



CERTIFICATION TEST REPORT
FOR THE
CORDLESS MOUSE, M-RK45
FCC PART 15 SUBPART C
COMPLIANCE

DATE OF ISSUE: FEBRUARY 8, 1999


PREPARED FOR:

Logitech Inc.
6505 Kaiser Drive
Fremont, CA 94555

P.O. No: 614126
W.O. No: 70774

Report No: FC99-006

DOCUMENTATION CONTROL:

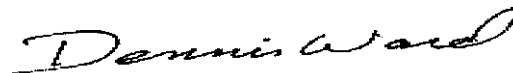

Tracy Phillips
Documentation Control Supervisor
CKC Laboratories, Inc.

PREPARED BY:

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

Date of test: January 28, 1999

APPROVED BY:



Dennis Ward
Director of Laboratories
CKC Laboratories, Inc.

This report contains a total of 20 pages and may be reproduced in full only. Partial reproduction may only be done with the written consent of CKC Laboratories, Inc.

TABLE OF CONTENTS

Administrative Information	3
Summary Of Results	4
Equipment Under Test (EUT) Description	4
Measurement Uncertainty	4
EUT Operating Frequency	4
Peripheral Devices	4
Report Of Measurements	6
Table 1: Six Highest Radiated Emission Levels – Fcc 15.209	6
Table A : List Of Test Equipment	7
EUT Setup	8
Test Instrumentation And Analyzer Settings	9
Table B : Analyzer Bandwidth Settings Per Frequency Range	9
Spectrum Analyzer Detector Functions	10
Peak	10
Quasi-Peak	10
Average	10
Test Methods	11
Radiated Emissions Testing	11
Sample Calculations	12
Appendix A : Information About The Equipment Under Test	13
I/O Ports	14
Crystal Oscillators	14
Printed Circuit Boards	14
Required EUT Changes To Comply	14
Equipment Configuration Block Diagram	15
Photograph Showing Radiated Emissions	16
Photograph Showing Radiated Emissions	17
Appendix B : Measurement Data Sheets	18

CKC Laboratories, Inc. has Certificates of Accreditation from the following agencies:
DATEch (Germany); A2LA (USA); FCC (USA); VCCI (Japan); BCIQ (Taiwan); HOKLAS (Hong Kong).
CKC Laboratories, Inc. has Letters of Acceptance through an MRA for the following agencies:
ACA/NATA (Australia); SABS (South Africa); SWEDAC (Sweden); TUV Rheinland-Germany; TUV Rheinland-Korea; TUV Rheinland-Russia; Radio Communication Agency (RA); NEMKO (Norway).

ADMINISTRATIVE INFORMATION

DATE OF TEST: January 28, 1999

PURPOSE OF TEST: To demonstrate the compliance of the Cordless Mouse, M-RK45, with the requirements for Part 15, Subpart C devices.

MANUFACTURER: Logitech Inc.
6505 Kaiser Drive
Fremont, CA 94555

REPRESENTATIVE: Bharat Shah

TEST LOCATION: CKC Laboratories, Inc.
1653 Los Viboras Road
Hollister, CA 95023

TEST PERSONNEL: Chris Groat

TEST METHOD: ANSI C63.4 1992

FREQUENCY RANGE TESTED: 26 MHz - 1000 MHz

EQUIPMENT UNDER TEST:

Cordless Mouse

Manuf: Logitech
Model: M-RK45
Serial: 099
FCC ID: DZL201215 (pending)

Receiver

Manuf: Logitech
Model: C-RA3
Serial: EVT2-032
FCC ID: N/A

SUMMARY OF RESULTS

The Logitech Inc. Cordless Mouse, M-RK45, was tested in accordance with ANSI C63.4 1992 for compliance with Part 15, Subpart C.

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

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Cordless mouse.

MEASUREMENT UNCERTAINTY

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

EUT OPERATING FREQUENCY

The EUT was operating at 26.59 MHz.

TEMPERATURE AND HUMIDITY DURING TESTING

The temperature during testing was within $+15^{\circ}\text{C}$ and $+35^{\circ}\text{C}$.
The relative humidity was between 20% and 75%.

PERIPHERAL DEVICES

The EUT was tested with the following peripheral devices:

Printer

Manuf: HP
Model: Deskjet 340
Serial: N/A
FCC ID: N/A

Mouse

Manuf: HP
Model: SAD-2505
Serial: 952014-2000
FCC ID: N/A

Monitor

Manuf: HP
Model: D5258A
Serial: DK73795774
FCC ID: N/A

Wingman

Manuf: Logitech
Model: G-YC-PHI
Serial: PHB843
FCC ID: N/A

Keyboard

Manuf: HP
Model: SK-2505
Serial: M970848474
FCC ID: N/A

Host PC

Manuf: HP
Model: 8180
Serial: N/A
FCC ID: N/A

REPORT OF MEASUREMENTS

The following Table reports the six highest worst case levels reported during the test performed on the Cordless Mouse, M-RK45. The data sheet from which this table was compiled is contained in Appendix B.

Table 1: Six Highest Radiated Emission Levels - FCC 15.209

FREQUENCY MHz	METER READING dB μ V	CORRECTION FACTORS				CORRECTED READING dB μ V/m	SPEC LIMIT dB μ V/m	MARGIN dB	NOTES
		Ant dB	Amp dB	Cable DB	Dist dB				
26.592	25.5	7.6	0.0	0.0		33.1	40.0	-6.9	N
53.152	32.3	10.8	-27.8	1.5		16.8	40.0	-23.2	V
186.104	29.7	15.5	-27.2	3.3		21.3	43.5	-22.2	H
212.713	28.7	16.1	-27.1	3.5		21.2	43.5	-22.3	H
265.932	33.4	16.9	-26.9	4.0		27.4	46.0	-18.6	V
292.515	28.7	19.6	-26.8	4.3		25.8	46.0	-20.2	V

Test Method: ANSI C63.4 1992
Spec Limit : 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's are setup for worst case emissions. Test setup is in accordance to ANSI C 63.4. Receiver and Cordless Mouse are placed together at the center of the turntable. The mouse is transmitting to the receiver via RF signal. Note: 26.592, shown above, is the fundamental frequency.

TABLE A
LIST OF TEST EQUIPMENT

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. Display Section, Hewlett Packard, Model No. 85662A, S/N 2542A10641. Calibration date: September 18, 1998. Calibration due date: September 18, 1999.
3. RF Section, Hewlett Packard, Model No. 8567A, S/N 2727A00473. Calibration date: January 29, 1998. Calibration due date: January 29, 1999.
4. Quasi-Peak Adapter, Hewlett Packard, Model No. 85650A, S/N 2811A01065. Calibration date: September 18, 1998. Calibration due date: September 18, 1999.
5. Preamplifier, Hewlett Packard, Model No. 8447D, S/N 2727A06124. Calibration date: January 4, 1999. Calibration due date: January 4, 2000.
6. Biconical Antenna, A & H Systems, Model No. SAS-200/540, S/N 416. Calibration date: October 5, 1998. Calibration due date: October 5, 1999.
7. 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.
8. Magnetic Loop Antenna, EMCO, Model No. 6502, S/N 2078. Calibration date: June 1, 1998. Calibration due date: June 1, 1999.
9. Hollister site C calibration date: April 3, 1998. Calibration due date: April 3, 1999.
10. Test software, EMI Test 2.91.

EUT SETUP

The equipment under test (EUT) and the peripherals listed were setup 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 radiated emissions. Additionally, a description of the EUT is 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.

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 Mouse, M-RK45. Below 30 MHz the magnetic loop antenna was used. 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 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
RADIATED EMISSIONS	26 MHz	1000 MHz	120 kHz

SPECTRUM ANALYZER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in Table 1 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. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data for the Cordless Mouse, M-RK45.

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 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 emissions data of the Cordless Mouse, M-RK45, 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 scan, 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.

SAMPLE CALCULATIONS

The basic spectrum analyzer reading was converted using correction factors as shown in the emissions readings in Tables 1. 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.

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

#	Freq MHz	Rdng DBuV	Cable	Pream	Bicon	Maglp	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 dB μ V.

Pream is short for the preamplifier factor or gain in dB.

Bicon is the biconical antenna factor in dB.

Maglp is the magnetic 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 dB μ V/m is the corrected reading which is now in dB μ V/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.

APPENDIX A
INFORMATION ABOUT THE EQUIPMENT UNDER TEST

INFORMATION ABOUT THE EQUIPMENT UNDER TEST	
Test Software/Firmware: CRT was displaying: Power Supply Manufacturer: Power Supply Part Number: AC Line Filter Manufacturer: AC Line Filter Part Number:	
The AC power cord is removable and is NOT shielded	
Line voltage used during testing: 120V 50Hz	

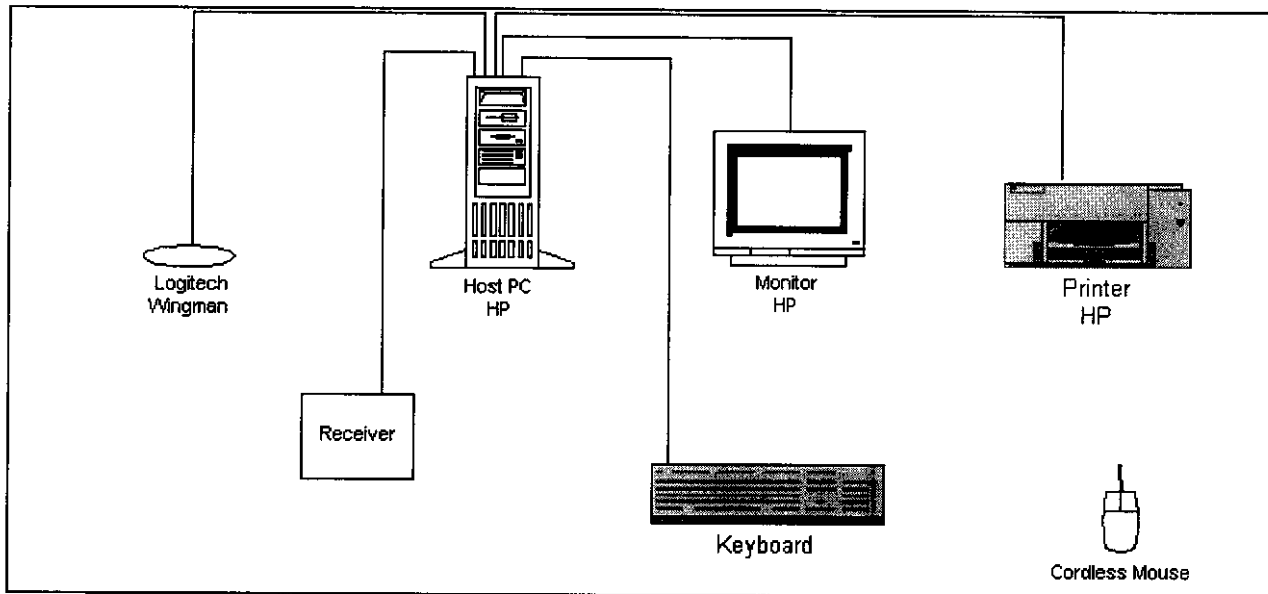
I/O PORTS	
Type	#

CRYSTAL OSCILLATORS	
Type	Freq. In MHz
	2.0
	13.52
	26.59

PRINTED CIRCUIT BOARDS				
Function	Model & Rev	Clocks, MHz	Layers	Location
PWA	201215-0000			

REQUIRED EUT CHANGES TO COMPLY:
None.

EQUIPMENT CONFIGURATION BLOCK DIAGRAM



Block Diagram

NOTES:

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

Customer: Logitech Inc. Date: Jan-28-99
 Specification: FCC 15 C PARA 15.209 Time: 18:32
 Test Type: Maximized Emissions Sequence#: 7
 Equipment: Receiver & Cordless Mouse
 Manufacturer: Logitech, Inc. Tested By: Chris Groat
 Model: C-RA3 & M-RK45
 S/N: EVT2-032 & 099

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Cordless Mouse	Logitech	M-RK45	099
Receiver	Logitech	C-RA3	EVT2-032

Support Devices:

Function	Manufacturer	Model #	S/N
Printer	HP	Deskjet 340	N/A
Mouse	HP	SAD-2505	952014-2000
Monitor	HP	D5258A	DK73795774
Keyboard	HP	SK-2505	M970848474
Wingman	Logitech	G-YC-PHI	PHB843
Host PC	HP	8180	N/A

Test Conditions / Notes:

EUT's are setup for worst case emissions. Test setup is in accordance to ANSI C 63.4. Receiver and Cordless Mouse are placed together at the center of the turntable. The mouse is transmitting to the receiver via RF signal.

Measurement Data:

Sorted by Margin

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	maglp dB	Pream dB	Bicon dB	Cable dB	Dist dB	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar
1	26.592	25.5	+7.6	+0.0	+0.0	+0.0	+0.0	33.1	40.0	-6.9	None
2	265.932	33.4	+0.0	-26.9	+16.9	+4.0	+0.0	27.4	46.0	-18.6	Vert
3	265.935	31.9	+0.0	-26.9	+16.9	+4.0	+0.0	25.9	46.0	-20.1	Horiz
4	292.515	28.7	+0.0	-26.8	+19.6	+4.3	+0.0	25.8	46.0	-20.2	Vert
5	292.492	26.8	+0.0	-26.8	+19.6	+4.3	+0.0	23.9	46.0	-22.1	Horiz
6	186.104	29.7	+0.0	-27.2	+15.5	+3.3	+0.0	21.3	43.5	-22.2	Horiz
7	212.713	28.7	+0.0	-27.1	+16.1	+3.5	+0.0	21.2	43.5	-22.3	Horiz
8	186.152	29.6	+0.0	-27.2	+15.5	+3.3	+0.0	21.2	43.5	-22.3	Vert

9	212.725	28.5	+0.0	-27.1	+16.1	+3.5	+0.0	21.0	43.5	-22.5	Vert
10	53.152	32.3	+0.0	-27.8	+10.8	+1.5	+0.0	16.8	40.0	-23.2	Vert
11	132.989	32.1	+0.0	-27.5	+12.4	+2.7	+0.0	19.7	43.5	-23.8	Vert
12	159.514	31.5	+0.0	-27.3	+12.1	+3.0	+0.0	19.3	43.5	-24.2	Horiz
13	53.194	29.6	+0.0	-27.8	+10.8	+1.5	+0.0	14.1	40.0	-25.9	Horiz
14	159.534	29.5	+0.0	-27.3	+12.1	+3.0	+0.0	17.3	43.5	-26.2	Vert
15	239.296	27.4	+0.0	-26.9	+15.4	+3.7	+0.0	19.6	46.0	-26.4	Horiz
16	79.764	31.7	+0.0	-27.8	+6.6	+2.0	+0.0	12.5	40.0	-27.5	Horiz
17	106.365	30.5	+0.0	-27.6	+10.8	+2.3	+0.0	16.0	43.5	-27.5	Vert
18	79.770	31.5	+0.0	-27.8	+6.6	+2.0	+0.0	12.3	40.0	-27.7	Vert
Quasi Peak											
^	79.742	34.1	+0.0	-27.8	+6.6	+2.0	+0.0	14.9	40.0	-25.1	Vert
20	132.969	28.2	+0.0	-27.5	+12.4	+2.7	+0.0	15.8	43.5	-27.7	Horiz
21	239.313	25.9	+0.0	-26.9	+15.4	+3.7	+0.0	18.1	46.0	-27.9	Vert
22	106.367	29.4	+0.0	-27.6	+10.8	+2.3	+0.0	14.9	43.5	-28.6	Horiz