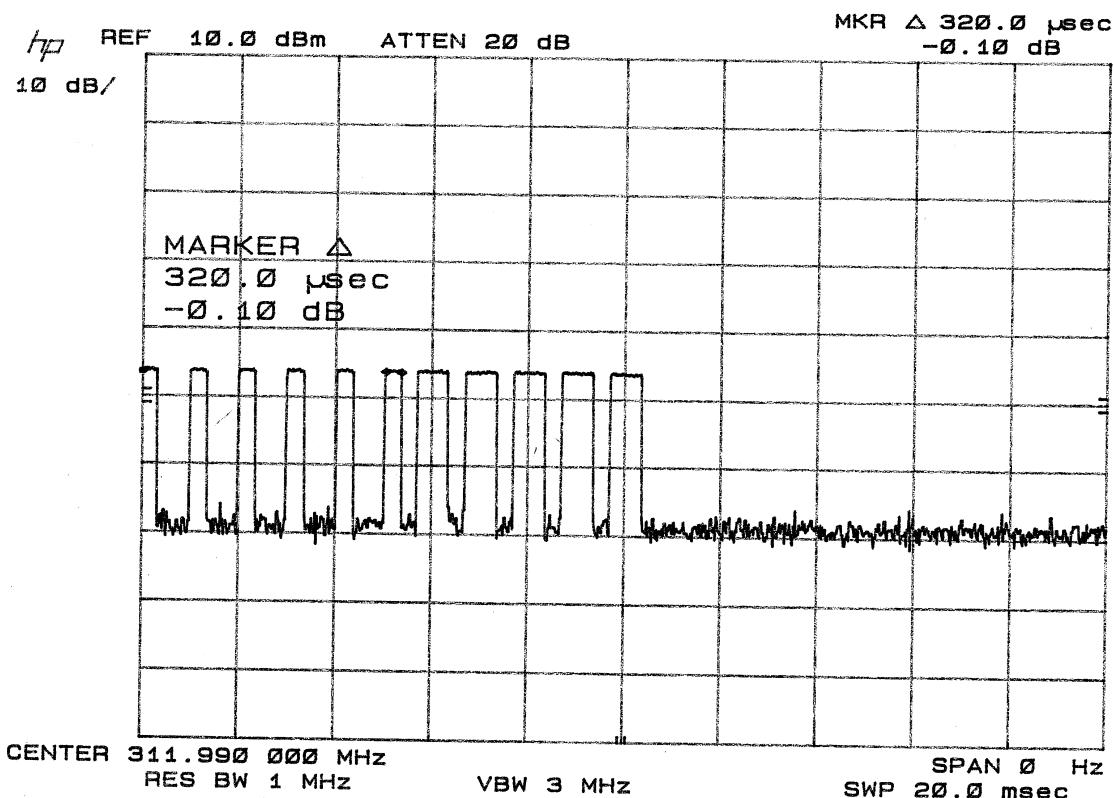
$$20 \log .3069 = 10.26 \text{ Limit Relaxation}$$

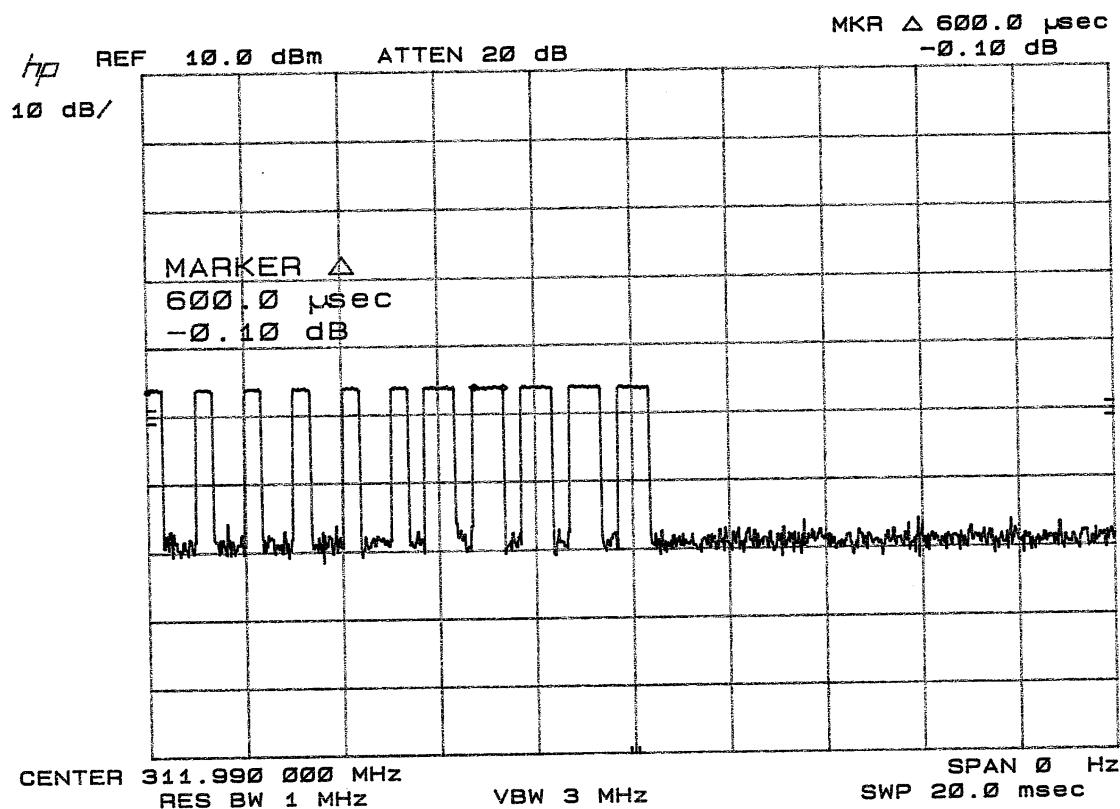
Limit @ 312 MHz 75.44
Relaxation 10.26
New Limit 85.7 dBuV @ 3 Meters

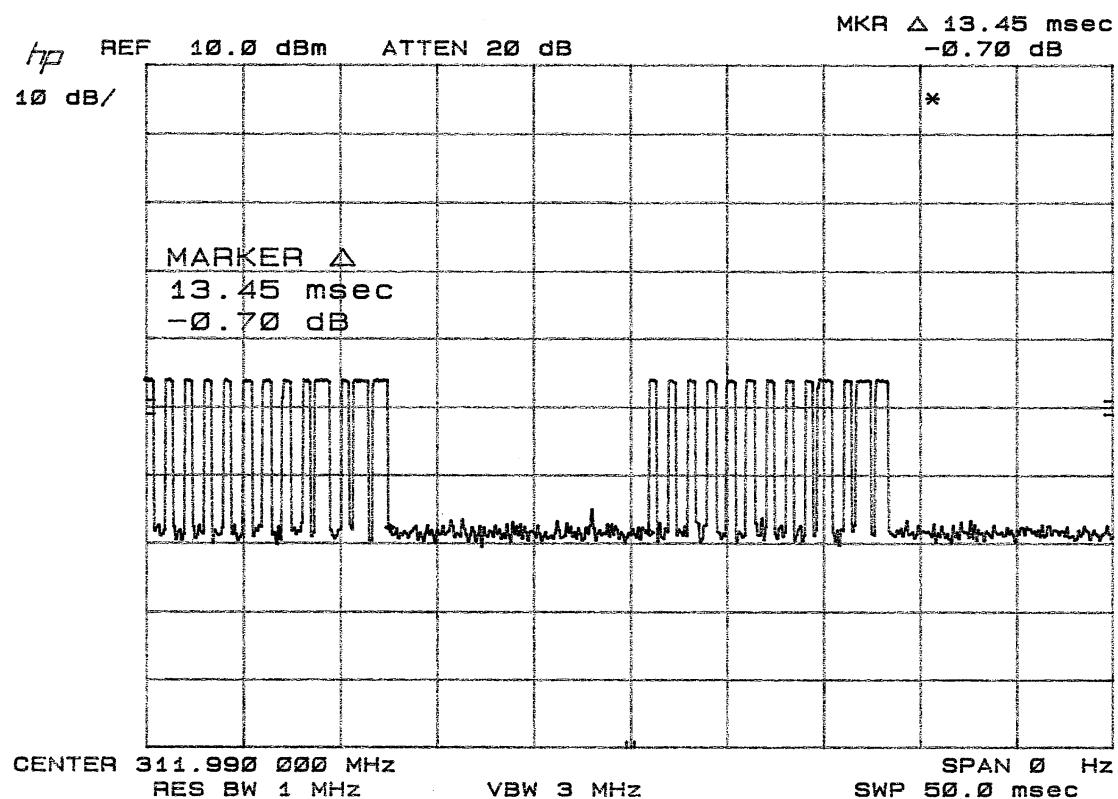
Spurious Limit $85.7 - 20 = 65.7$ dBuV @ 3 Meters
 $65.7 + 9.5 = 75.2$ dBuV @ 1 Meter

Restricted Band Limit Relaxation

$$20 \log (500) = 54 + 10.3 + 9.5 = 73.8 \text{ dBuV} @ 1 \text{ Meter}$$



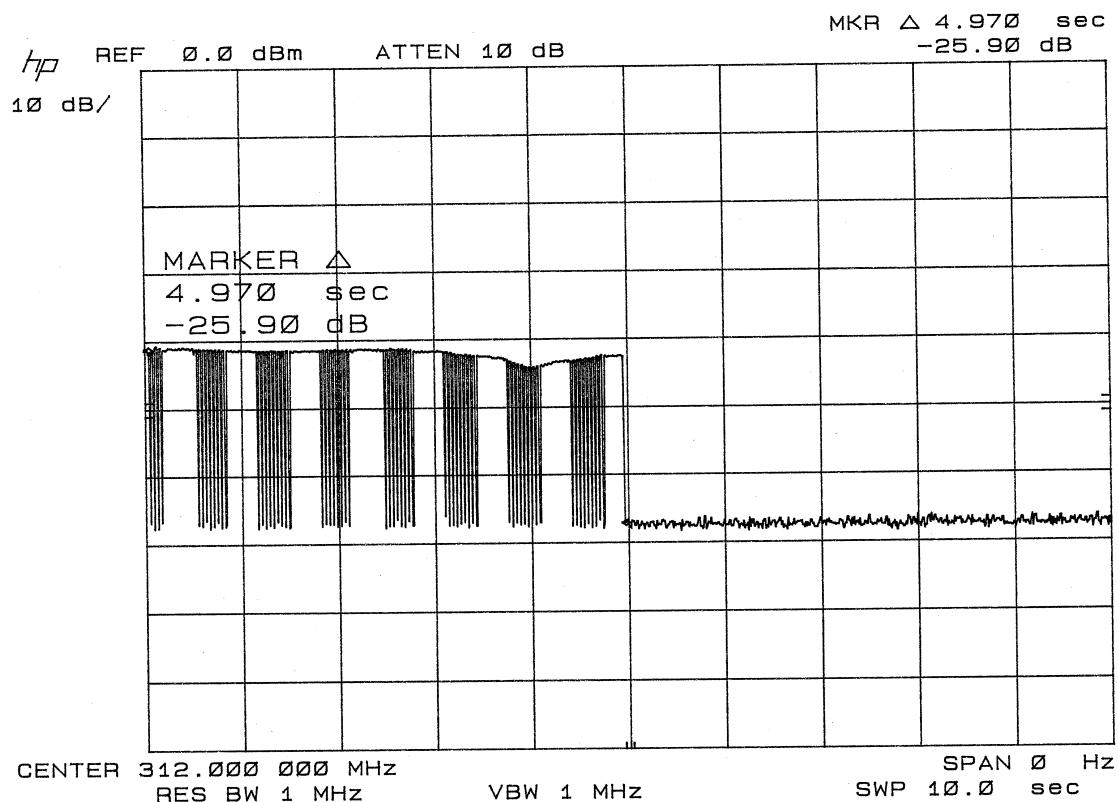




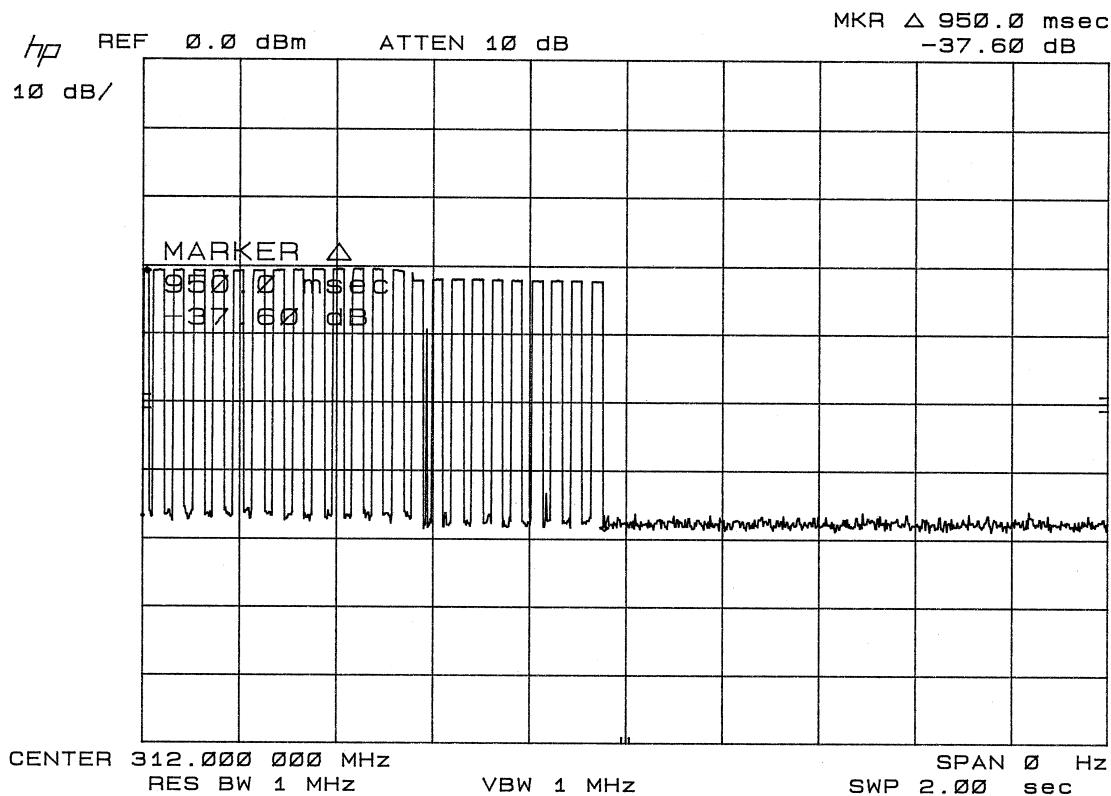
Appendix D

Transmission Duration

Normal Transmission



Supervisory Transmission



Appendix E

Occupied Bandwidth Data Sheets

Occupied Bandwidth Datasheet**Tel-Tron Technologies Corporation
Transmitter**

SERIAL #: None
DATE: June 3, 2002
PROJECT #: 02323-10

MEASUREMENT DISTANCE (m): 1.0
ANTENNA POLARIZATION: Horizontal
DETECTOR FUNCTION: Peak

