
Project Number: 03137-10

Prepared for:

COWTEK, INC.
28110 Avenue Stanford Unit C.
Valencia, CA 91335

By

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October 2002

CERTIFICATION
Electromagnetic Interference
Test Report

COWTEK, INC.
Temperature Bolus
(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

Applicant: CowTek, Inc.

Applicant's Address: 28110 Avenue Stanford Unit C
Valencia, CA 91335

Model: Temperature Bolus

Serial Number: None

Project Number: 03137-10

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 **CowTek, Inc. Temperature Bolus** was tested to and found to be in compliance with FCC Part 15 Subpart C, 15.231 (e) 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	417.95	50.3	72.3	-22.0
Harmonic	835.95	32.8	52.3	-19.5
<u>Occupied Bandwidth</u>	<u>Frequency (MHz)</u>	<u>Bandwidth Limit (MHz)</u>	<u>Bandwidth Measured (kHz)</u>	
	417.95	1.045	74	

Jeffrey A. Lenk
President

This report has been reviewed and accepted by CowTek, Inc.. The undersigned is responsible for ensuring that the **Temperature Bolus** will continue to comply with the FCC rules.

1.0 EUT Description

The Equipment Under Test (EUT) is the **CowTek, Inc. Temperature Bolus**. The **Temperature Bolus** is an active, battery-powered temperature-monitoring device which records and tracks temperature changes in cattle. The bolus is designed to ignore minor temperature fluxuations caused by diet or exertion while reporting prolonged elevated temperatures, which are indications of illnesses or infections, which demand attention and treatment. The EUT operates at 418 MHz and is designed for compliance with 47 CFR 15.231(e) of the FCC rules. Specific test requirements for this device include the following:

47 CFR 15.231(e)	Fundamental Transmit Power
47 CFR 15.231(e) & 15.205	Spurious Radiated Power
47 CFR 15.109	Unintentional Radiated Emissions
47 CFR 15.231(e) & 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>
CowTek, Inc., Temperature Bolus	None	QBKETD-2740	Temperature Bolus

1.1 EUT Operation

The **Temperature Bolus** was placed in a special test mode, causing it to transmit every three seconds with a three burst transmission per each three-second period. The EUT was placed in the center of a plastic five-gallon water bottle, which was filled with water containing 1/3 grass, 1/2 cup vinegar, 1/2 cup salt. Setup and operational modes cover worst-case configuration and operational modes for the device. The frequency of the transmitting signal is 418 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 **Temperature Bolus**. 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 **Temperature Bolus** 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. One side of the device is weighted which causes the device to remain horizontal on the bottom of the cow's stomach. The off center weight also prevents rotation of the device around its long axis, therefore the device was tested in the only plane found in normal operation.

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(e) radiated limits for an intentional radiator operating at 418 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 §15.249 for 418 MHz radiator is higher than the restricted band limits of §15.205. The limit of §15.205 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.

<u>Signal Type</u>	<u>Test Distance</u> <u>(Meters)</u>	<u>Field Strength</u> <u>(μV/m)</u>	<u>(dBμV/m)</u>
Fundamental (418 MHz)	3	4133.3	72.3
2nd Harmonics (836 MHz)	3	413.3	52.3
Harmonics (3rd and above)	1	413.3	52.3

Duration of each transmission shall not be greater than one second, and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

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 and transmission timing are 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 **Temperature Bolus** are below the FCC Part 15.231 and FCC Part 15.205 maximum emission criteria. The silent period between transmissions in normal operation was

not verified due to the EUT's abnormal configuration of a transmission recurrence every three seconds. In normal operation, the EUT will not transmit more frequently than once per half hour. This is specified in the operating manual.

3.0 Occupied Bandwidth Measurements

Measurements of the occupied bandwidth for the fundamental signals 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 1.045 MHz for the transmitter working at 418 MHz.

Measurement of the occupied bandwidth was performed to verify that the emission bandwidth from the EUT did not exceed 1.045 MHz. The typical occupied bandwidth for the module is 74 kHz.

3.3 Test Results

The occupied bandwidth test data is included in Appendix D. The occupied bandwidth for the fundamental frequency (418 MHz) is 74 kHz. The figure is typical for the **Temperature Bolus**.

The intended center frequency for the EUT was centered at 418 MHz. The center frequency is within the allowed band. The fundamental signal generated by the **Temperature Bolus** is within the band allowed under FCC Part 15.231 emission band criteria.

4.0 Antenna Requirement

An analysis of the **Temperature Bolus** 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 **Temperature Bolus** 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 **Temperature Bolus** 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 **Temperature Bolus** during the performance of the test program in order to meet the FCC criteria.

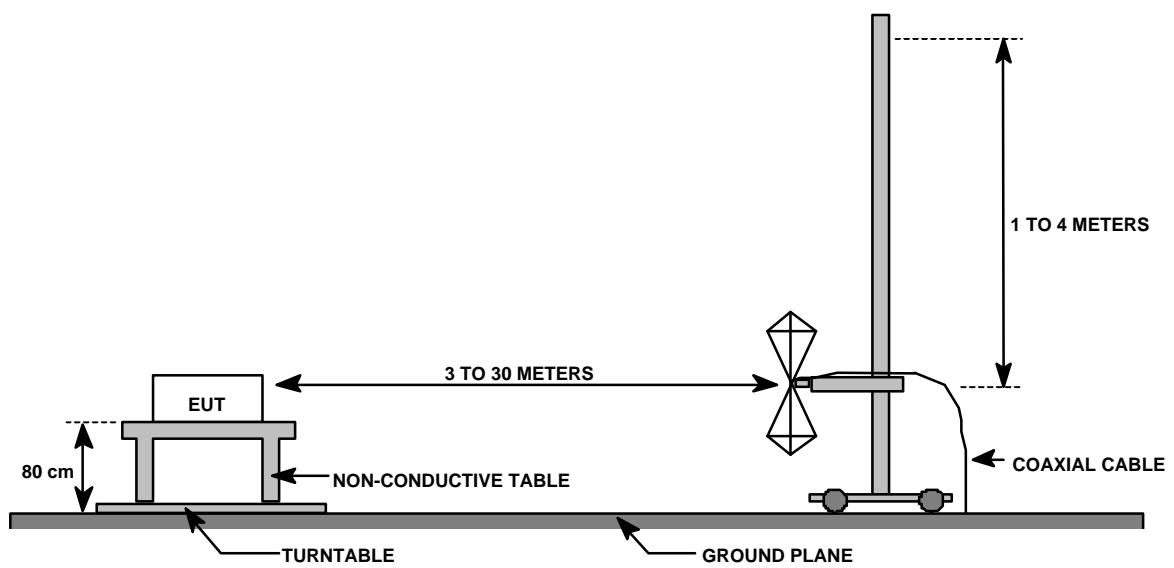
6.0 List of Test Equipment

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>
HP 856620A	Display Unit	November 2002
HP 8566B	Spectrum Analyzer	November 2002
HP 85650A	Quasi Peak Adapter	November 2002
HP 8447D	Preamplifier	October 2002
Tektronix 2706	RF Preselector	October 2002
EMCO 3146	Log Antenna	July 2003
EMCO 3115	Ridge Guide	June 2003
MITEQ	20 GHz Preamplifier	January 2003
MITEQ	18 GHz 20 dB Preamplifier	January 2003
Compliance Design B-100	Biconical Antenna	November 2002

FIGURE 1: Radiated Emissions Test Setup



Fundamental Radiated Data Sheet

CowTek, Inc. Temperature Bolus

SERIAL #: None
DATE: September 29, 2002
PROJECT #: 03137-10

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)
417.95	180	1.9	53.2	27.3	16.2	8.2	50.3	72.3	-22.0

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)
417.95	120	1.1	46.5	27.3	16.2	8.2	43.6	72.3	-28.7

TEST ENGINEER: Bob Ripley

Appendix B

Harmonic Radiated Emissions Data Sheets

Harmonic Radiated Data Sheet

CowTek, Inc. Temperature Bolus

SERIAL #: None
DATE: September 29, 2002
PROJECT #: 03137-10

MEASUREMENT DISTANCE (m): 3
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)
836	180	1.4	23.2	26.2	22.1	12.2	31.3	52.3	-21.0
1254	0	1.0	24.5	20.8	25.7	2.0	31.4	61.8	-30.4

Comment: The frequency of 836 was measured at 3 meters.

TEST ENGINEER: Bob Ripley

Harmonic Radiated Data Sheet

CowTek, Inc. Temperature Bolus

SERIAL #: None

DATE: September 29, 2002

PROJECT #: 03137-10

MEASUREMENT DISTANCE (m): 3

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)
835.95	180	1.2	24.7	26.2	22.1	12.2	32.8	52.3	-19.5
1254	180	1.0	24.2	20.8	25.7	2.0	31.1	61.8	-30.7

Comment: The frequency of 835.95 was measured at 3 meters.

TEST ENGINEER: Bob Ripley

Timing Duration Data Sheet

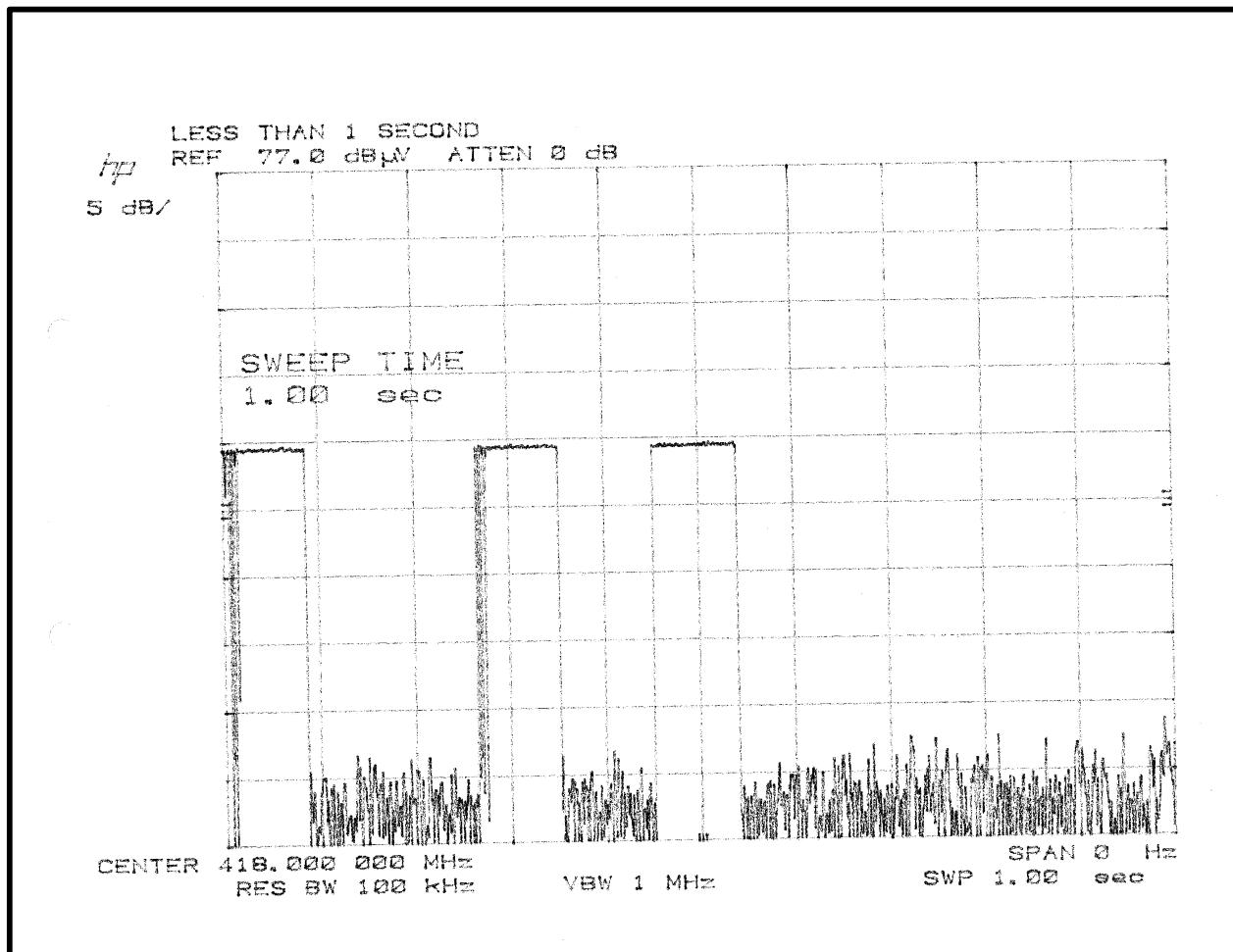
CowTek, Inc. Temperature Bolus

SERIAL #: None

MEASUREMENT DISTANCE (m): 1

DATE: September 29, 2002

PROJECT #: 03137-10



TEST ENGINEER: Bob Ripley

Appendix C

Occupied Bandwidth Data Sheets

Occupied Bandwidth Datasheet

CowTek, Inc. Temperature Bolus

SERIAL #: None

DATE: September 29, 2002

PROJECT #: 03137-10

MEASUREMENT DISTANCE (m): 1.0

ANTENNA

POLARIZATION:

Horizontal

DETECTOR FUNCTION: Peak

