

EXHIBIT D

CKC TEST REPORT



NOTIFICATION TEST REPORT
FOR THE
HOME ALARM SYSTEM, BHS-FOB
FCC PART 15, SUBPART B
CLASS B COMPLIANCE

DATE OF ISSUE: JUNE 16, 1998

PREPARED FOR:

Sentrol
12345 SW Leveton Drive
Tualafin, OR 97062

P.O. No: 90210

W.O. No: 68,584

Report No: **FB98-078**

Date of test: April 20, 1998 & May 5, 1998

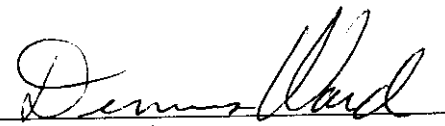
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ADMINISTRATIVE INFORMATION

DATE OF TEST: April 20, 1998 & May 5, 1998

PURPOSE OF TEST: To demonstrate the compliance of the Home Alarm System, BHS-FOB, with the FCC Part 15, Subpart B requirements for Class B devices.

MANUFACTURER: Sentrol
12345 SW Leveton Drive
Tualafin, OR 97062

REPRESENTATIVE: Mr. Ron Baugh

TEST LOCATION: CKC Laboratories, Inc.
5473A Clouds Rest
Mariposa, CA 95338

TEST PERSONNEL: Craig Mullis

TEST METHOD: ANSI C63.4 1992

FREQUENCY RANGE TESTED: 450kHz - 1000MHz

EQUIPMENT UNDER TEST: Receiver
Manuf: Sentrol
Model: BHS-FOB/RCVR
Serial: N/A
FCC ID: Pending

SUMMARY OF RESULTS

The Sentrol Home Alarm System, BHS-FOB was tested in accordance with ANSI C63.4 (1992) for compliance with the Class B requirements of Part 15, Subpart B of the FCC Rules.

As received, the above equipment was found to be fully compliant with the Class B limits of FCC Part 15, Subpart B for both radiated and conducted emissions.

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

RF receiver and key FOB transmitter for use in security alarm system.

MEASUREMENT UNCERTAINTY

Associated with data in this report is a ± 4 dB measurement uncertainty.

PERIPHERAL DEVICES

The EUT was tested with the following peripheral devices:

Control Panel

Manuf: Sentrol
Model:
Serial:

Button Pad

Manuf: Sentrol
Model:
Serial:

REPORT OF MEASUREMENTS

The following Tables 1 and 2 report the six highest radiated and conducted emissions levels recorded during the tests performed on the Home Alarm System, BHS-FOB. The data sheets from which these tables were compiled are contained in Appendix B.

Table 1: Six Highest Radiated Emission Levels

FREQUENCY MHz	METER READING dBμV	CORRECTION FACTORS				CORRECTED READING dBμV/m	SPEC LIMIT dBμV/m	MARGIN dB	NOTES
		Ant dB	Amp dB	Cable dB	Dist dB				
36.094	49.5	10.7	-27.5	1.1		33.8	40.0	-6.2	VQ
47.997	47.9	10.6	-27.4	1.2		32.3	40.0	-7.7	V
48.061	46.9	10.6	-27.4	1.2		31.3	40.0	-8.7	H
314.580	49.4	18.2	-26.9	3.5		44.2	46.0	-1.8	HDQ
629.034	39.9	20.3	-28.2	5.2		37.2	46.0	-8.8	H
943.558	37.2	23.9	-27.2	6.5		40.4	46.0	-5.6	HQ

Test Method: ANSI C63.4 1992
Spec Limit : FCC Class B
Test Distance: 3 Meters

NOTES: H = Horizontal Polarization
V = Vertical Polarization
N = No Polarization
D = Dipole Reading
Q = Quasi Peak Reading
A = Average Reading

COMMENTS: Receiver located on turntable. Support devices located off the turntable.
Operating in ARMED mode and powered through the control panel.

Table 2: Six Highest Conducted Emission Levels

FREQUENCY MHz	METER READING dB μ V	CORRECTION FACTORS				CORRECTED READING dB μ V	SPEC LIMIT dB μ V	MARGIN dB	NOTES
		Lisn dB							
1.696104	33.6	0.0				33.6	48.0	-14.4	W
3.149780	33.5	0.0				33.5	48.0	-14.5	B
10.016900	33.6	0.0				33.6	48.0	-14.4	B
15.993910	33.6	0.0				33.6	48.0	-14.4	W
24.035500	34.6	0.0				34.6	48.0	-13.4	W
28.692540	33.5	0.0				33.5	48.0	-14.5	B

Test Method: ANSI C63.4 1992
Spec Limit : FCC Class B
Test Distance: No Distance

NOTES: Q = Quasi Peak Reading
A = Average Reading
B = Black Lead
W = White Lead

COMMENTS: Operating in ARMED mode and powered through the control panel which is connected to the LISN. Added 470pf cap across the GND and +V terminals in the receiver.

TABLE A
LIST OF TEST EQUIPMENT

1. Spectrum Analyzer, Hewlett Packard, Model No. 85662A, S/N 2403A08241.
2. Preamp, Hewlett Packard, Model No. 8447D, S/N -1937A02604.
3. Quasi-Peak Adapter, Hewlett Packard, Model No. 85650A, S/N 2811A01267
4. Biconical Antenna, A & H Systems, Model No. SAS-200/542, S/N 156
5. Log Periodic Antenna, A & H Systems, Model No. SAS-200/512, S/N 154.
6. Magnetic Loop Antenna, EMCO, Model No. 6502, S/N 1074.
7. Horn Antenna, EMCO, Model No. 3115, S/N 4683.
8. LISN (FCC), Solar Electronics, S/N 855996, 992.
9. LISN, Solar Electronics, S/N 8144793, 474.
10. Test software, EMI Test 2.86.
11. Spectrum Analyzer, Hewlett Packard, Model No. HP 8568B, S/N 2007A01066 (RF section),
Model No. 85662A, S/N 2005A01550 (Display unit).
12. Preamp, Hewlett Packard, Model No. 8447D, S/N 1937A01933.
13. Quasi-Peak Adapter, Hewlett Packard, Model No. 85650A, S/N 2043A00272.
14. Biconical Antenna, Electro-metric Model No. BIA-30, S/N 136.
15. Log Periodic Antenna, Electro-metric, Model No. LPA-30, S/N 352.
16. Horn Antenna, Amplifier Research, Model No. AT4000, S/N 11791.

EUT SETUP

The equipment under test (EUT) and the peripherals listed were setup in a manner that represented their normal use, as shown in the setup photographs in Appendix A. Any special conditions required for the EUT to operate normally are identified in the comments that accompany Table 1 for radiated emissions, and Table 2 for conducted emissions.

During radiated emissions testing, the EUT was mounted on a nonconductive, rotating table 80 cm above the conductive grid. The nonconductive table dimensions were 1 meter by 1.5 meters. This configuration is typical for radiated emissions testing of table top devices.

I/O cables were connected to the EUT and peripherals in the manner required for normal operation of the system. Excess cabling was bundled in the center in a serpentine fashion using 30-40 centimeter lengths.

During conducted emissions testing, the EUT was located 80 centimeters above the conducting ground plane on a nonconducting table. The metal plane was grounded to the earth through the green wire safety ground. Power to the EUT was provided via 3 meters of shielded power cable from a filter grounded to the metal plane to a LISN. The LISN was also grounded to the plane and attached to the LISN was a 4 ganged grounded outlet whose source was also shielded and 60 cm in length. All other objects were kept a minimum of 1 meter away from the EUT during the conducted test.

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed in Table A were used to collect both the radiated and conducted emissions data for the Home Alarm System, BHS-FOB. For radiated measurements below 300 MHz, the biconical antenna was used. For frequencies from 300 to 1000 MHz, the log periodic antenna was used. All antennas were located at a distance of 3 meters from the edge of the EUT. Conducted emissions tests required the use of the FCC type LISN's.

The HP spectrum analyzer was used for all measurements. Table B shows the analyzer bandwidth settings that were used in designated frequency bands. For conducted emissions, a reference level of 100 dB μ V and a vertical scale size of 10 dB per division were used. A 10 dB external attenuator was also used during conducted tests, with internal offset correction in the analyzer. During radiated testing, the measurements were made with 0 dB of attenuation, a reference level of 97 dB μ V, and a vertical scale of 10 dB per division.

TABLE B : ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE

TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	450 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz

SPECTRUM ANALYZER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in Tables 1 and 2 indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "Peak" mode. Whenever a "Quasi-Peak" or "Average" reading is listed as one of the six highest readings, this is indicated as a "Q" or an "A" in Table 1 or Table 2. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data for the Home Alarm System, BHS-FOB.

Peak

In this mode, the Spectrum Analyzer or test engineer recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature of the analyzer called "peak hold," the analyzer had the ability to measure transients or low duty cycle transient emission peak levels. In this mode the analyzer made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

When the true peak values exceeded or were within 2 dB of the specification limit, quasi-peak measurements were taken using the HP 85650A Quasi-Peak Adapter for the HP 8568B Spectrum Analyzer. The detailed procedure for making quasi peak measurements contained in the HP Quasi-Peak Adapter manual were followed.

Average

When the frequencies exceed 1 GHz, average measurements may be made using the spectrum analyzer. To make these measurements, the test engineer reduces the video bandwidth on the analyzer until the modulation of the signal is filtered out. At this point the analyzer is set into the linear mode and the scan time is reduced.

TEST METHODS

The radiated and conducted emissions data of the Home Alarm System, BHS-FOB, was taken with the HP Spectrum Analyzer. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the "Sample Calculations". The corrected data was then compared to the FCC Part 15, Subpart B, Class B emissions limits to determine compliance.

Preliminary and final measurements were taken in order to better ensure that all emissions from the EUT were found and maximized.

Radiated Emissions Testing

During the preliminary radiated scan, the EUT was powered up and operating in its defined FCC test mode with the power cable facing the antenna. The frequency range of 30 MHz - 88 MHz was then scanned with the biconical antenna located about 1.5 meter above the ground plane in the vertical configuration. During this scan, the turntable was rotated and all peaks which were at or near the limit were recorded. The frequency range of 100 - 300 MHz was scanned in the same manner, using the biconical antenna, and the peaks recorded. Lastly, a scan of the FM band from 88 - 110 MHz was made, using a reduced resolution bandwidth and a reduced frequency span. The biconical antenna was changed to the horizontal polarity and the above steps were repeated. After changing to the log periodic antenna in the horizontal configuration, the frequency range of 300 - 1000 MHz was scanned. The log periodic antenna was changed to the vertical polarity and the frequency range of 300 - 1000 MHz was again scanned. Care was taken to ensure that no frequencies were missed within the FM and TV bands. An analysis was performed to determine if the signals that were at or near the limit were caused by an ambient transmission. If unable to determine by analysis, the equipment was powered down to make the final determination if the EUT was the source of the emission.

For the final radiated scan, the equipment was again positioned with its power cable facing the antenna. A thorough scan of all frequencies was manually made using a small frequency span, rotating the turntable as needed. Comparison with the previously recorded measurements was then made.

Using the peak readings from both scans as a guide, the test engineer then maximized the readings with respect to the table rotation, antenna height and configuration of the cable. Maximizing of the cable was achieved by monitoring the spectrum analyzer on a closed circuit television monitor while the EUT cable was being moved and rearranged on the EUT table for maximum emissions. Photographs showing the final worst case configuration of the EUT are contained in Appendix A.

Conducted Emissions Testing

For conducted emissions testing, a 30 to 50 second sweep time was used for automated measurements in the frequency bands of 450 kHz to 1.705 MHz, 1.705 MHz to 3 MHz, and 3 MHz to 30 MHz. All readings within 20 dB of the limit were recorded. At frequencies where the recorded emissions were close to the limit, further investigation was performed manually at a slower sweep rate.

SAMPLE CALCULATIONS

The basic spectrum analyzer reading was converted using correction factors as shown in the six highest emissions readings in Tables 1 and 2. For radiated emissions in dB μ V/m, the spectrum analyzer reading in dB μ V was corrected by using the following formula:

$$\begin{aligned} &\text{Meter reading (dB}\mu\text{V)} \\ &+ \text{Antenna Factor (dB)} \\ &+ \text{Cable Loss (dB)} \\ &- \text{Distance Correction (dB)} \\ &- \text{Pre-amplifier Gain (dB)} \\ &= \text{Corrected Reading (dB}\mu\text{V/m)} \end{aligned}$$

This reading was then compared to the applicable specification limit to determine compliance. For conducted emissions, no correction factors were needed when 50 μ H LISN's were used.

APPENDIX A

INFORMATION ABOUT THE EQUIPMENT UNDER TEST

INFORMATION ABOUT THE EQUIPMENT UNDER TEST

Test Software/Firmware:	V1.0
CRT was displaying:	
Power Supply Manufacturer:	
Power Supply Part Number:	
AC Line Filter Manufacturer:	
AC Line Filter Part Number:	
The EUT has no power cord.	
Test Voltage: 10 14 VDC	

I/O PORTS

Type	#

CRYSTAL OSCILLATORS

Type	Freq In MHz

PRINTED CIRCUIT BOARDS

Function	Model & Rev	Clocks, MHz	Layers	Location
RF Receiver	BHS-FOB Receiver Rev. A	12 MHz	2	

REQUIRED EUT CHANGES TO COMPLY:

Added 470pf cap across the GND and +V terminals in the receiver.
--

APPENDIX B
MEASUREMENT DATA SHEETS

Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest Rd, Barn • Mariposa, CA 95338 • (800)-500-4EMC

Customer: Sentrol/Scantronics
Specification: FCC B RADIATED
Test Type: Maximized Emissions
Equipment: Home Alarm System
Manufacturer: Sentrol/Scantronics
Model: BHS-FOB
S/N: See below

Date: Apr-20-98
Time: 14:48
Sequence#: 4
Tested By: Craig Mullis

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Receiver	Sentrol	BHS-FOB/RCVR	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
Control Panel	Sentrol		
Button Pad	Sentrol		

Test Conditions / Notes:

Receiver located on turntable. Support devices located off the turntable. Operating in ARMED mode and powered through the control panel.

Measurement Data:

Sorted by Margin

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	Pream dB	Barn dB	Bicon dB	Log S dB	Dist dB	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar
1	314.580	49.4	-26.9	+3.5	+0.0	+18.2	+0.0	44.2	46.0	-1.8	Horiz
	Dipole QP										
^	314.578	50.1	-26.9	+3.5	+0.0	+18.2	+0.0	44.9	46.0	-1.1	Horiz
	Dipole										
3	314.580	42.7	-26.9	+3.5	+0.0	+21.6	+0.0	40.9	46.0	-5.1	Vert
	Quasi Peak										
^	314.567	43.9	-26.9	+3.5	+0.0	+21.6	+0.0	42.1	46.0	-3.9	Vert
5	943.558	37.2	-27.2	+6.5	+0.0	+23.9	+0.0	40.4	46.0	-5.6	Horiz
	Quasi Peak										
^	943.560	39.2	-27.2	+6.5	+0.0	+23.9	+0.0	42.4	46.0	-3.6	Horiz
7	36.094	49.5	-27.5	+1.1	+10.7	+0.0	+0.0	33.8	40.0	-6.2	Vert
	Quasi Peak										
^	36.045	51.7	-27.5	+1.1	+10.7	+0.0	+0.0	36.0	40.0	-4.0	Vert
9	36.091	48.8	-27.5	+1.1	+10.7	+0.0	+0.0	33.1	40.0	-6.9	Horiz
	Quasi Peak										
^	36.094	50.2	-27.5	+1.1	+10.7	+0.0	+0.0	34.5	40.0	-5.5	Horiz

11	47.997	47.9	-27.4	+1.2	+10.6	+0.0	+0.0	32.3	40.0	-7.7	Vert
12	943.560	34.9	-27.2	+6.5	+0.0	+23.9	+0.0	38.1	46.0	-7.9	Vert
13	48.061	46.9	-27.4	+1.2	+10.6	+0.0	+0.0	31.3	40.0	-8.7	Horiz
14	629.034	39.9	-28.2	+5.2	+0.0	+20.3	+0.0	37.2	46.0	-8.8	Horiz

Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest Rd, Barn • Mariposa, CA 95338 • (800)-500-4EMC

Customer: **Sentrol/Scantronics**
Specification: **FCC B COND**
Test Type: **Conducted Emissions**
Equipment: **Home Alarm System**
Manufacturer: **Sentrol/Scantronics**
Model: **BHS-FOB**
S/N: **See below**

Date: May-05-98
Time: 15:49
Sequence#: 3
Tested By: Craig Mullis

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Receiver	Sentrol	BHS-FOB/RCVR	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
Control Panel	Sentrol		
Button Pad	Sentrol		

Test Conditions / Notes:

Operating in ARMED mode and powered through the control panel which is connected to the LISN. Added 470pf cap across the GND and +V terminals in the receiver.

Measurement Data:

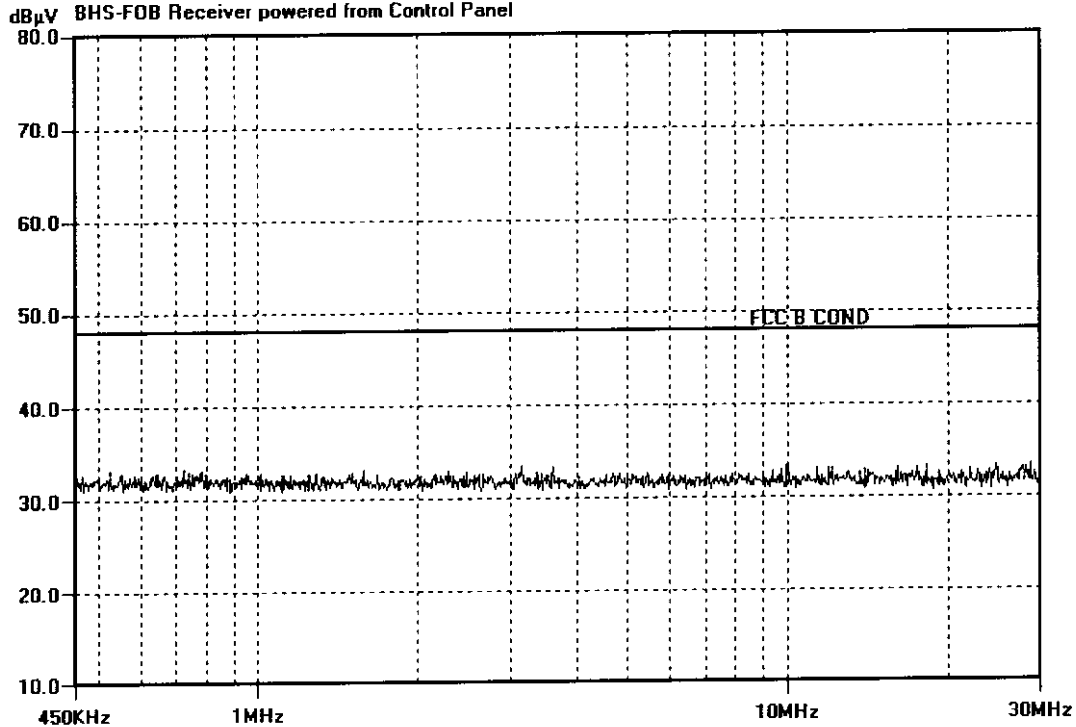
Sorted by Margin

Test Lead: Black

#	Freq	Rdng dBμV	dB	dB	dB	dB	Dist dB	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar
1	10.017M	33.6					+0.0	33.6	48.0	-14.4	Black
2	28.693M	33.5					+0.0	33.5	48.0	-14.5	Black
3	3.150M	33.5					+0.0	33.5	48.0	-14.5	Black
4	723.744k	33.4					+0.0	33.4	48.0	-14.6	Black
5	24.733M	33.3					+0.0	33.3	48.0	-14.7	Black
6	18.258M	33.3					+0.0	33.3	48.0	-14.7	Black
7	3.605M	33.3					+0.0	33.3	48.0	-14.7	Black
8	28.045M	33.2					+0.0	33.2	48.0	-14.8	Black
9	27.634M	33.2					+0.0	33.2	48.0	-14.8	Black
10	12.106M	33.2					+0.0	33.2	48.0	-14.8	Black

11	12.009M	33.2	+0.0	33.2	48.0	-14.8	Black
12	11.431M	33.2	+0.0	33.2	48.0	-14.8	Black
13	1.583M	33.2	+0.0	33.2	48.0	-14.8	Black
14	525.829k	33.2	+0.0	33.2	48.0	-14.8	Black
15	17.585M	33.1	+0.0	33.1	48.0	-14.9	Black
16	16.106M	33.1	+0.0	33.1	48.0	-14.9	Black
17	784.408k	33.1	+0.0	33.1	48.0	-14.9	Black
18	9.728M	33.0	+0.0	33.0	48.0	-15.0	Black
19	2.288M	33.0	+0.0	33.0	48.0	-15.0	Black
20	740.427k	33.0	+0.0	33.0	48.0	-15.0	Black

CKC Laboratories, Inc. Date: Tue May-05-1998 Time: 15:38:17 WO#: 68584
FCC B COND Test Lead: Black Sequence#: 3
BHS-FOB Receiver powered from Control Panel



Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest Rd, Barn • Mariposa, CA 95338 • (800)-500-4EMC

Customer: Sentrol/Scantronics
Specification: FCC B COND
Test Type: Conducted Emissions
Equipment: Home Alarm System
Manufacturer: Sentrol/Scantronics
Model: BHS-FOB
S/N: See below

Date: May-05-98
Time: 15:38
Sequence#: 2
Tested By: Craig Mullis

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Receiver	Sentrol	BHS-FOB/RCVR	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
Control Panel	Sentrol		
Button Pad	Sentrol		

Test Conditions / Notes:

Operating in ARMED mode and powered through the control panel which is connected to the LISN. Added 470pf cap across the GND and +V terminals in the receiver.

Measurement Data:

Sorted by Margin

Test Lead: White

#	Freq	Rdng dBμV	dB	dB	dB	dB	Dist dB	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar
1	24.035M	34.6					+0.0	34.6	48.0	-13.4	White
2	15.994M	33.6					+0.0	33.6	48.0	-14.4	White
3	1.696M	33.6					+0.0	33.6	48.0	-14.4	White
4	17.006M	33.5					+0.0	33.5	48.0	-14.5	White
5	12.009M	33.5					+0.0	33.5	48.0	-14.5	White
6	10.017M	33.5					+0.0	33.5	48.0	-14.5	White
7	5.657M	33.5					+0.0	33.5	48.0	-14.5	White
8	4.403M	33.5					+0.0	33.5	48.0	-14.5	White
9	28.020M	33.4					+0.0	33.4	48.0	-14.6	White
10	1.880M	33.4					+0.0	33.4	48.0	-14.6	White

11	659.289k	33.4	+0.0	33.4	48.0	-14.6	White
12	28.693M	33.3	+0.0	33.3	48.0	-14.7	White
13	2.262M	33.3	+0.0	33.3	48.0	-14.7	White
14	19.279M	33.2	+0.0	33.2	48.0	-14.8	White
15	1.105M	33.2	+0.0	33.2	48.0	-14.8	White
16	837.148k	33.2	+0.0	33.2	48.0	-14.8	White
17	536.446k	33.2	+0.0	33.2	48.0	-14.8	White
18	1.253M	33.1	+0.0	33.1	48.0	-14.9	White
19	683.555k	33.1	+0.0	33.1	48.0	-14.9	White
20	652.465k	33.1	+0.0	33.1	48.0	-14.9	White

CKC Laboratories, Inc. Date: Tue May-05-1998 Time: 15:20:18 W0#: 68584
FCC B COND Test Lead: White Sequence#: 2
BHS-F08 Receiver powered from Control Panel

