



CERTIFICATION TEST REPORT
FOR THE
TRACKBALL, RF, COMPUTER PERIPHERALS, T-RA18
FCC PART 15.227
COMPLIANCE

DATE OF ISSUE: MARCH 8, 2000

PREPARED FOR:

Logitech Inc.
6505 Kaiser Drive
Fremont, CA 94555

W.O. No: 73596

Report No: FC00-020

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: February 8 & 25, 2000

APPROVED BY:

Dennis Ward
Director of Laboratories
CKC Laboratories, Inc.

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ADMINISTRATIVE INFORMATION

DATE OF TEST: February 8 & 25, 2000

PURPOSE OF TEST: To demonstrate the compliance of the Trackball, RF, Computer Peripherals, T-RA18, with the requirements for FCC Part 15.227 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: Art Rice & Stephen Goulet

TEST METHOD: ANSI C63.4 1992

FREQUENCY RANGE TESTED: 9 kHz - 1000 MHz

EQUIPMENT UNDER TEST: **Trackball, RF, Computer Peripheral**
Manuf: Logitech Inc.
Model: T-RA18
Serial: PQP1-319
FCC ID: DZL201382 (pending)

SUMMARY OF RESULTS

The Logitech Inc. Trackball, RF, Computer Peripherals, T-RA18, was tested in accordance with ANSI C63.4 1992 for compliance with FCC 15.227.

As received, the above equipment was found to be fully compliant with the limits of FCC 15.227. The results in this report apply only to the items tested, as identified herein.

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Mouse.

MEASUREMENT UNCERTAINTY

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

PERIPHERAL DEVICES

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

Keyboard

Manuf: Dell
Model: SK-1000REW
Serial: 12710-95R-4157
FCC ID: GYUR43Sk

Modem

Manuf: Best Data
Model: 56SIPX
Serial: 56SPX72729
FCC ID: DoC

Host PC

Manuf: Dell
Model: Dimension XPS T450
Serial: 1H43F
FCC ID: DoC

Mouse

Manuf: Logitech
Model: DVT-090398
Serial: Sample
FCC ID: DoC

RF Receiver

Manuf: Logitech Inc.
Model: C-RD3-DUAL
Serial: DVT208
FCC ID: DoC

Monitor

Manuf: NEC
Model: JC-1745UMA-1
Serial: 7221430LA
FCC ID: DoC

Printer

Manuf: HP
Model: C2655-60015
Serial: SG69K111KR
FCC ID: DoC

REPORT OF MEASUREMENTS

The following tables report the highest worst case levels recorded during the tests performed on the Trackball, RF, Computer Peripherals, T-RA18. 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 Levels									
FREQUENCY MHz	METER READING dBμV	CORRECTION FACTORS				CORRECTED READING dBμV/m	SPEC LIMIT dBμV/m	MARGIN dB	NOTES
		Mag dB	PWM dB	Cable dB	Dist dB				
27.057	51.1	6.6	-6.7			51.0	80.0	-29.0	Y
27.057	54.2	6.6	-6.7			54.1	80.0	-25.9	Y
27.057	54.0	6.6	-6.7			53.9	80.0	-26.1	Z
27.057	41.1	6.6	-6.7			41.0	80.0	-39.0	X
27.057	50.1	6.6	-6.7			50.0	80.0	-30.0	Z
27.058	36.3	6.6	-6.7			36.2	80.0	-43.8	X

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.227
Test Distance: 3 Meters

NOTES: X,Y,Z – see comments below

COMMENTS: EUT and ancillary equipment tested in accordance with ANSI C63.4 1992 test methods. The T-RA18 operates in the 26.96 - 27.28 MHz band per FCC Part 15.227. The T-RA18 Cordless Mouse will continuously emit the RF signal to the computer via the RF Receiver. The T-RA18 firmware has been configured to continuously transmit. The RF receiver is connected to the host PC's PS/2 port. PC monitor is displaying the moving cursor produced by exercising the EUT. A USB mouse is used to initiate the Windows 98 operating system on the host PC. The modem, monitor and printer are connected to the host PC. Measuring the fundamental of the 27.045 MHz transmitter in three axes. **X = mouse is flat on table in normal operating position. Y = mouse is rotated 90° to the right side. Z = mouse is rotated 90° to the front. The Y position was determined to be worst case.** All readings were pulse width modulation (PWM) averaged readings. Determining pulse width and duty cycle per FCC 15.35(c) requirements. Observed that there appear to be 4 different pulse widths (0.5, 0.7, 1.0, & 1.5 mS). In a 100 mS time period, 70 pulses of 0.5 mS, 11 pulses of 0.7 mS, 2 pulses of 1 mS, & 1 pulse of 1.5 Ms were counted. The total time for all the pulses was 46.2 mS. That calculated to a 46.2 % duty cycle for a 100 mS reference time period. That resulted in a -6.71 dB correction for a PWM averaged reading. Set up to measure fundamental frequency transmit level in three orthogonal planes. Used the active loop antenna. Worst level was -29.0 dB average in the Y position.

Table 2: Highest Radiated Emission Levels - 9kHz-30MHz

FREQUENCY MHz	METER READING dBµV	CORRECTION FACTORS				CORRECTED READING dBµV/m	SPEC LIMIT dBµV/m	MARGIN dB	NOTES
		Mag dB	Amp dB	Cable dB	Dist dB				
0.158	62.5	9.6				72.1	103.6	-31.5	N
0.212	56.8	9.7				66.5	101.1	-34.6	N
13.534	28.7	8.8				37.5	70.0	-32.5	N
No other readings were found.									

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 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 and ancillary equipment tested in accordance with ANSI C63.4 1992 test methods. The T-RA18 operates in the 26.96 - 27.28 MHz band per FCC Part 15.227. The T-RA18 Cordless Mouse will continuously emit the RF signal to the computer via the RF Receiver. The T-RA18 firmware has been configured to continuously transmit. The RF receiver is connected to the host PC's PS/2 port. PC monitor is displaying the moving cursor produced by exercising the EUT. A USB mouse is used to initiate the Windows 98 operating system on the host PC. The modem, monitor and printer are connected to the host PC. Measuring spurious emissions in the .009 to 30 MHz range. Video Monitor was shut off during this test. Maximized any signal that was found to be within 10 dB of the limit. Some signals found may be from support equipment.

Table 3: Six Highest Radiated Emission Levels - 30MHz-1000MHz

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				
38.123	47.2	11.5	-27.5	1.2		32.4	40.0	-7.6	H
66.052	49.7	8.6	-27.5	1.7		32.5	40.0	-7.5	H
338.725	46.3	15.7	-26.7	4.2		39.5	46.0	-6.5	H
395.214	45.2	18.0	-27.2	4.5		40.5	46.0	-5.5	HQ
733.903	36.6	22.3	-27.5	6.9		38.3	46.0	-7.7	H
764.149	36.0	23.4	-27.5	7.5		39.4	46.0	-6.6	V

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 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 and ancillary equipment tested in accordance with ANSI C63.4 1992 test methods. The T-RA18 operates in the 26.96 - 27.28 MHz band per FCC Part 15.227. The T-RA18 Cordless Mouse will continuously emit the RF signal to the computer via the RF Receiver. The T-RA18 firmware has been configured to continuously transmit. The RF receiver is connected to the host PC's PS/2 port. PC monitor is displaying the moving cursor produced by exercising the EUT. A USB mouse is used to initiate the Windows 98 operating system on the host PC. The modem, monitor and printer are connected to the host PC. Measuring the harmonics of the 27.045 MHz transmitter and any spurious signals in the 30-1000 MHz range per FCC 15.209/2.1053. Maximized any signal found that was within 10 dB of the limit. Some signals listed may be from the host PC or peripherals.

TABLE A
LIST OF TEST EQUIPMENT
Hollister C

Function	S/N	Calibration Date	Cal Due Date	Asset #
HP 85650A QPA	3033A01467	09/17/1999	09/17/2000	641
HP 85680B SA	2140A01743	05/10/1999	05/10/2000	384
HP 85662 Display	2134A02864	05/10/1999	05/10/2000	387
Loop Ant, Emco 6502	2078	06/17/1999	06/17/2000	432
Log Periodic, A.H. SAS-200/512	CKC-HC	06/28/1999	06/28/2000	510
Bicon, A.H. SAS-200/540	416	10/29/1999	10/29/2000	509
Cable, Rad., Site C	radcable00hc	01/12/2000	01/12/2001	0
HP 8447D Preamp	2727A06124	01/06/2000	01/06/2001	480

Test software, EMI Test 3.09.

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 Tables 1-3 for radiated emissions. Additionally, a complete description of all EUT configurations 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.

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed in Table A were used to collect the radiated emissions data for the Trackball, RF, Computer Peripherals, T-RA18. For radiated measurements below 30 MHz the magnetic loop antenna was used. For radiated measurements between 30 to 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	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 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 1-3 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 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 Trackball, RF, Computer Peripherals, T-RA18.

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 less than 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.

TEST METHODS

The radiated emissions data of the Trackball, RF, Computer Peripherals, T-RA18, 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 15.227 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. Frequencies below 30 MHz were scanned using the magnetic loop 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 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, the equipment was again positioned 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 and antenna height. Photographs showing the final worst case configuration of the EUT are contained in Appendix A.

FCC Part 15.215- 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.

Frequency Range of Transmitter: 27 MHz

In accordance with Part 15.247(a), the field strength of the emissions within the 26.96-27.28 MHz band did not exceed 10,000 microvolts/meter at 3 meters. The emission limit in this paragraph is based on the measurement instrumentation employing an average detector. The provisions in 15.35 for limiting peak emissions apply.

SAMPLE CALCULATIONS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in Tables 1-3. 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 dB μ V	Cable	Amp	Bicon	Log	Dist	Corr dB μ V/m	Spec	Margin	Polar
	Mag	PWM									

means reading number

Freq MHz is the frequency in MHz of the obtained reading.

Rdng dB μ V is the reading obtained on the spectrum analyzer in dB μ V.

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

Bicon is the biconical antenna factor in dB.

Log is the log periodic 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.

Mag is the magnetic loop antenna factor in dB.

PWM is the pulse width modulation factor in dB as called in 15.35 (c).

APPENDIX A

INFORMATION ABOUT THE EQUIPMENT UNDER TEST

INFORMATION ABOUT THE EQUIPMENT UNDER TEST	
Test Software/Firmware:	Special soft ware makes cursor to go around
CRT was displaying:	Showing cursor
Power Supply Manufacturer:	N/A
Power Supply Part Number:	N/A
AC Line Filter Manufacturer:	N/A
AC Line Filter Part Number:	N/A

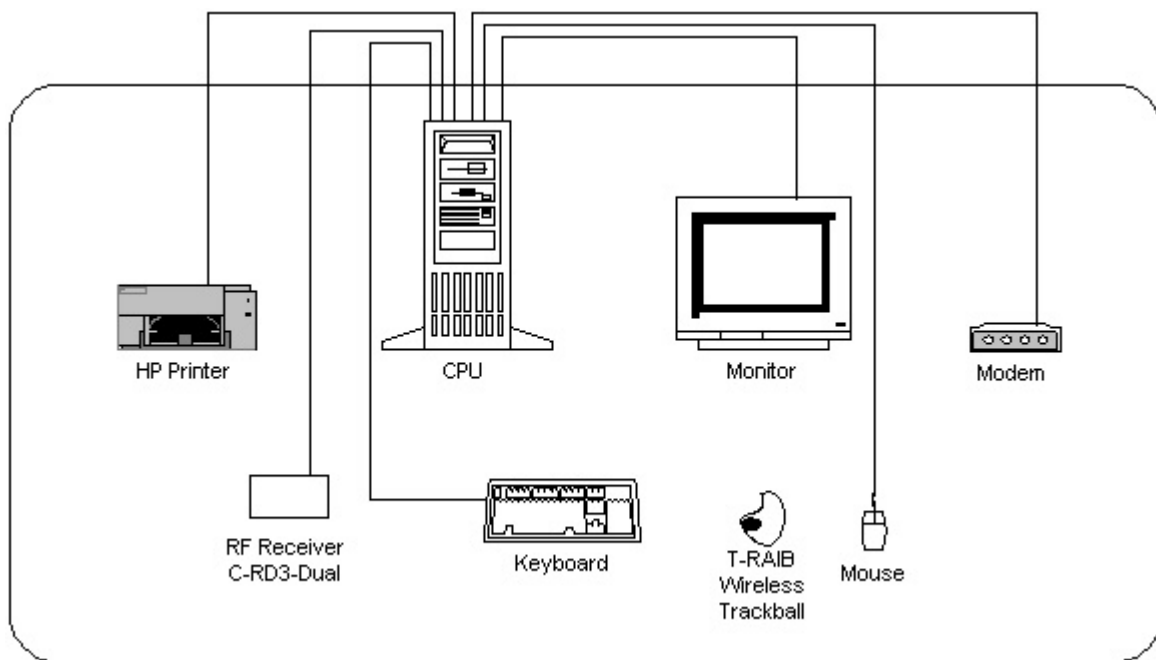
I/O PORTS	
Type	#

CRYSTAL OSCILLATORS	
Type	Freq In MHz
Ceramic	6 Mhz

PRINTED CIRCUIT BOARDS				
Function	Model & Rev	Clocks, MHz	Layers	Location
Not provided by customer at this time.				

REQUIRED EUT CHANGES TO COMPLY:
None.

EQUIPMENT CONFIGURATION BLOCK DIAGRAM



PHOTOGRAPH SHOWING RADIATED EMISSIONS



Radiated Emissions - Front View

PHOTOGRAPH SHOWING RADIATED EMISSIONS



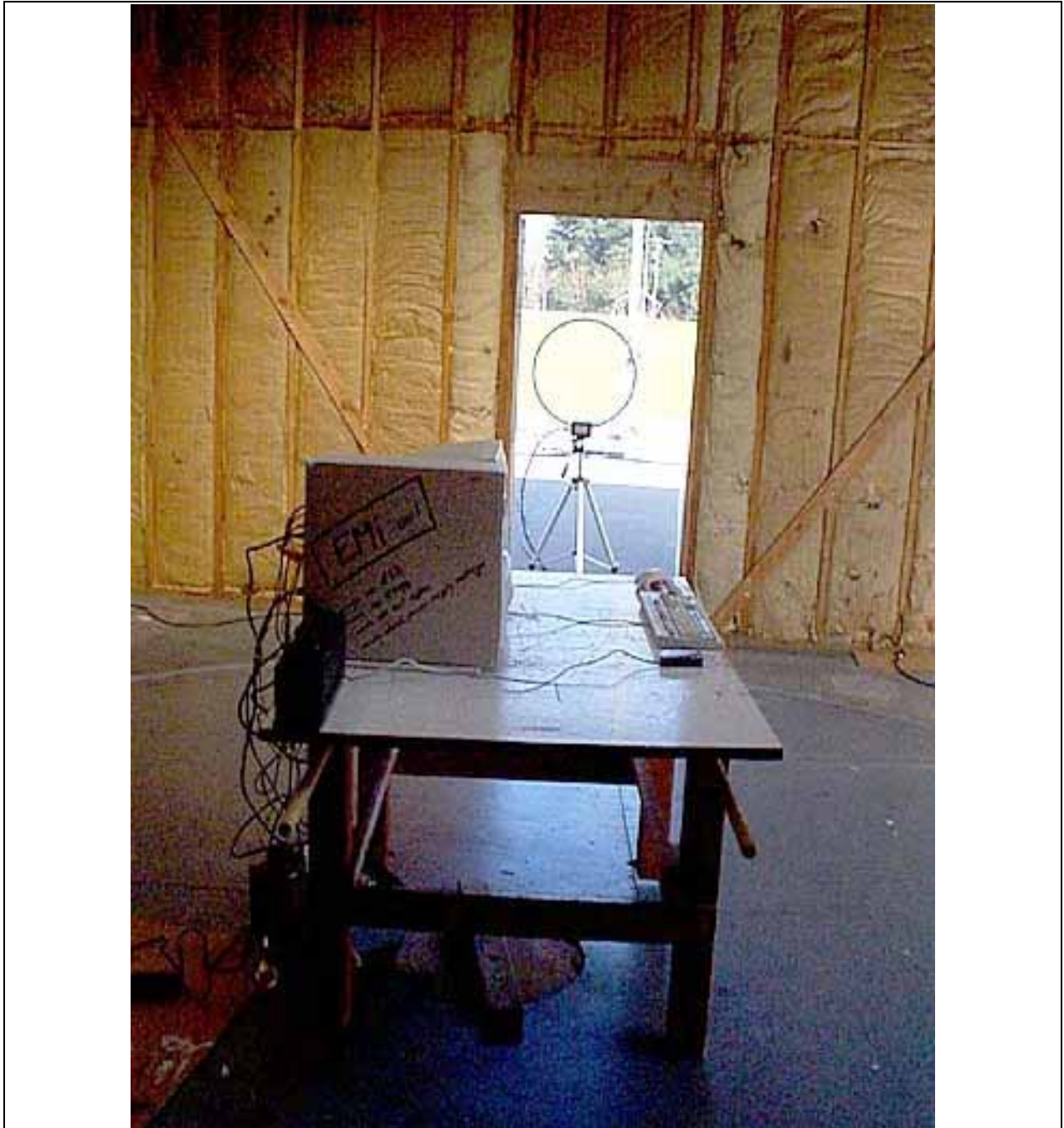
Radiated Emissions - Front View

PHOTOGRAPH SHOWING RADIATED EMISSIONS



Radiated Emissions - Back View

PHOTOGRAPH SHOWING RADIATED EMISSIONS

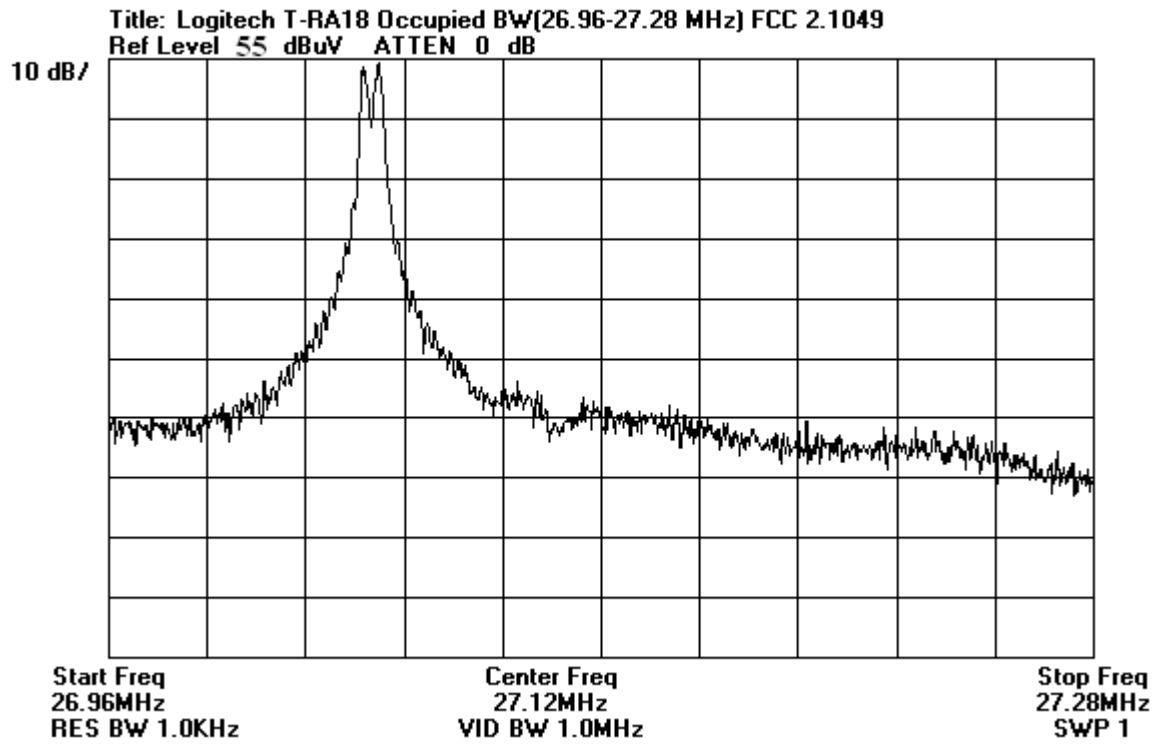


Radiated Emissions - Side View

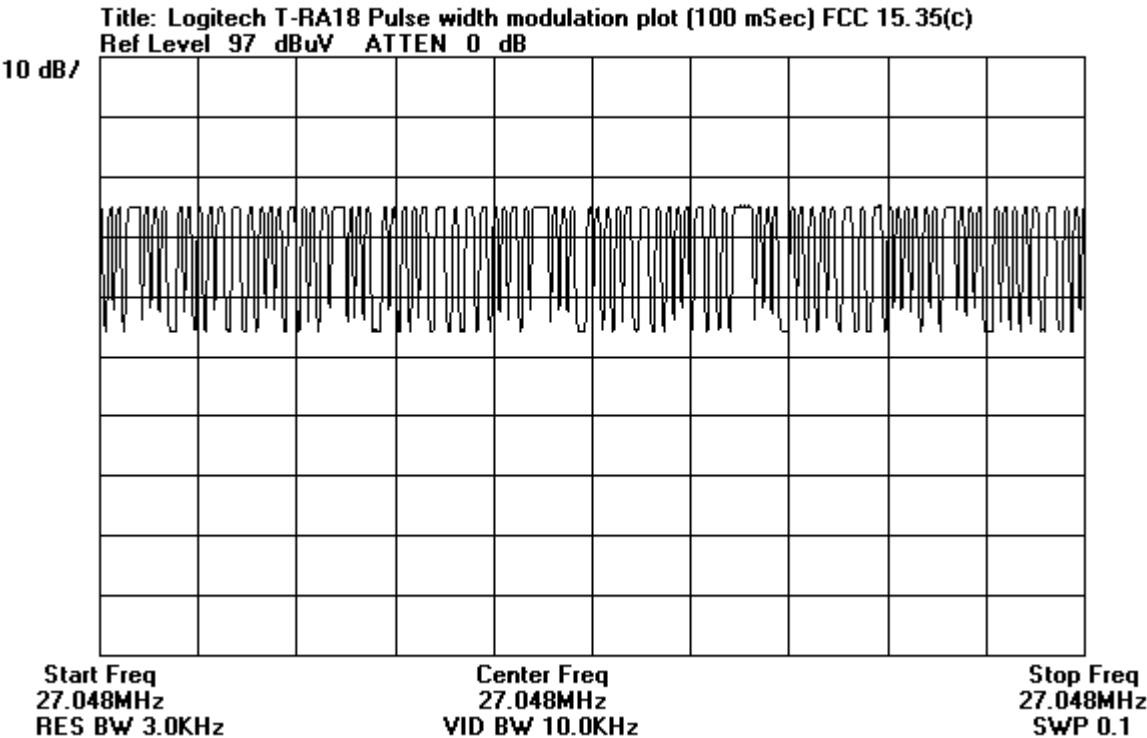
APPENDIX B

MEASUREMENT DATA SHEETS

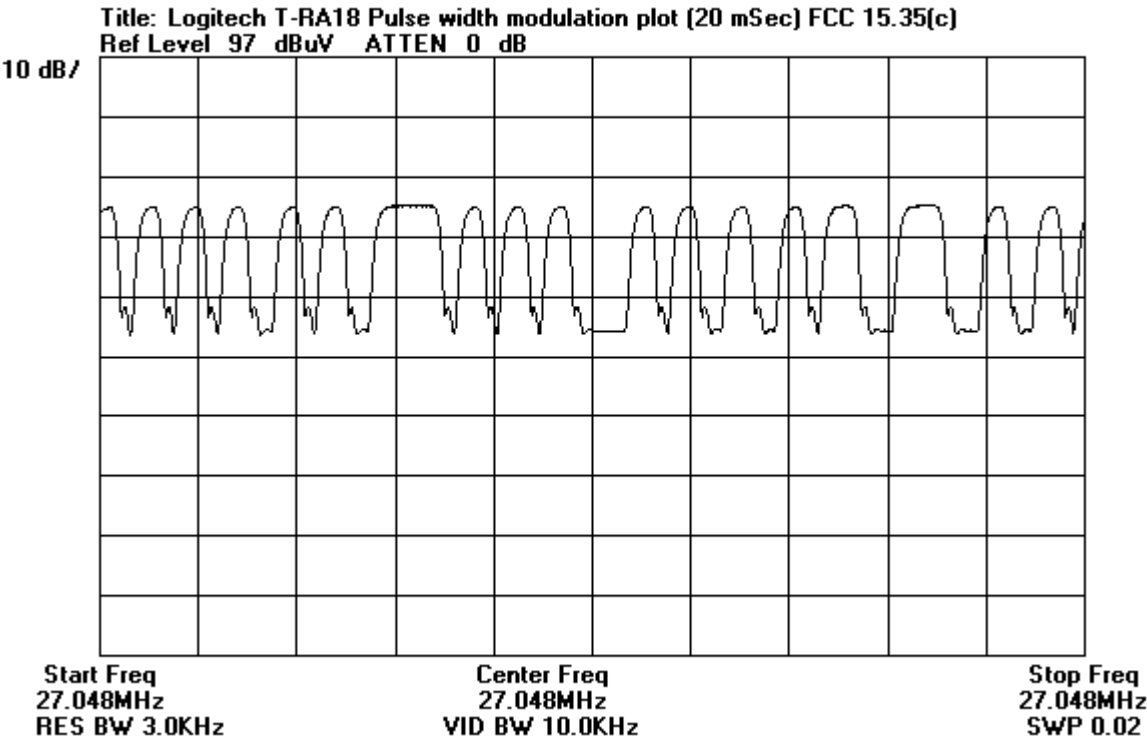
Occupied Bandwidth Plot Part 2.1049



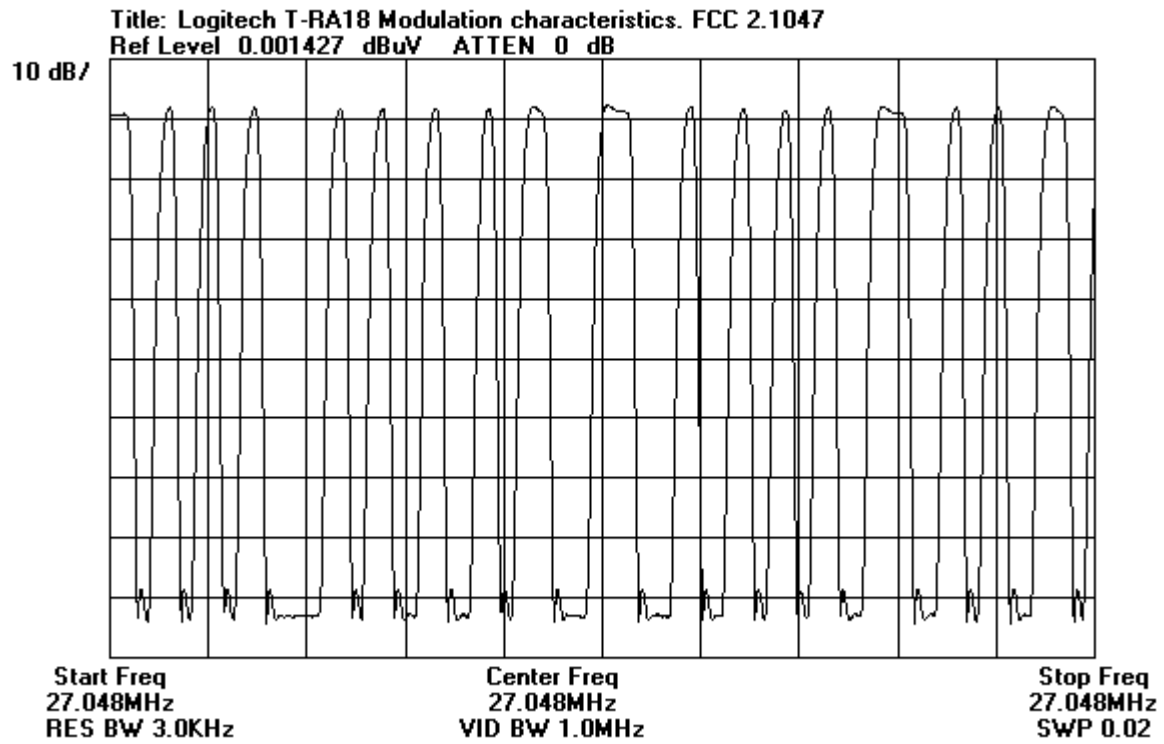
Detector Functions and Bandwidth Part 15.35 (c)



Detector Functions and Bandwidth Part 15.35 (c)



Modulation Characteristics Part 2.1047



Test Location: CKC Laboratories, Inc. • 1653 Los Viboras Road ,Site C • Hollister, CA 95023 • (831) 637-1051
 Customer: **Logitech, Inc.**
 Specification: **FCC15.227 (26.96-27.28 MHz)**
 Work Order #: **73596** Date: 02/25/2000
 Test Type: **Maximized Emissions** Time: 16:49:57
 Equipment: **Cordless Track Ball** Sequence#: 3
 Manufacturer: Logitech Tested By: Art Rice
 Model: T-RA18
 S/N: PQP1-319

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Cordless Track Ball*	Logitech	T-RA18	PQP1-319

Support Devices:

Function	Manufacturer	Model #	S/N
Keyboard	Dell	SK-1000REW	12710-95R-4157
RF Receiver	Logitech	C-RD3-DUAL	DVT208
Modem	Best Data	56SIPX	56SPX72729
Monitor	NEC	JC-1745UMA-1	7221430LA
Host PC	Dell	Dimension XPS T450	1H43F
Printer	HP	C2655-60015	SG69K111KR
Mouse	Logitech	DVT-090398	Sample

Test Conditions / Notes:

EUT and ancillary equipment tested in accordance with ANSI C63.4 1992 test methods. The T-RA18 operates in the 26.96 to 27.28 MHz band per FCC Part 15.227. The T-RA18 Cordless Mouse will continuously emit the RF signal to the computer via the RF Receiver. The T-RA18 firmware has been configured to continuously transmit. The RF receiver is connected to the host PC's PS/2 port. PC monitor is displaying the moving cursor produced by exercising the EUT. A USB mouse is used to initiate the Windows 98 operating system on the host PC. The modem, monitor and printer are connected to the host PC. Measuring the fundamental of the 27.045 MHz transmitter in three axes. X= mouse is flat on table in normal operating position. Y= mouse is rotated 90 degrees to the right side. Z= mouse is rotated 90 degrees to the front. The Y position was determined to be worst case. All readings were pulse width modulation averaged readings. Determining pulse width and duty cycle per FCC 15.35(c) requirements. Observed that there appear to be 4 different pulse widths (0.5, 0.7, 1.0, & 1.5 mS). In a 100 mS time period, I counted 70 pulses of 0.5 mS, 11 pulses of 0.7 mS, 2 pulses of 1 mS, & 1 pulse of 1.5 mS. The total time for all the pulses was 46.2 mS. That calculated to a 46.2 % duty cycle for a 100 mS reference time period. That resulted in a -6.71 dB correction for a "Pulse width modulation averaged reading". Set up to measure fundamental frequency transmit level in three orthogonal planes. Used the active loop antenna. Worst level was -29.0 dB average in the Y position.

Measurement Data:			Reading listed by margin.				Test Distance: 3 Meters				
#	Freq MHz	Rdng dBµV	Mag dB	PWM dB			Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	27.057M	51.1	+6.6	-6.7			+0.0	51.0	80.0	-29.0	None
	Ave								T-RA18 is in the Y position.		
^	27.057M	54.2	+6.6	-6.7			+0.0	54.1	80.0	-25.9	None
									T-RA18 is in the Y position. Peak reading.		

^	27.057M	54.0	+6.6	-6.7	+0.0	53.9	80.0	-26.1	None
							T-RA18 is in the Z position. Peak reading.		
^	27.057M	41.1	+6.6	-6.7	+0.0	41.0	80.0	-39.0	None
							T-RA18 is in the X position. Peak reading.		
5	27.057M	50.1	+6.6	-6.7	+0.0	50.0	80.0	-30.0	None
	Ave						T-RA18 is in the Z position.		
6	27.058M	36.3	+6.6	-6.7	+0.0	36.2	80.0	-43.8	None
	Ave						T-RA18 is in the X position.		

Test Location: CKC Laboratories, Inc. • 1653 Los Viboras Road ,Site C • Hollister, CA 95023 • (831) 637-1051
 Customer: **Logitech, Inc.**
 Specification: **FCC15.209**
 Work Order #: **73596** Date: 02/25/2000
 Test Type: **Maximized Emissions** Time: 17:34:59
 Equipment: **Cordless Track Ball** Sequence#: 4
 Manufacturer: Logitech Tested By: Art Rice
 Model: T-RA18
 S/N: PQP1-319

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Cordless Track Ball*	Logitech	T-RA18	PQP1-319

Support Devices:

Function	Manufacturer	Model #	S/N
Keyboard	Dell	SK-1000REW	12710-95R-4157
RF Receiver	Logitech	C-RD3-DUAL	DVT208
Modem	Best Data	56SIPX	56SPX72729
Monitor	NEC	JC-1745UMA-1	7221430LA
Host PC	Dell	Dimension XPS T450	1H43F
Printer	HP	C2655-60015	SG69K111KR
Mouse	Logitech	DVT-090398	Sample

Test Conditions / Notes:

EUT and ancillary equipment tested in accordance with ANSI C63.4 1992 test methods. The T-RA18 operates in the 26.96 to 27.28 MHz band per FCC Part 15.227. The T-RA18 Cordless Mouse will continuously emit the RF signal to the computer via the RF Receiver. The T-RA18 firmware has been configured to continuously transmit. The RF receiver is connected to the host PC's PS/2 port. PC monitor is displaying the moving cursor produced by exercising the EUT. A USB mouse is used to initiate the Windows 98 operating system on the host PC. The modem, monitor and printer are connected to the host PC. Measuring spurious emissions in the .009 to 30 MHz range. Video Monitor was shut off during this test. Maximized any signal that was found to be within 10 dB of the limit. Some signals found may be from support equipment.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dB μ V	Mag				Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
			dB	dB	dB	dB					
1	4.229M	34.6	+9.8				+0.0	44.4	70.0	-25.6	None
									Ambient level.		
2	158.370k	62.5	+9.6				+0.0	72.1	103.6	-31.5	None
									Maximized.		
3	13.534M	28.7	+8.8				+0.0	37.5	70.0	-32.5	None
									Maximized.		
4	212.190k	56.8	+9.7				+0.0	66.5	101.1	-34.6	None
									Maximized.		
5	416.800k	48.3	+10.0				+0.0	58.3	95.2	-36.9	None
									Ambient level.		
6	25.050k	46.6	+12.4				+0.0	59.0	119.6	-60.6	None
									Ambient level.		
7	80.850k	34.8	+11.1				+0.0	45.9	109.4	-63.5	None
									Ambient level.		

Test Location: KCK Laboratories, Inc. • 1653 Los Viboras Road ,Site C • Hollister, CA 95023 • (831) 637-1051

Customer: **Logitech, Inc.**

Specification: **FCC15.209**

Work Order #: **73596**

Date: 02/25/2000

Test Type: **Maximized Emissions**

Time: 14:11:54

Equipment: **Cordless Track Ball**

Sequence#: 2

Manufacturer: Logitech

Tested By: Art Rice

Model: T-RA18

S/N: PQP1-319

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Cordless Track Ball*	Logitech	T-RA18	PQP1-319

Support Devices:

Function	Manufacturer	Model #	S/N
Keyboard	Dell	SK-1000REW	12710-95R-4157
RF Receiver	Logitech	C-RD3-DUAL	DVT208
Modem	Best Data	56SIPX	56SPX72729
Monitor	NEC	JC-1745UMA-1	7221430LA
Host PC	Dell	Dimension XPS T450	1H43F
Printer	HP	C2655-60015	SG69K111KR
Mouse	Logitech	DVT-090398	Sample

Test Conditions / Notes:

EUT and ancillary equipment tested in accordance with ANSI C63.4 1992 test methods. The T-RA18 operates in the 26.96 to 27.28 MHz band per FCC Part 15.227. The T-RA18 Cordless Mouse will continuously emit the RF signal to the computer via the RF Receiver. The T-RA18 firmware has been configured to continuously transmit. The RF receiver is connected to the host PC's PS/2 port. PC monitor is displaying the moving cursor produced by exercising the EUT. A USB mouse is used to initiate the Windows 98 operating system on the host PC. The modem, monitor and printer are connected to the host PC. Measuring the harmonics of the 27.045 MHz transmitter and any spurious signals in the 30-1000 MHz range per FCC 15.209/2.1053. Maximized any signal found that was within 10 dB of the limit. Some signals listed may be from the host PC or peripherals.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	Amp dB	Bicon dB	Log dB	Cable dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	395.214M	45.2	-27.2	+0.0	+18.0	+4.5	+0.0	40.5	46.0	-5.5	Horiz
QP											
^	395.174M	45.7	-27.2	+0.0	+18.0	+4.5	+0.0	41.0	46.0	-5.0	Horiz
3	338.725M	46.3	-26.7	+0.0	+15.7	+4.2	+0.0	39.5	46.0	-6.5	Horiz
4	764.149M	36.0	-27.5	+0.0	+23.4	+7.5	+0.0	39.4	46.0	-6.6	Vert
5	66.052M	49.7	-27.5	+8.6	+0.0	+1.7	+0.0	32.5	40.0	-7.5	Horiz
6	38.123M	47.2	-27.5	+11.5	+0.0	+1.2	+0.0	32.4	40.0	-7.6	Horiz

7	733.903M	36.6	-27.5	+0.0	+22.3	+6.9	+0.0	38.3	46.0	-7.7	Horiz
8	37.854M	46.1	-27.5	+11.5	+0.0	+1.2	+0.0	31.3	40.0	-8.7	Horiz
9	846.761M	31.1	-26.8	+0.0	+23.5	+8.2	+0.0	36.0	46.0	-10.0	Vert
10	189.311M	37.3	-26.8	+13.2	+0.0	+3.1	+0.0	26.8	43.5 7th harmonic	-16.7	Horiz
11	162.266M	38.1	-26.9	+12.1	+0.0	+2.9	+0.0	26.2	43.5 6th harmonic	-17.3	Horiz
12	135.225M	39.7	-27.2	+11.1	+0.0	+2.4	+0.0	26.0	43.5 5th harmonic	-17.5	Horiz
13	243.407M	36.6	-26.5	+14.6	+0.0	+3.3	+0.0	28.0	46.0 9th harmonic	-18.0	Horiz
14	54.090M	38.7	-27.5	+9.0	+0.0	+1.5	+0.0	21.7	40.0 2nd harmonic	-18.3	Vert
15	54.095M	38.2	-27.5	+9.0	+0.0	+1.5	+0.0	21.2	40.0 2nd harmonic	-18.8	Horiz
16	81.137M	37.0	-27.4	+8.2	+0.0	+1.8	+0.0	19.6	40.0 3rd harmonic	-20.4	Horiz
17	243.407M	34.2	-26.5	+14.6	+0.0	+3.3	+0.0	25.6	46.0 9th harmonic	-20.4	Vert
18	216.356M	33.8	-26.7	+14.0	+0.0	+3.2	+0.0	24.3	46.0 8th harmonic	-21.7	Horiz
19	135.223M	34.6	-27.2	+11.1	+0.0	+2.4	+0.0	20.9	43.5 5th harmonic	-22.6	Vert
20	108.182M	35.9	-27.3	+9.4	+0.0	+2.2	+0.0	20.2	43.5 4th harmonic	-23.3	Horiz
21	81.135M	33.9	-27.4	+8.2	+0.0	+1.8	+0.0	16.5	40.0 3rd harmonic	-23.5	Vert
22	162.269M	31.4	-26.9	+12.1	+0.0	+2.9	+0.0	19.5	43.5 6th harmonic	-24.0	Vert
23	216.359M	30.8	-26.7	+14.0	+0.0	+3.2	+0.0	21.3	46.0 8th harmonic	-24.7	Vert
24	270.451M	27.2	-26.5	+15.8	+0.0	+3.6	+0.0	20.1	46.0 10th harmonic	-25.9	Horiz
25	189.314M	28.1	-26.8	+13.2	+0.0	+3.1	+0.0	17.6	43.5 7th harmonic	-25.9	Vert
26	270.449M	25.1	-26.5	+15.8	+0.0	+3.6	+0.0	18.0	46.0 10th harmonic	-28.0	Vert
27	108.180M	30.1	-27.3	+9.4	+0.0	+2.2	+0.0	14.4	43.5 4th harmonic	-29.1	Vert