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Project Number: 02288-10

Prepared for:

**CONNECTEDWIRELESS CORPORATION**

101 West 6th Street suite 200.  
Austin, TX 78701

By

Professional Testing (EMI), Inc.  
1601 FM 1460, Suite B  
Round Rock, Texas 78664

February 2002

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**CERTIFICATION**  
**Electromagnetic Interference**  
**Test Report**

**CONNECTEDWIRELESS CORPORATION**  
**STR 7200-1**  
**(Intentional Radiator Portion)**

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



# Certificate of Compliance

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Applicant: ConnectedWireless Corporation  
 Applicant's Address: 101 West 6th Street suite 200  
 Austin, TX 78701  
 Model: STR 7200-1  
 Serial Number: 011001  
 Project Number: 02288-10

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 **ConnectedWireless Corporation, STR 7200-1** 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	433.97	70.0	72.8	-2.8
Spurious	868.06	44.7	52.8	-5.8
<u>Occupied Bandwidth</u>	<u>Frequency (MHz)</u>	<u>Bandwidth (kHz)</u>	<u>Bandwidth Limit (kHz)</u>	
Start Pulse	433.97	200	1084.8	
Transmit Pulse	433.97	150	1084.8	

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Jeffrey A. Lenk  
 President

## 1.0 EUT Description

The Equipment Under Test (EUT) is the **ConnectedWireless Corporation, STR 7200-1**. The **STR 7200-1** is a battery powered add-on accessory for the Symbol PDT7200 bar code reader that gives it the ability to read Savi RF ID tags when attached. The EUT operates at 433.97 MHz and is designed for compliance with 47 CFR 15.231 of the FCC rules.

The wakeup command generates a 3 second transmission of a 30 kHz FSK tone containing no data. This falls under 15.231(a).

The control and data commands are transmitted with FSK with a  $\pm 50$  kHz deviation at a rate of 9600 baud. They are shorter than 12 ms in length and contain recognition codes or data. These recognition codes include an address number, which is used to select an RFID tag or a group of RFID tags, and a control number that indicates one of several actions to be taken. These transmissions may also include data. These commands are repeated no more than once every 100 ms, this signal falls under 15.231(e).

Specific test requirements for this device include the following:

47 CFR 15.231	Fundamental Transmit Power
47 CFR 15.231, 15.205 & 15.209	Spurious Radiated Power
47 CFR 15.231 & 2.1049	Occupied Bandwidth (2.989 used as Procedural Reference)

The system tested consisted of the following:

<u>Manufacturer &amp; Model</u>	<u>Serial #</u>	<u>FCC ID #</u>	<u>Description</u>
ConnectedWireless Corporation, STR 7200-1	01100 1	P93-STR7200-1	RF Tag Reader

## 1.1 EUT Operation

The **STR 7200-1** was tested with special test software to continuously read RF tags. Setup and operational modes cover worst-case configuration and operational modes for the device. The frequency of the transmitting signal is 433.97 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 **STR 7200-1**. 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 **STR 7200-1** 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 device. The fundamental and spurious emissions of the device were measured with the measurement 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 433.97 MHz band. In addition to these requirements, the EUT must meet the restricted emission band requirements of §15.205. For this frequency range, the unintentional radiated emission limits of §15.231 for 433.97 MHz radiator is higher than the restricted band limits of §15.205. The limit of §15.231(e) was used for the spurious emission test. 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.

### 47 CFR, Part 15.231(a) limits

Frequency <u>MHz</u>	Test Distance <u>(Meters)</u>	Field Strength	
		Fundamental <u>(<math>\mu</math>V/m)</u>	Spurious <u>(<math>\mu</math>V/m)</u>
260 to 470	3	3,750 to 12,500 *	375 to 1,250 *
Above 470	3	12,500	1,250

\* linear interpolation

### 47 CFR, Part 15.231(e) limits

Frequency <u>MHz</u>	Test Distance <u>(Meters)</u>	Field Strength	
		Fundamental <u>(<math>\mu</math>V/m)</u>	Spurious <u>(<math>\mu</math>V/m)</u>
260 to 470	3	1,500 to 5,000 *	150 to 500 *
Above 470	3	5,000	500

\* linear interpolation

## 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 radiated emissions generated by the **STR 7200-1** 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 for the fundamental signals of the of the FCC Part 15.231 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. The occupied bandwidth was also measured on the device. Peak detection was used for all tests. The occupied bandwidth was based on a 26 dB criteria (26 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 1.0848 MHz for the transmitter working at 433.97 MHz.

Measurement of the occupied bandwidth was performed to verify that the emission bandwidth from the EUT did not exceed 1.0848 MHz. The typical occupied bandwidth for the module is 200 kHz.

### 3.3 Test Results

The occupied bandwidth test data is included in Appendix C. The measure and occupied bandwidth for the fundamental frequency (433.97 MHz) is 200 kHz. The figure is typical for the **STR 7200-1**.

The intended center frequency for the EUT was centered at 433.97 MHz. The center frequency is within the allowed band. The fundamental signal generated by the **STR 7200-1** is within the band allowed under FCC Part 15.231 emission band criteria.

## 4.0 Antenna Requirement

An analysis of the **STR 7200-1** 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 **STR 7200-1** were analyzed with respect to the rules. The antenna for this unit is an internal 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 **STR 7200-1** 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

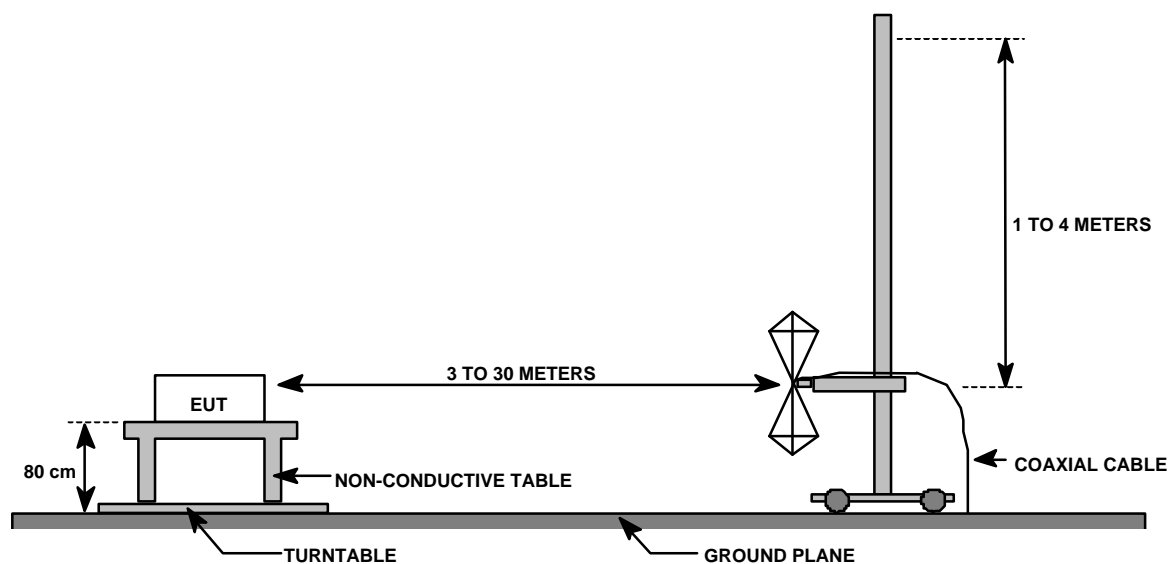
There were no modifications made on the **STR 7200-1** during the performance of the test program in order to meet the FCC criteria.

#### 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>
EMCO 3115	Ridge Guide	July 2002
Advantest R3265	Spectrum Analyzer	February 2002
MITEQ	20 GHz Preamplifier	February 2002
Tektronix 2706	RF Preselector	November 2002
HP 8447D	Preamp	May 2002
EMCO 3146	Log Antenna	November 2002
HP 8591E	Spectrum Analyzer	March 2002

**FIGURE 1: Radiated Emissions Test Setup**



## **Appendix A Radiated Emissions Data Sheets**

**Fundamental Radiated Data Sheet****ConnectedWireless Corporation  
STR 7200-1**

SERIAL #: 011001  
 DATE: February 5, 2002  
 PROJECT #: 02288-10

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

$$\text{Corrected Level} = \text{Recorded Level} - \text{Amplifier Gain} + \text{Antenna Factor} + \text{Cable Loss}$$

*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)
433.97	70	2	90.5	27.3	17.3	9.6	70.0	72.8	-2.8*
433.97	70	2	75.0	27.3	17.3	9.6	74.5	80.8	-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)
433.97	0	1	85.7	27.3	17.3	9.6	65.2	72.8	-7.6*
433.97	0	1	71.5	27.3	17.3	9.6	71.0	80.8	-9.8~

**Comment:** \*Transmit Pulse 10 mS on time. Limit from 15.231(e)  
 ~Start Pulse. Limit from 15.231(a)

**TEST ENGINEER: Bob Ripley**

## **Appendix B**

## **Spurious Radiated Emissions Data Sheets**

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**Spurious Radiated Data Sheet****ConnectedWireless Corporation  
STR 7200-1**

SERIAL #: 011001  
 DATE: February 5, 2002  
 PROJECT #: 02288-10

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

$$\text{Corrected Level} = \text{Recorded Level} - \text{Amplifier Gain} + \text{Antenna Factor} + \text{Cable Loss}$$

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)
868.06	340	2	34.5	26.3	22.7	13.8	44.7	52.8	-8.1
1301.7	90	1	40.3	20.8	25.6	2.0	47.1	52.8	-5.7
1735.0	0	1	45.1	21.7	26.2	2.3	52.0	52.8	-0.8

**Note:** 868.06 MHz was measured at 3 meters. Limit from 15.231(e).

**TEST ENGINEER: Bob Ripley**

**Spurious Radiated Data Sheet****ConnectedWireless Corporation  
STR 7200-1**

SERIAL #: 011001  
 DATE: February 5, 2002  
 PROJECT #: 02288-10

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)
868.06	70	1	33.6	26.3	22.7	13.8	43.8	52.9	-9.1
1735.0	100	1	44.4	21.7	26.2	2.3	51.3	52.9	-1.6
2169.8	900	1	33.8	22.3	27.9	2.6	42.1	52.9	-10.8
2603.0	0	1	28.9	21.8	26.9	3.0	37.0	52.9	-15.9

**Note:** 868.06 MHz was measured at 3 meters. Limit from 15.231(e).

**TEST ENGINEER: Bob Ripley**

## **Appendix C**

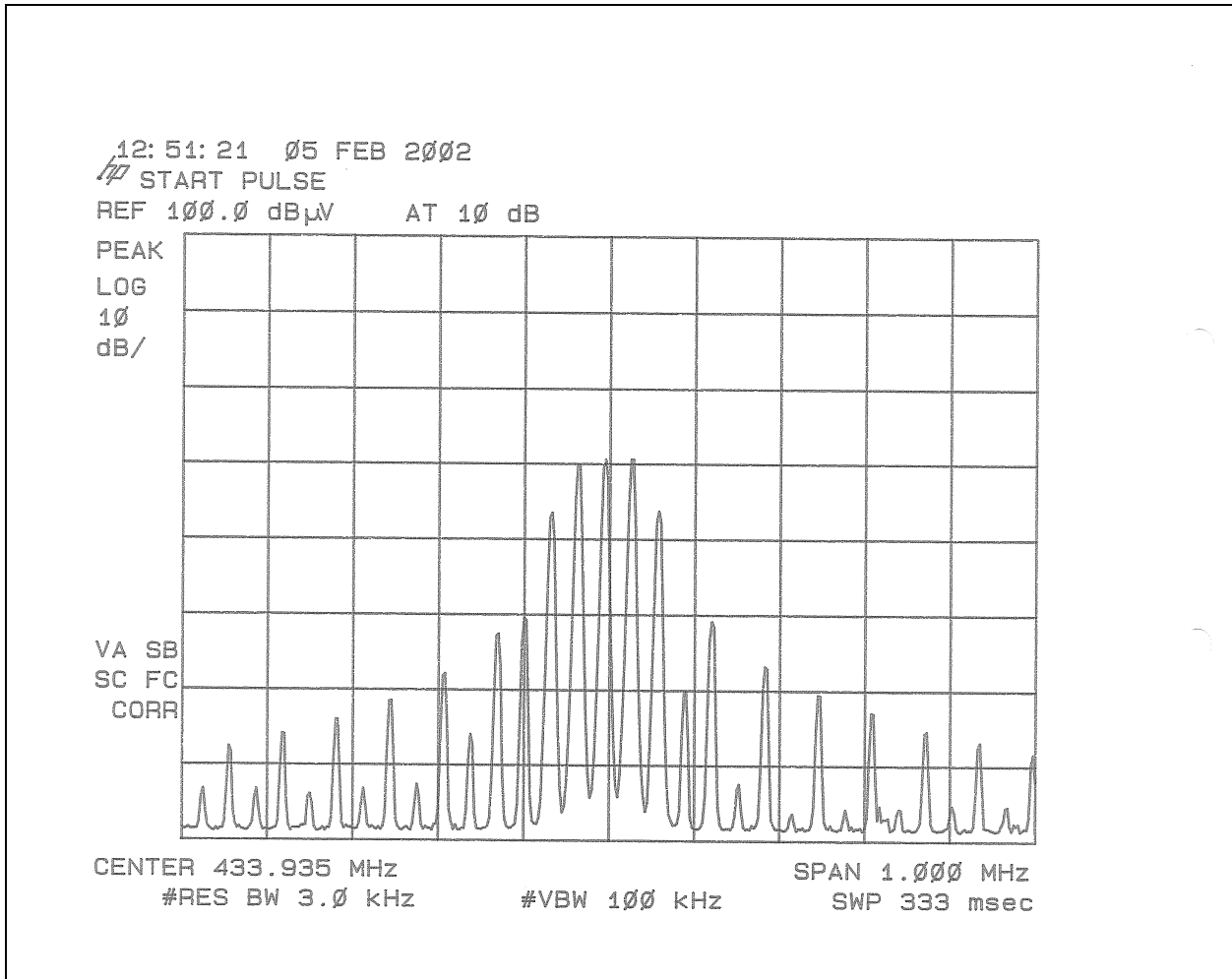
## **Occupied Bandwidth Data Sheets**

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**Occupied Bandwidth Datasheet**  
**Start Pulse**  
**Connected Wireless Corporation**  
**STR 7200-1**

SERIAL #: 011001  
DATE: February 5, 2002  
PROJECT #: 02288-10

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

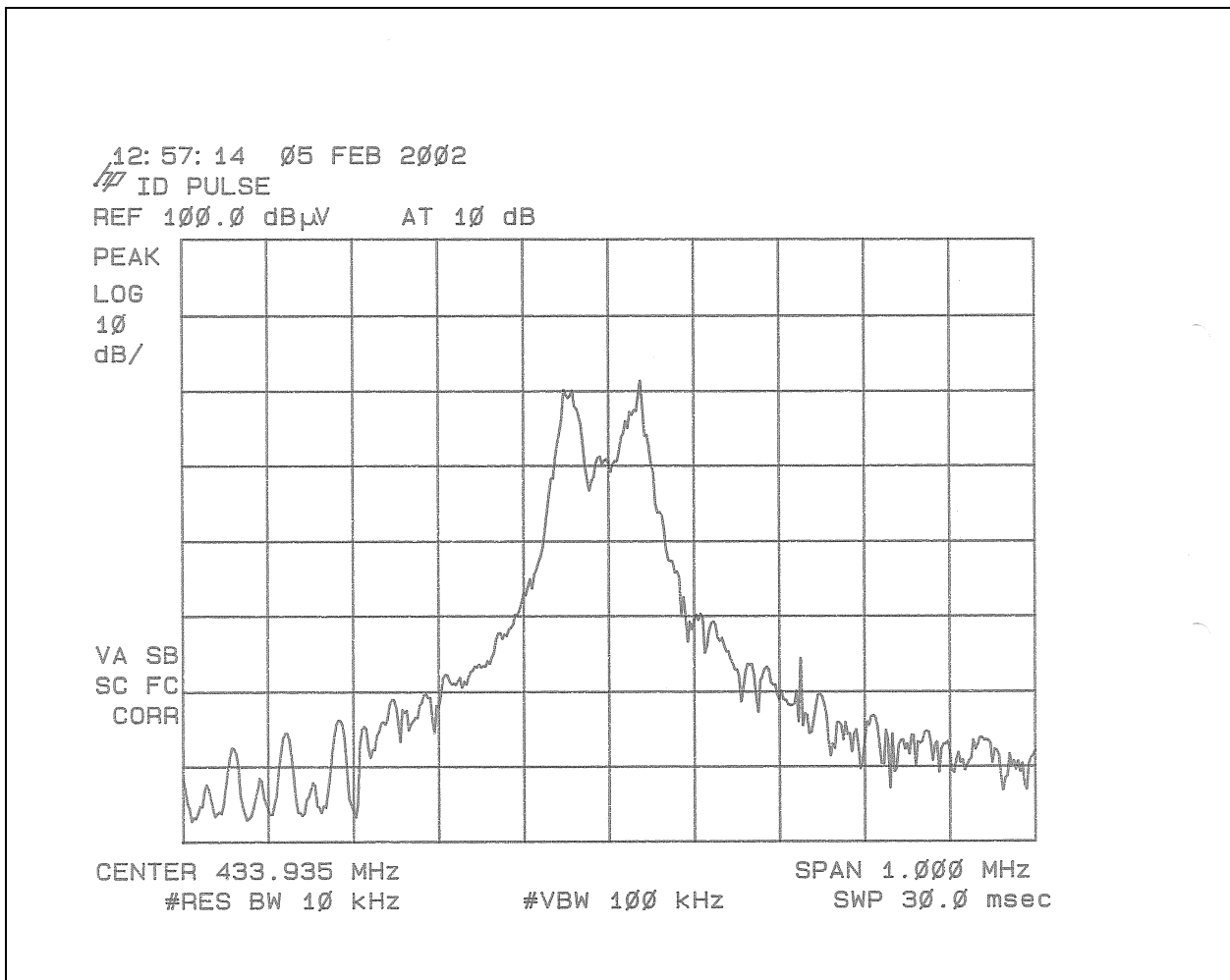


**TEST ENGINEER: Bob Ripley**

**Occupied Bandwidth Datasheet  
Transmitter Pulse  
ConnectedWireless Corporation  
STR 7200-1**

SERIAL #: 011001  
DATE: February 5, 2002  
PROJECT #: 02288-10

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



**TEST ENGINEER: Bob Ripley**

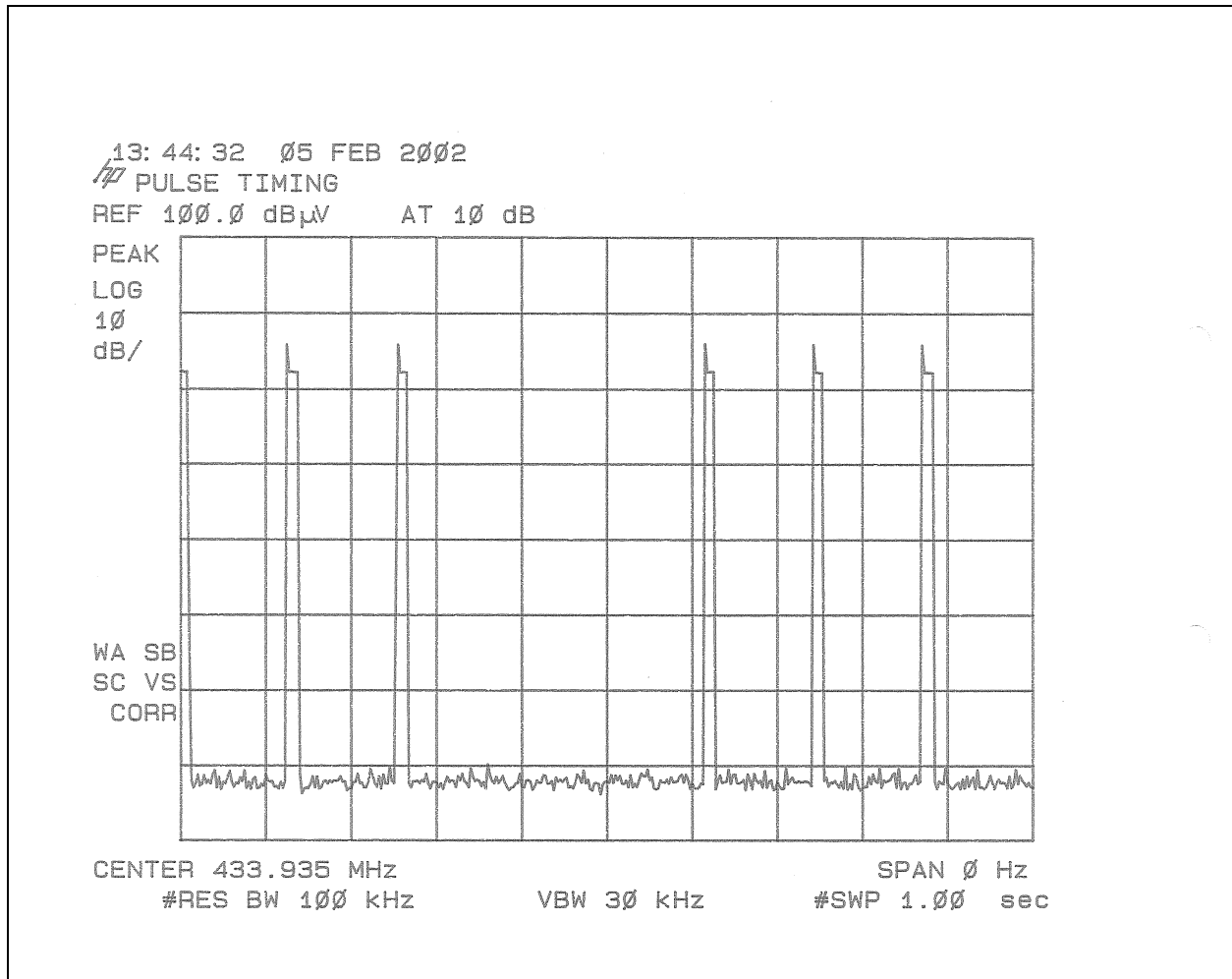




## **Appendix D**

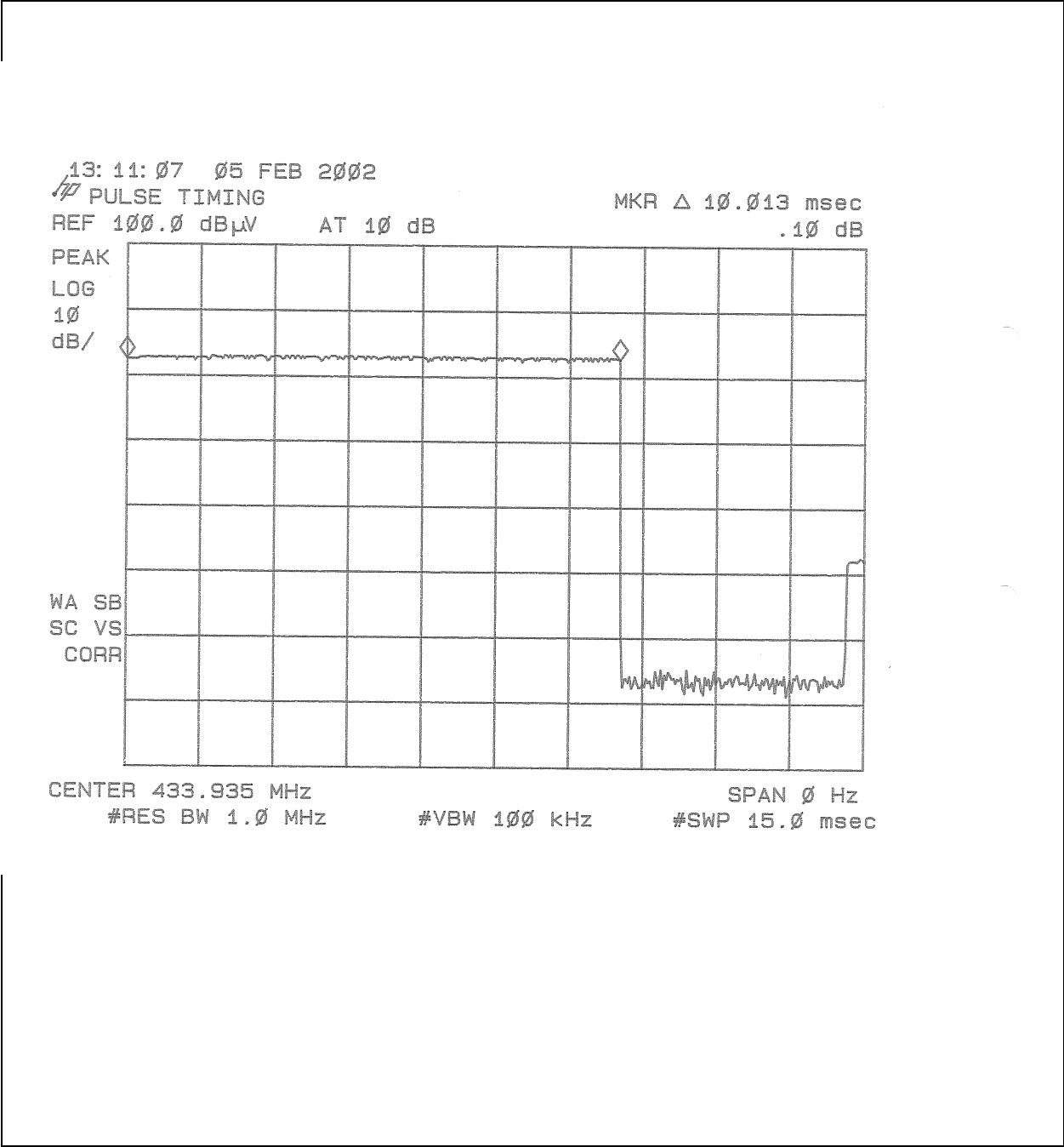
## **Transmitter Duty Cycle**

## Complete Transmitter Sequence



**Comment:** Transmitter Duty Cycles of 10 Ms out of 100 Ms allows an average power reduction of 20 dB.

# Transmit Pulse 10 Ms Durations

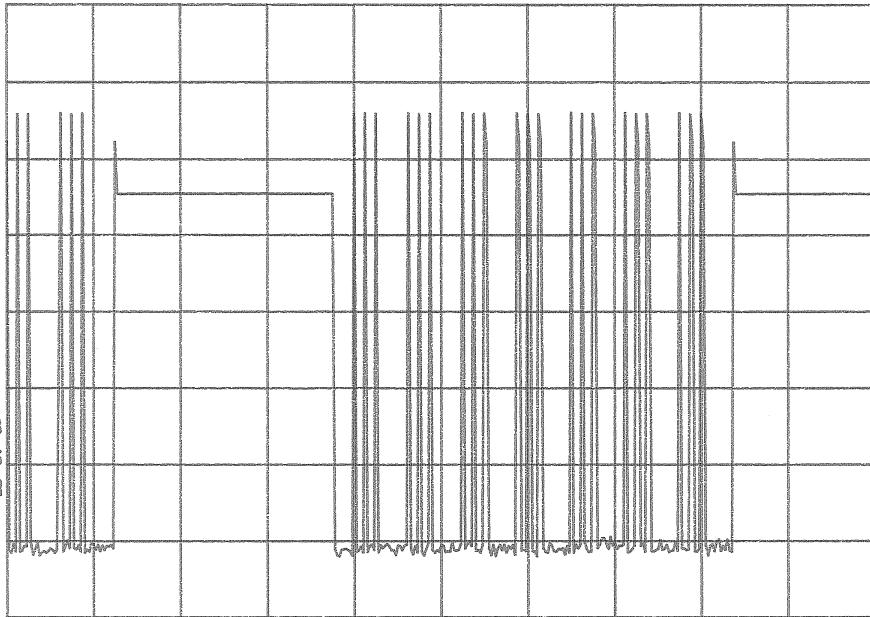


## Transmit Pulses Less Than One Per .1 Second

13: 49: 47 05 FEB 2002

PULSE TIMING

REF 100.0 dBμV AT 10 dB

PEAK  
LOG  
10  
dB/WA SB  
SC VS  
CORRCENTER 433.935 MHz  
#RES BW 100 kHz

VBW 30 kHz

SPAN 0 Hz  
#SWP 10.0 sec