



**CERTIFICATION TEST REPORT**  
**FOR THE**  
**4043A AMH100 HANDHELD READER**  
**FCC PART 15 SUBPART C**  
**COMPLIANCE**

**DATE OF ISSUE: DECEMBER 7, 1998**

**PREPARED FOR:**

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9292 Jeronimo Road  
Irvine, CA 92618-1905

W.O. No: 70452

Report No: **FC98-027**

**DOCUMENTATION CONTROL:**

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Date of test: December 3, 1998

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## 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.....	5
Table 1: Highest Fundamental Radiated Emission Level.....	5
Table 2: Six Highest Radiated Emission Levels.....	6
Table A : List Of Test Equipment.....	7
EUT Setup.....	8
Test Instrumentation And Analyzer Settings.....	8
Table B : Analyzer Bandwidth Settings Per Frequency Range.....	8
Spectrum Analyzer Detector Functions.....	9
Peak.....	9
Quasi-Peak.....	9
Average.....	9
Test Methods.....	10
Radiated Emissions Testing.....	10
Power Output Measurement.....	10
Sample Calculations.....	11
Appendix A : Information About The Equipment Under Test.....	12
I/O Ports.....	13
Crystal Oscillators.....	13
Printed Circuit Boards.....	13
Required EUT Changes To Comply.....	14
Photograph Showing Radiated Emissions.....	15
Appendix B : Measurement Data Sheets.....	16

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## ADMINISTRATIVE INFORMATION

**DATE OF TEST:** December 3, 1998

**PURPOSE OF TEST:** To demonstrate the compliance of the 4043A AMH100 Handheld Reader, with the requirements for FCC 15, Subpart C devices.

**MANUFACTURER:** HID Corporation  
9292 Jeronimo Road  
Irvine, CA 92618-1905

**REPRESENTATIVE:** Frank de Vall

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

**TEST PERSONNEL:** Dustin Oaks

**TEST METHOD:** ANSI C63.4 1992

**FREQUENCY RANGE TESTED:** 9 kHz - 1000 MHz

**EQUIPMENT UNDER TEST:**

### Handheld Reader

Manuf: HID  
Model: N/A  
Serial: N/A  
FCC ID: JQ64043 (pending)

### Handheld Computer

Manuf: Symbol  
Model: PDT6100  
Serial: ALPH2388  
FCC ID: JQ64043 (pending)

## **SUMMARY OF RESULTS**

The HID Corporation 4043A AMH100 Handheld Reader was tested in accordance with ANSI C63.4 1992 for compliance with FCC 15, Subpart C of the FCC Rules.

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

### **EQUIPMENT UNDER TEST (EUT) DESCRIPTION**

Hand held reader capable of reading from and writing to the Atmel AT24RF08 tag when used in conjunction with a host computer.

### **MEASUREMENT UNCERTAINTY**

Associated with data in this report is a  $\pm 4$ dB measurement uncertainty.

### **EUT OPERATING FREQUENCY**

The EUT was operating at 0.125MHz.

### **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 not tested with any peripheral devices.

## REPORT OF MEASUREMENTS

The following Tables 1 and 2, report the highest emissions levels recorded during the tests performed on the 4043A AMH100 Handheld Reader. All readings taken are peak readings, unless otherwise stated by an "A" or "Q". The data sheets from which these tables were compiled are contained in Appendix B.

<b>Table 1: Highest Fundamental Radiated Emission Level</b>									
FREQUENCY	METER READING	CORRECTION FACTORS				CORRECTED READING	SPEC LIMIT	MARGIN	NOTES
		Mag L	Barn dB	40dB- DB	Dist dB				
MHz	dBμV	dB	dB	DB	dB	dBμV/m	dBμV/m	dB	
0.125120	41.2	12.2	0.1	-40.0		13.5	25.7	-12.2	N

Test Method: ANSI C63.4 1992  
 Spec Limit : FCC Part 15.209  
 Test Distance: 30 Meters

NOTES: N = No Polarization  
 Q = Quasi Peak Reading  
 A = Average Reading

COMMENTS: EUT operating in continuous "Write Page" mode. EUT is battery operated (3.6 VDC). Antenna connected to Handheld unit via RJ45 cable.

Spec Limit @ 125kHz IAW 15.209 =  $2400/125 = 19.2\mu\text{V}/\text{M} = 25.7\text{dB}\mu\text{V}/\text{M}$  @ 300 Meters.

The 40dB correction factor is IAW 15.31 for measuring signals at distances other than specified in 15.209

**Table 2: 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				
48.670	46.8	10.9	-27.2	1.3		31.8	40.0	-8.2	HQ
47.982	46.4	11.0	-27.2	1.3		31.5	40.0	-8.5	V
149.410	45.3	13.1	-27.0	2.2		33.6	43.5	-9.9	H
148.444	44.4	13.2	-27.0	2.2		32.8	43.5	-10.7	V
448.091	38.9	18.6	-27.8	4.4		34.1	46.0	-11.9	H
210.509	38.0	17.4	-26.7	2.8		31.5	43.5	-12.0	V

Test Method: ANSI C63.4 1992  
 Spec Limit : FCC Part 15.209  
 Test Distance: 3 Meters

NOTES: H = Horizontal Polarization  
 V = Vertical Polarization  
 Q = Quasi Peak Reading  
 A = Average Reading

COMMENTS: EUT operating in continuous "Write Page" mode. EUT is battery operated (3.6 VDC). Antenna connected to Handheld unit via RJ45 cable. Frequency range scanned from 9kHz to 1GHz.

**TABLE A**  
**LIST OF TEST EQUIPMENT**

1. Spectrum Analyzer, Hewlett Packard, Model No. 8566B, S/N 2209A01404. Calibration date: June 12, 1998. Calibration due date: June 12, 1999.
2. Preamp, Hewlett Packard, Model No. 8447D, S/N 1937A02604. Calibration date: October 15, 1998. Calibration due date: October 15, 1999.
3. Quasi-Peak Adapter, Hewlett Packard, Model No. 85650A, S/N 2811A01267. Calibration date: June 12, 1998. Calibration due date: June 12, 1999.
4. Biconical Antenna, A & H Systems, Model No. SAS-200/542, S/N 156. Calibration date: June 9, 1998. Calibration due date: June 9, 1999.
5. Log Periodic Antenna, A & H Systems, Model No. SAS-200/512, S/N 154. Calibration date: June 9, 1998. Calibration due date: June 9, 1999.
6. Magnetic Loop Antenna, EMCO, Model No. 6502, S/N 1074. Calibration date: May 11, 1998. Calibration due date: May 11, 1999.
7. Site B (Barn) Calibration date: June 18, 1998. Site B (Barn) Calibration due date: June 18 1999.
8. Test software, EMI Test 2.91.

## EUT SETUP

The equipment under test (EUT) was setup in a manner that represented its 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 and Table 2 for radiated emissions. Additionally, a complete description of all the ports and I/O cables 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 hand held devices.

I/O cables were connected to the EUT 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 was used to collect the radiated emissions data for the 4043A AMH100 Handheld Reader. For radiated measurements below 30 MHz, the magnetic loop antenna was used. For frequencies from 30 to 300 MHz, the biconical antenna was used. For frequencies from 300 to 1000 MHz, the log periodic antenna was used. Refer to the test data sheets contained in Appendix B for the exact distance of the antennas from the edge of the table.

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 $\mu$ 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	9kHz	150kHz	200Hz
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 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 4043A AMH100 Handheld Reader.

### **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 6 dB of the specification limit, quasi-peak measurements were taken using the HP 85650A Quasi-Peak Adapter for the HP 8566B 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 450 kHz or 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 4043A AMH100 Handheld Reader 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 with the I/O cable facing the antenna. The frequency range of 9 kHz to 30 MHz was scanned with 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.

Using the peak readings from the above scan 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 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.

### **Power Output Measurement**

At a test distance of 30 meters, the maximum ERP for 4043A AMH100 Handheld Reader was measured at 53.5 dBuV/m. In accordance with 15.31, a 40dB correction factor was used to adjust for the test distance. The factor corrected the reading to 13.5dBuV/m.

## 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 dB $\mu$ V/m, the spectrum analyzer reading in dB $\mu$ V was corrected by using the following formula:

$$\begin{aligned}
 & \text{Meter reading (dB}\mu\text{V)} \\
 & + \text{Antenna Factor (dB)} \\
 & + \text{Cable Loss (dB)} \\
 & - \text{Distance Correction (dB)} \\
 & - \text{Pre-amplifier Gain (dB)} \\
 & \pm \text{Other factors (pads, correction factor, current probe, etc.)} \\
 & = \text{Corrected Reading(dB}\mu\text{V/m)}
 \end{aligned}$$

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

A typical data sheet will display the following in column format (not necessarily in this order):

#	Freq MHz	Rdng dB $\mu$ V	Barn dB	Pream dB	Bicon dB	40dB- dB	Log 1 dB	Mag L dB
---	-------------	--------------------	------------	-------------	-------------	-------------	-------------	-------------

Dist dB	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar
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# means reading number

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

**Rdng dB $\mu$ V** is the reading obtained on the spectrum analyzer in dB $\mu$ V.

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

**Bicon** is the biconical antenna factor in dB.

**Log 1** is the log periodic antenna factor in dB.

**Barn** is the cable factors for the Barn site..

**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 $\mu$ V/m** is the corrected reading which is now in dB $\mu$ 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.

**40dB-** is the 15.31 correction factor for measuring signals at distances other than specified in 15.209.

**Mag L** is the magloop antenna factor in dB.

**APPENDIX A**  
**INFORMATION ABOUT THE EQUIPMENT UNDER TEST**

**INFORMATION ABOUT THE EQUIPMENT UNDER TEST**

Test Software/Firmware: Version 2.7  
 CRT was displaying: N/A  
 Power Supply Manufacturer: **N/A, Powered from Symbol HandHeld Computer**  
 Power Supply Part Number: N/A  
 AC Line Filter Manufacturer: N/A  
 AC Line Filter Part Number: N/A

Line voltage used during testing: **5.0V DC**

**I/O PORTS**

Type	#
RS-232	1

**CRYSTAL OSCILLATORS**

Type	Freq In MHz
Ceramic Resonator	8.0

**PRINTED CIRCUIT BOARDS**

Function	Model & Rev	Clocks, MHz	Layers	Location
All (Excite, receive, Communicate to host)	ENG—191 Rev 3	8 MHz	4	N/A



**PHOTOGRAPH SHOWING RADIATED EMISSIONS**



Radiated Emissions - Front View

NOTES:

**APPENDIX B**  
**MEASUREMENT DATA SHEETS**



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

Customer: **HID Corporation** Date: Dec-03-98  
 Specification: **FCC 15 C PARA 15.209** Time: 03:00  
 Test Type: **Maximized Emissions** Sequence#: 1  
 Equipment: **Handheld Reader**  
 Manufacturer: **HID** Tested By: Dustin Oaks  
 Model: 4043A  
 S/N: N/A

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

Function	Manufacturer	Model #	S/N
Handheld Computer	Symbol	PDT6100	ALPH2388
Handheld Reader	HID	N/A	N/A

**Support Devices:**

Function	Manufacturer	Model #	S/N
None			

**Test Conditions / Notes:**

EUT operating in continuous "Write Page" mode. EUT is battery operated (3.6 VDC). Antenna connected to Handheld unit via RJ45 cable.  
 Spec Limit @ 125kHz IAW 15.209 =  $2400/125 = 19.2\mu\text{V}/\text{M} = 25.7\text{dB}\mu\text{V}/\text{M}$  @ 300 Meters.  
 The 40dB correction factor is IAW 15.31 for measuring signals at distances other than specified in 15.209

**Measurement Data:**

Sorted by Margin

Test Distance: 30 Meters

#	Freq	Rdng dB $\mu$ V	Mag L Barn 40dB-			Dist dB	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar
			dB	dB	dB					
1	125.120k	41.2	+12.2	+0.1	-40.0	+0.0	13.5	25.7	-12.2	None

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

Customer: **HID Corporation**  
 Specification: **FCC 15.209**  
 Test Type: **Maximized Emissions**  
 Equipment: **Handheld Reader**  
 Manufacturer: **HID**  
 Model: **4043A**  
 S/N: **N/A**

Date: Dec-03-98  
 Time: 02:14  
 Sequence#: 3  
 Tested By: Dustin Oaks

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

Function	Manufacturer	Model #	S/N
Handheld Computer	Symbol	PDT6100	ALPH2388
Handheld Reader	HID	N/A	N/A

**Support Devices:**

Function	Manufacturer	Model #	S/N
None			

**Test Conditions / Notes:**

EUT operating in continuous "Write Page" mode. EUT is battery operated (3.6 VDC). Antenna connected to Handheld unit via RJ45 cable. Frequency range scanned from 9kHz to 1GHz.

**Measurement Data:**

Sorted by Margin

Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	Pream Bicon Log 1 Barn				Dist dB	Corr DBµV/m	Spec dBµV/m	Margin dB	Polar
			dB	dB	dB	dB					
1	48.670	46.8	-27.2	+10.9	+0.0	+1.3	+0.0	31.8	40.0	-8.2	Horiz
	Quasi Peak										
^	48.600	52.7	-27.2	+10.9	+0.0	+1.3	+0.0	37.7	40.0	-2.3	Horiz
3	47.982	46.4	-27.2	+11.0	+0.0	+1.3	+0.0	31.5	40.0	-8.5	Vert
4	149.410	45.3	-27.0	+13.1	+0.0	+2.2	+0.0	33.6	43.5	-9.9	Horiz
5	148.444	44.4	-27.0	+13.2	+0.0	+2.2	+0.0	32.8	43.5	-10.7	Vert
6	448.091	38.9	-27.8	+0.0	+18.6	+4.4	+0.0	34.1	46.0	-11.9	Horiz
7	210.509	38.0	-26.7	+17.4	+0.0	+2.8	+0.0	31.5	43.5	-12.0	Vert
8	352.086	36.8	-26.9	+0.0	+19.9	+3.6	+0.0	33.4	46.0	-12.6	Horiz
9	416.091	37.7	-27.4	+0.0	+18.1	+4.1	+0.0	32.5	46.0	-13.5	Horiz
10	74.640	44.1	-27.2	+7.9	+0.0	+1.5	+0.0	26.3	40.0	-13.7	Horiz
11	336.086	34.5	-26.8	+0.0	+20.7	+3.5	+0.0	31.9	46.0	-14.1	Horiz

12	400.091	36.9	-27.2	+0.0	+17.9	+3.9	+0.0	31.5	46.0	-14.5	Horiz
13	704.109	32.6	-27.8	+0.0	+21.1	+5.4	+0.0	31.3	46.0	-14.7	Horiz
14	384.086	35.7	-27.1	+0.0	+18.5	+3.8	+0.0	30.9	46.0	-15.1	Horiz
15	368.086	35.0	-27.0	+0.0	+19.2	+3.7	+0.0	30.9	46.0	-15.1	Horiz
16	448.093	35.5	-27.8	+0.0	+18.6	+4.4	+0.0	30.7	46.0	-15.3	Vert
17	736.109	31.3	-27.7	+0.0	+21.5	+5.5	+0.0	30.6	46.0	-15.4	Horiz
18	688.109	31.6	-27.8	+0.0	+20.9	+5.4	+0.0	30.1	46.0	-15.9	Horiz
19	432.091	34.9	-27.6	+0.0	+18.4	+4.2	+0.0	29.9	46.0	-16.1	Horiz
20	352.086	33.3	-26.9	+0.0	+19.9	+3.6	+0.0	29.9	46.0	-16.1	Vert
21	384.086	34.6	-27.1	+0.0	+18.5	+3.8	+0.0	29.8	46.0	-16.2	Vert
22	320.086	31.4	-26.7	+0.0	+21.5	+3.5	+0.0	29.7	46.0	-16.3	Vert
23	640.109	32.2	-27.9	+0.0	+20.2	+5.1	+0.0	29.6	46.0	-16.4	Horiz
24	560.093	33.1	-27.7	+0.0	+19.5	+4.7	+0.0	29.6	46.0	-16.4	Vert
25	464.091	34.0	-27.8	+0.0	+18.8	+4.4	+0.0	29.4	46.0	-16.6	Horiz
26	624.109	32.2	-27.9	+0.0	+20.0	+5.0	+0.0	29.3	46.0	-16.7	Horiz
27	336.086	31.8	-26.8	+0.0	+20.7	+3.5	+0.0	29.2	46.0	-16.8	Vert
28	496.093	33.0	-27.8	+0.0	+19.3	+4.4	+0.0	28.9	46.0	-17.1	Vert
29	432.093	33.6	-27.6	+0.0	+18.4	+4.2	+0.0	28.6	46.0	-17.4	Vert
30	368.086	32.4	-27.0	+0.0	+19.2	+3.7	+0.0	28.3	46.0	-17.7	Vert
31	608.109	31.2	-27.9	+0.0	+19.8	+5.0	+0.0	28.1	46.0	-17.9	Horiz
32	320.086	29.8	-26.7	+0.0	+21.5	+3.5	+0.0	28.1	46.0	-17.9	Horiz
33	156.932	36.2	-27.0	+13.8	+0.0	+2.3	+0.0	25.3	43.5	-18.2	Vert
34	592.098	31.0	-27.9	+0.0	+19.7	+4.9	+0.0	27.7	46.0	-18.3	Vert
35	416.086	32.5	-27.4	+0.0	+18.1	+4.1	+0.0	27.3	46.0	-18.7	Vert
36	128.107	35.2	-27.2	+14.1	+0.0	+2.0	+0.0	24.1	43.5	-19.4	Vert
37	172.580	32.2	-26.9	+15.2	+0.0	+2.5	+0.0	23.0	43.5	-20.5	Horiz

38	161.419	32.6	-27.0	+14.2	+0.0	+2.3	+0.0	22.1	43.5	-21.4	Vert
39	112.094	33.8	-27.2	+13.1	+0.0	+1.9	+0.0	21.6	43.5	-21.9	Vert
40	115.270	33.1	-27.2	+13.4	+0.0	+1.9	+0.0	21.2	43.5	-22.3	Horiz