

## Test Report

DUT: Thermostat with RF Tranceiver  
Model T8665C  
Test Date: 13-July-2001

Manufacturer: Honeywell, Inc.  
Home and Building Controls  
1985 Douglas Drive  
(763) 954-4972

Conducted by: Control Design & Testing, Inc.  
6010 Red Fox Drive  
Spotsylvania, VA 22553  
(540) 582-2826

CD&amp;T

FCC ID: HS9-T8665C

## A. DEVICE UNDER TEST

The product submitted for test is a thermostat used to control heating and air conditioning systems. The product incorporates a radio transceiver circuit to relay data and control commands with other devices as part of an energy management system. The product is designed to operate under the provisions of Part 15.249 of the FCC rules.

The transmit and receive frequencies are 916.500 MHz. nominal. The modulation mode is on/off keying using a proprietary protocol at 19.2 K bits/second. The device is powered from an internal 4.5 VDC source consisting of three standard "AA" alkaline batteries, connected in series. The transceiver circuitry is regulated at 3 volts.

The rf section consists of an RF Monolithics TR1000L transceiver hybrid, a two element antenna matching network and a 3.1 inch, #18AWG, solid wire antenna. The antenna is soldered directly to the printed circuit board. There is no provision to connect an external antenna.

## B. MEASUREMENT PROCEDURE: RADIATED EMISSIONS

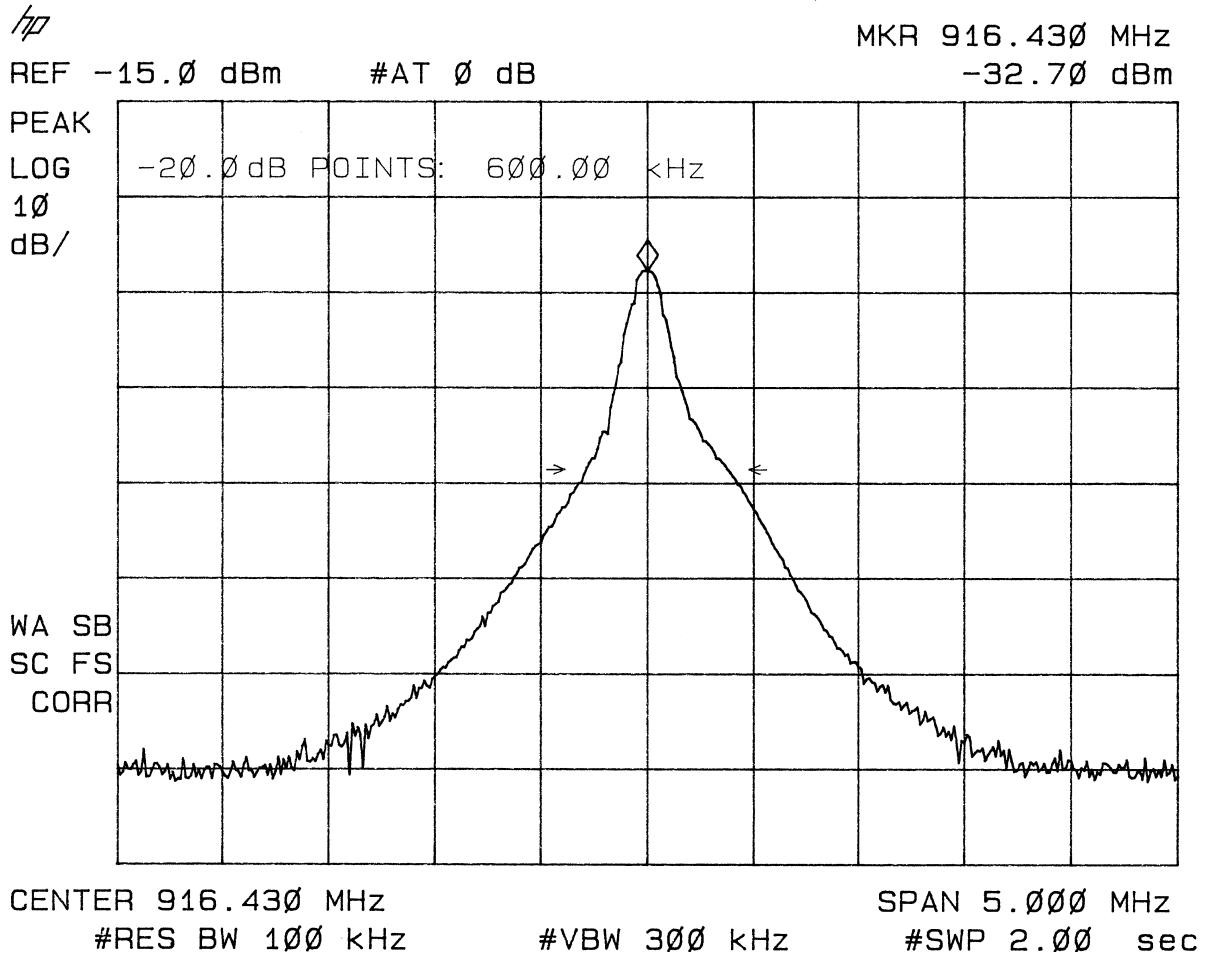
Testing of this device was conducted at the Hyak Laboratory test facility located in Spotsylvania, Virginia.

Transmitter field strength measurements were conducted according to the procedures set forth in ANSI C63.4 (1992). ). Testing was conducted with fresh batteries and monitored periodically to insure that the battery voltage (under load) was maintained at 95% of nominal or greater.

The device under test was placed on a rotating turntable 0.8 meters high, centered 3 meters distant from the measurement antenna. The device was placed in the center of the turntable and tested in the two positions shown in the test setup photographs.

For transmitted radiated emission measurements, the sample was programmed to continuously transmit a typical data. This mode was also used to capture the occupied bandwidth plot shown below.

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 within 30 dB. of the limits were noted.

The receiver in this device is a pulse sequenced TRF, clocked at approximately 1.54 MHz. 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.

The controller circuit has clock oscillators at 32 kHz. , 500kHz. and 8 MHz. These frequencies and related harmonics were also investigated. Two frequencies related to the 8 MHz. clock (32.00 MHz. and 40.00 MHz.) were detected but were greater than 30dB below the limit and are not recorded in the table.

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: HONEYWELL				FCC ID: HS9-T8665C			
ANTENNA: DIPOLES/DRG HORN				EUT: DATA TRANSMITTER			
PART 15.249				TEST DATE: 05-DEC-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
916.431	V	30.5	-44.14		46559		50000
1832.862	V	30.2	-91.17		200		500
2749.293	V	33.4	-93.66		217		500
3665.724	H	35.7	-97.21		188		500
4582.155	V	36.6	-100.83		138		500
5498.586	H	38.6	-104.54		113		500
6415.016	H	39.1	-111.06		56		500
7331.446	V	40.8	-117.52		33		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 7<sup>th</sup> and 8<sup>th</sup> harmonics.

C. OCCUPIED BANDWIDTH AND DUTY CYCLE

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 -4dB, but since the peak readings for all detected harmonics were below the limits, the duty cycle correction factor was not applied to the calculations.