DZL221222

CKC LABORATORIES, INC. Testing the Future

EXHIBIT D

CKC TEST REPORT

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

DZL 221222

CKC LABORATORIES, INC. Testing the Future

ACCREDITED

CERTIFICATION TEST REPORT

FOR THE

CORDLESS RF MOUSE, ARECIBO, MODEL M-RG53

FCC PART 15 SUBPART C

COMPLIANCE

DATE OF ISSUE: APRIL 2, 1999

PREPARED FOR:

Logitech
6505 Kaiser Drive
Fremont, CA 94555

P.O. No:
W.O. No: 71201

Report No: FC99-018

PREPARED BY:

Joyce Walker
CKC Laboratories, Inc.
5473A Clouds Rest
Mariposa, CA 95338

Date of test: March 25, 1999

DOCUMENTATION CONTROL:

Tracy Phillips
Documentation Control Supervisor
CKC Laboratories, Inc.

APPROVED BY:

Dennis Ward

Dennis Ward
Director of Laboratories
CKC Laboratories, Inc.

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

TABLE OF CONTENTS

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

ADMINISTRATIVE INFORMATION

DATE OF TEST:	March 25, 1999
PURPOSE OF TEST:	To demonstrate the compliance of the Cordless RF Mouse, Arecibo, Model M-RG53, with the requirements for FCC Part 15 Subpart C devices.
MANUFACTURER:	Logitech 6505 Kaiser Drive Fremont, CA 94555
REPRESENTATIVE:	Bharat Shah
TEST LOCATION:	CKC Laboratories, Inc. 1653 Los Viboras Road Hollister, CA 95023
TEST PERSONNEL:	Simon Navarro
TEST METHOD:	ANSI C63.4 1992
FREQUENCY RANGE TESTED:	150 kHz - 1000 MHz
EQUIPMENT UNDER TEST:	**Cordless RF Mouse** Manuf: Suzhou Logitech Electronics Company Model: Arecibo Serial: 12 FCC ID: DZL221222 (pending)

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

SUMMARY OF RESULTS

The Logitech Cordless RF Mouse, Arecibo, Model M-RG53, was tested in accordance with ANSI C63.4 1992 for compliance with FCC Part 15 Subpart C.

As received, the above equipment was found to be fully compliant with the limits of FCC Part 15 Subpart C. The results in this report apply only to the items tested, as identified herein.

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Cordless peripheral computer mouse.

MEASUREMENT UNCERTAINTY

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

EUT OPERATING FREQUENCY

The EUT was operating at 27.045 & 27.053 MHz.

TEMPERATURE AND HUMIDITY DURING TESTING

The temperature during testing was within +15°C and + 35°C.
The relative humidity was between 20% and 75%.

PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

Host PC		**Monitor**	
Manuf:	HP	Manuf:	HP
Model:	Pavillion 8180	Model:	D5258A
Serial:	US73553464	Serial:	DK73795774

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

Keyboard

Manuf:	HP
Model:	SK-2505
Serial:	M970848474

Receiver

Manuf:	Logitech
Model:	850787-0000
Serial:	EVT#2-024

Printer

Manuf:	HP
Model:	C2655-60015
Serial:	SG69K111KR

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

REPORT OF MEASUREMENTS

The following tables report the highest worst case levels recorded during the tests performed on the Cordless RF Mouse, Arecibo, Model M-RG53. All readings taken are peak readings unless otherwise noted by a "Q" or "A". The data sheets from which these tables were compiled are contained in Appendix B.

Table 1: Fundamental Radiated Emission

FREQUENCY	METER READING	CORRECTION FACTORS				CORRECTED READING	SPEC LIMIT	MARGIN	NOTES
		Loop Ant	Amp	Cable	Dist				
MHz	dBμV	dB	dB	dB	dB	dBμV/m	dBμV/m	dB	
27.043	40.8	7.6				48.4	80.0	-31.6	N

Test Method: ANSI C63.4 1992
Spec Limit : FCC 15.227
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: EUT continuously transmitting a 27.045 MHz signal.

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

Table 2: Six Highest Spurious Emission Levels

FREQUENCY	METER READING	CORRECTION FACTORS				CORRECTED READING	SPEC LIMIT	MARGIN	NOTES
		Bicon Ant	Amp	Cable	Dist				
MHz	dBμV	dB	dB	dB	dB	dBμV/m	dBμV/m	dB	
81.128	43.5	6.7	-27.8	2.0		24.4	40.0	-15.6	H
299.159	38.5	20.2	-26.8	4.4		36.3	46.0	-9.7	HQ
315.025	44.0	13.2	-26.9	4.5		34.8	46.0	-11.2	H
365.655	37.0	15.4	-27.3	4.7		29.8	46.0	-16.2	H
398.885	39.8	16.7	-27.5	5.0		34.0	46.0	-12.0	H
432.135	38.0	16.8	-27.8	5.2		32.2	46.0	-13.8	H

Test Method: ANSI C63.4 1992
Spec Limit : FCC 15.209
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: EUT continuously transmitting a 27.045 MHz signal.

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

LIST OF TEST EQUIPMENT

Hollister C
VCCI Acceptance No. R-452 and C-463

1. Spectrum Analyzer, Hewlett Packard, Model No. 8568B, S/N 2601A02378 (rf Unit). Calibration date: September 18, 1998. Calibration due date: September 18, 1999.

2. Quasi-Peak Adapter, Hewlett Packard, Model No. 85650A, S/N 2811A01065. Calibration date: September 18, 1998. Calibration due date: September 18, 1999.

3. Preamplifier, Hewlett Packard, Model No. 8447D, S/N 2727A06124. Calibration date: January 4, 1999. Calibration due date: January 4, 2000.

4. Biconical Antenna, A & H Systems, Model No. SAS-200/540, S/N 416. Calibration date: October 5, 1998. Calibration due date: October 5, 1999.

5. Log Periodic Antenna, A & H Systems, Model No. SAS-200/512, S/N CKC-HC. Calibration date: May 8, 1998. Calibration due date: May 8, 1999.

6. Hollister site C calibration date: April 3, 1998. Calibration due date: April 3, 1999.

7. Test software, EMI Test 2.91.

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

EUT SETUP

The equipment under test (EUT) and the peripheral(s) listed were set up in a manner that represented their normal use. Any special conditions required for the EUT to operate normally are identified in the comments that accompany Table 1 for fundamental radiated emissions, Table 2 for spurious emissions. Additionally, a complete description of all the ports are included on the information sheets contained in Appendix A.

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 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.

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed in Table A were used to collect the radiated emissions data for the Cordless RF Mouse, Arecibo, Model M-RG53. 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.

The HP spectrum analyzer was used for all measurements. Table B shows the analyzer bandwidth settings that were used in designated frequency bands. During radiated testing, the measurements were made with 0 dB of attenuation, a reference level of 97 dBμV, and a vertical scale of 10 dB per division.

TABLE B : ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE

TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

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 the appropriate table. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data for the Cordless RF Mouse, Arecibo, Model M-RG53.

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 Quasi-Peak Adapter for the HP Spectrum Analyzer. The detailed procedure for making quasi peak measurements contained in the HP Quasi-Peak Adapter manual were followed.

Average

When the frequencies are below 30 MHz, 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.

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

TEST METHODS

The radiated emissions data of the Cordless RF Mouse, Arecibo, Model M-RG53, 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 C 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. 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 with the biconical antenna in the same manner, 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 check 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 peripherals. Photographs showing the final worst case configuration of the EUT are contained in Appendix A.

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

FCC Part 15.215(c) - Occupied Bandwidth Measurements

In accordance with Part 15.215(c), the fundamental frequency was kept within the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

SAMPLE CALCULATIONS

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

Meter reading (dBμV)
+ Antenna Factor (dB)
+ Cable Loss (dB)
- Distance Correction (dB)
- Pre-amplifier Gain (dB)

= Corrected Reading(dBμV/m)

This reading was then compared to the applicable specification limit to determine compliance.

A typical data sheet will display the following in column format:

#	Freq MHz	Rdng dBuV	Cable	Amp.	Bicon	Loop	Log C	Dist	Corr dBuV/m	Spec	Margin	Polar

means reading number
Freq MHz is the frequency in MHz of the obtained reading.
Rdng dBuV is the reading obtained on the spectrum analyzer in dBμV.
Amp. is short for the preamplifier factor or gain in dB.
Bicon is the biconical antenna factor in dB.
Log C is the log periodic antenna factor in dB.
Loop is the loop antenna factor in dB.
Cable is the cable loss in dB of the coaxial cable on the OATS.
Dist is the distance factor (in dB). It is used when testing at a different test distance than the one stated in the spec.
Corr dBμV/m is the corrected reading which is now in dBμV/m (field strength).
Spec is the specification limit (dB) stated in the agency's regulations.
Margin is the closeness to the specified limit in dB; + is over and - is under the limit.
Polar is the Polarity of the antenna with respect to earth.

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

APPENDIX A

INFORMATION ABOUT THE EQUIPMENT UNDER TEST

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

INFORMATION ABOUT THE EQUIPMENT UNDER TEST	
Test Software/Firmware:	**Special firm ware which exercise product**
CRT was displaying:	**Control panel, Mouse cursor was moving**
Power Supply Manufacturer:	**N/A**
Power Supply Part Number:	
AC Line Filter Manufacturer:	**N/A**
AC Line Filter Part Number:	
The EUT has no power cord.	

I/O PORTS	
Type	#
RF	

CRYSTAL OSCILLATORS	
Type	Freq. In MHz
Crystal Oscillator	13.5975
Crystal Oscillator	13.5225

PRINTED CIRCUIT BOARDS				
Function	Model & Rev	Clocks, MHz	Layers	Location
	221222-0000 Rev. A	13.5975, 13.5225		

REQUIRED EUT CHANGES TO COMPLY:
None.

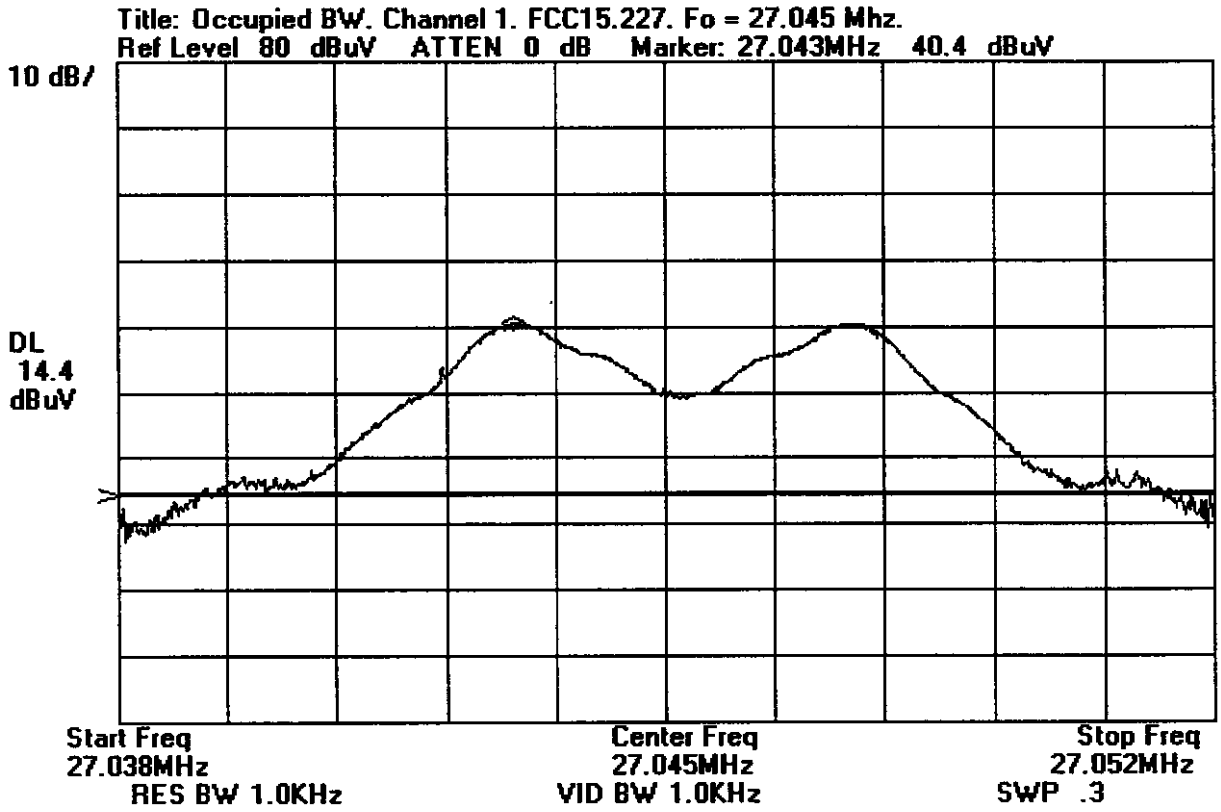
5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

APPENDIX B

MEASUREMENT DATA SHEETS

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

Occupied Bandwidth Plot



5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

Test Location: CKC Laboratories, Inc. • 1653 Las Viboras Rd. (Site C) • Hollister, CA. 95023 • (800) 500-4EMC

Customer:	**Logitech, Inc.**	Date:	Mar-25-99
Specification:	**FCC Part 15.227(a)**	Time:	13:50
Test Type:	**Maximized**	Sequence#:	1
Equipment:	**Wireless mouse**		
Manufacturer:	Logitech, Inc.	Tested By:	Simon Navarro
Model:	Arecibo		
S/N:	12		

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Wireless mouse*	Logitech, Inc.	Arecibo	12

Support Devices:

Function	Manufacturer	Model #	S/N
Host PC	HP	Pavillion 8180	US73553464
Monitor	HP	D5258A	DK73795774
Keyboard	HP	SK-2505	M970848474
Printer	HP	C2655-60015	SG69K111KR
Receiver mouse	Logitech, Inc.	850787-0000	EVT#2-024

Test Conditions / Notes:

EUT continuously transmitting a 27.045 MHz signal defined as channel 1.

Measurement Data: Sorted by Margin Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	dB	Loop dB	dB	dB	Dist dB	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar
1	27.043	40.8		+7.6			+0.0	48.4	80.0	-31.6	None

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

Test Location: CKC Laboratories, Inc. • 1653 Las Viboras Rd. (Site C) • Hollister, CA. 95023 • (800) 500-4EMC

Customer: **Logitech, Inc.**
Specification: **FCC Part 15.227(b)/15.209**
Test Type: **Maximized**
Equipment: **Wireless mouse**
Manufacturer: Logitech, Inc.
Model: Arecibo
S/N: 12

Date: Mar-25-99
Time: 15:54
Sequence#: 2

Tested By: Simon Navarro

Equipment Under Test **(* = EUT):**

Function	Manufacturer	Model #	S/N
Wireless mouse*	Logitech, Inc.	Arecibo	12

Support Devices:

Function	Manufacturer	Model #	S/N
Host PC	HP	Pavillion 8180	US73553464
Monitor	HP	D5258A	DK73795774
Keyboard	HP	SK-2505	M970848474
Printer	HP	C2655-60015	SG69K111KR

Test Conditions / Notes:

EUT continuously transmitting a 27.045 MHz signal.

Measurement Data: Sorted by Margin Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	Cable dB	Amp dB	Bicon dB	Log C dB	Dist dB	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar
1	299.159 Quasi Peak	38.5	+4.4	-26.8	+20.2	+0.0	+0.0	36.3	46.0	-9.7	Horiz
2	299.159	38.3	+4.4	-26.8	+20.2	+0.0	+0.0	36.1	46.0	-9.9	Horiz
3	315.025	44.0	+4.5	-26.9	+0.0	+13.2	+0.0	34.8	46.0	-11.2	Horiz
4	398.885	39.8	+5.0	-27.5	+0.0	+16.7	+0.0	34.0	46.0	-12.0	Horiz
5	299.195	34.6	+4.4	-26.8	+20.2	+0.0	+0.0	32.4	46.0	-13.6	Vert
6	432.135	38.0	+5.2	-27.8	+0.0	+16.8	+0.0	32.2	46.0	-13.8	Horiz
7	432.114	37.8	+5.2	-27.8	+0.0	+16.8	+0.0	32.0	46.0	-14.0	Vert
8	81.128	43.5	+2.0	-27.8	+6.7	+0.0	+0.0	24.4	40.0	-15.6	Horiz
9	315.044	39.5	+4.5	-26.9	+0.0	+13.2	+0.0	30.3	46.0	-15.7	Vert
10	365.655	37.0	+4.7	-27.3	+0.0	+15.4	+0.0	29.8	46.0	-16.2	Horiz

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257

11	54.090	39.2	+1.5	-27.8	+10.7	+0.0	+0.0	23.6	40.0	-16.4	Vert
12	135.225	39.2	+2.7	-27.5	+12.3	+0.0	+0.0	26.7	43.5	-16.8	Vert
13	332.419	37.3	+4.5	-27.1	+0.0	+14.0	+0.0	28.7	46.0	-17.3	Vert
14	54.115	38.0	+1.5	-27.8	+10.7	+0.0	+0.0	22.4	40.0	-17.6	Horiz
15	336.085	36.1	+4.5	-27.1	+0.0	+14.2	+0.0	27.7	46.0	-18.3	Horiz
16	319.030	36.8	+4.5	-27.0	+0.0	+13.4	+0.0	27.7	46.0	-18.3	Horiz
17	189.315	31.5	+3.3	-27.2	+15.8	+0.0	+0.0	23.4	43.5	-20.1	Vert
18	304.315	33.2	+4.4	-26.8	+0.0	+12.7	+0.0	23.5	46.0	-22.5	Horiz
19	243.405	31.0	+3.7	-26.9	+15.3	+0.0	+0.0	23.1	46.0	-22.9	Horiz
20	108.180	34.8	+2.3	-27.6	+11.1	+0.0	+0.0	20.6	43.5	-22.9	Vert
21	270.450	27.8	+4.0	-26.9	+17.3	+0.0	+0.0	22.2	46.0	-23.8	Horiz
22	81.135	35.3	+2.0	-27.8	+6.7	+0.0	+0.0	16.2	40.0	-23.8	Vert
23	162.270	30.5	+3.1	-27.3	+12.5	+0.0	+0.0	18.8	43.5	-24.7	Horiz
24	135.225	30.7	+2.7	-27.5	+12.3	+0.0	+0.0	18.2	43.5	-25.3	Horiz
25	270.450	26.2	+4.0	-26.9	+17.3	+0.0	+0.0	20.6	46.0	-25.4	Vert
26	189.315	25.2	+3.3	-27.2	+15.8	+0.0	+0.0	17.1	43.5	-26.4	Horiz
27	162.270	28.3	+3.1	-27.3	+12.5	+0.0	+0.0	16.6	43.5	-26.9	Vert
28	216.360	25.8	+3.5	-27.1	+16.0	+0.0	+0.0	18.2	46.0	-27.8	Horiz
29	216.360	25.7	+3.5	-27.1	+16.0	+0.0	+0.0	18.1	46.0	-27.9	Vert
30	243.405	25.9	+3.7	-26.9	+15.3	+0.0	+0.0	18.0	46.0	-28.0	Vert
31	108.180	26.2	+2.3	-27.6	+11.1	+0.0	+0.0	12.0	43.5	-31.5	Horiz

5473A CLOUDS REST • MARIPOSA, CALIFORNIA 95338 • (209) 966-5240 • FAX (209) 966-4257