Test Report

DUT:	Wireless temperature sensor model ES500-A-RFT
Test Date:	13-July-2001
Manufacturer:	Excel Energy Technologies, Ltd. 624 S. Boston, Suite 300 Tulsa, OK 74119 (918) 585-5000
Conducted by:	Control Design & Testing, Inc. 6010 Red Fox Drive Spotsylvania, VA 22553 (540) 582-2826

CD&T FCC ID: PLS-ES500-A-RFT

A. DEVICE UNDER TEST

The product, designated the RFT, is a transceiver used to collect and relay data as part of an energy management system. The product is designed to operate under the provisions of Part 15.249 of the FCC rules and has been issued a Declaration of Conformity by Timco Engineering, Inc.

This device receives data from two transmitters, the PLS-ES100-A-TS temperature sensor and the PLS-ES200-A-PT pulse totalizer. The data received is then relayed to a computer or an Excelsyus (host system) main unit through an RS-485/232 port. This device can also be programmed to operate as a stand alone data collection point and retransmit the received data on to another RFT for remote downloading. When programmed as a receiving terminal for connection to a host system the device is referred to as a "listener" and designated ES500. When setup as a stand alone device it is referred to as a "repeater" and designated ES300. The circuitry is identical for both configurations and will be labeled PLS-ES500-A-RFT in either case.

The transmit frequency is 916.500 MHz. nominal. The modulation mode is on/off keying using a pulse width scheme. The device is powered from an external source of either 12VDC or 24VAC and has an internal 9.6 volt NiCad backup battery . The tranceiver circuitry is regulated at 3 volts.

The rf section consists of an RF Monolithics TR1000L transceiver module, a two element antenna matching network and molded rubber ¼ wave antenna. The antenna has a reverse pinned SMA connector molded into the base and connects to a matching threaded connector mounted on the circuit board.

B. MEASUREMENT PROCEDURE: RADIATED EMISSIONS

Testing of this device was conducted at the Hyak Laboratory test facility located in Spotsylvania, Virginia.

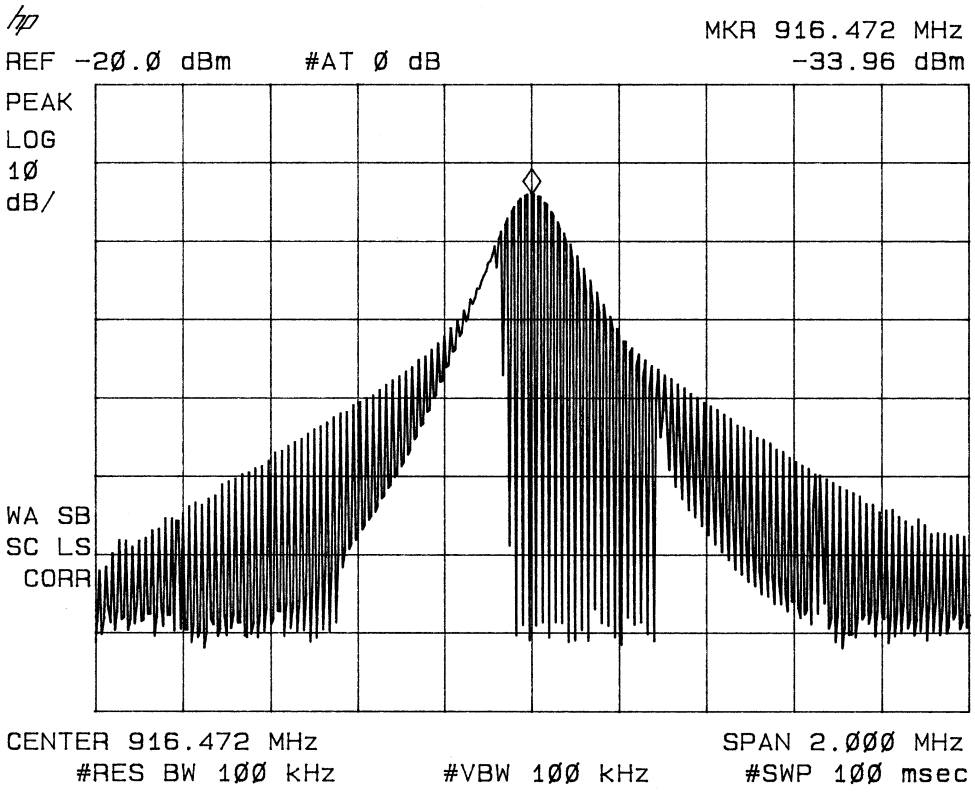
Transmitter field strength measurements were conducted according to the procedures set forth in ANSI C63.4 (1992). Testing was conducted with power supplied from a 12 volt class 2 power transformer with back-up batteries installed. The RS-232 data port was connect to COM1 on an NEC 2205C notebook computer. The compter was programmed to control the transmit and receive functions.

The device under test was placed on a rotating turntable 0.8 meters high, centered at 3 meters distant from the measurement antenna. The device was placed in the center of

the turntable with the computer placed underneath on a lower shelf. The device was tested in two positions shown in the test setup photographs.

For the purpose of testing, the sample was made to transmit a continuous 1 kHz, 50% duty cycle pulse stream. However, the occupied bandwidth (Plot 1) was captured with the sample device transmitting typical data packets.

Plot 1



The field strength measurements were taken using an HP8596E spectrum analyzer, an EMCO 3121C dipole set, an EMCO 3115 double ridge guide horn and an Avantek UJ210 preamp. The device was scanned in both transmit and receive modes from 30MHz. to 10GHz. and all emissions were noted. In this case, the only emissions detected were those harmonically related to the fundamental transmit frequency.

The receiver in this device is a pulse sequenced TRF clocked at 725 kHz. nominal and has no local oscillator. An effort was made to detect emissions that would be

harmonically related to the sequencer clock but none were found.

At each detected emission frequency, the device was measured by rotating the turntable and adjusting the antenna height over a range of 1 to 4 meters to obtain the maximum output level. This procedure was performed with both horizontal and vertical antenna polarizations for both of the setup positions shown in the test setup photos. The peak reading for each frequency was recorded in the fourth column in Table 1 below.

Table 1

RADIATED EMISSIONS DATA

CLIENT: EXCEL ENERGY FCC ID: PLS-ES500-A-RFT
ANTENNA: DIPOLES/DRG HORN EUT: DATA TRANSMITTER
PART 15.249, 15.35 TEST DATE: 13-JULY-01

Frequency In MHz.	Ant. Polar. H/V	Ant. Factor dB	Peak reading dBm	Duty Cycle -dB	Peak Power uV/m@3m	Corrected Power uV/m@3m	FCC Limit uV/m@3m
916.470	V	30.5	-43.65	0.0	49261	49261	50000
1832.940	V	30.2	-89.85	0.0	233	233	500
2749.410	V	33.4	-96.08	0.0	164	164	500
3665.880	H	35.7	-98.31	0.0	166	166	500
4582.349	H	36.6	-102.61	0.0	112	112	500
5498.819	V	38.6	-109.44	0.0	64	64	500
6415.288	H	39.1	-114.25	0.0	39	39	500

Measurements taken for weak emissions were performed by reducing the distance from the measurement antenna to 1 meter and factoring –9.54dB into the calculation. This method was used for the 6^{th} and 7^{th} harmonics.

C. DUTY CYCLE AND INTERVAL CALCULATIONS

The occupied bandwidth measurement was made using an HP8596E spectrum analyzer and plotted with an HP7475A pen plotter. The duty cycle correction factor for this device is approximately –6dB, but since the peak readings for all detected harmonics were below the limits, the duty cycle correction factor was not applied to the calculations.