Washington Laboratories, Ltd.

FCC & Industry Canada Certification Test Report
for the
ATEQ Corporation
VT55

FCC ID: TJB-ATEQ-VT5X
IC ID: 6034A-ATEQVT5X

WLL JOB# **10548**
September 2008

Prepared for:

ATEQ Corporation
42000 Koppernick Road Suite A4
Canton, MI 48187

Prepared By:

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ACCREDITED
Testing Certificate 2675.01

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Prepared by: James Ritter
EMC Compliance Engineer

Reviewed by: Steven D. Koster
EMC Operations Manager

Abstract

This report has been prepared on behalf of ATEQ Corporation to support the attached Application for Equipment Authorization. The test report and application are submitted for an Intentional Radiator under Part 15.209 of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-210 of Industry Canada. This Certification Test Report documents the test configuration and test results for an ATEQ Corporation VT55.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by the American Association for Laboratory Accreditation (A2LA) under Certificate 2675.01 as an independent FCC test laboratory.

The ATEQ Corporation VT55 complies with the limits for an Intentional Radiator device under FCC Part 15.209 and Industry Canada RSS-210.

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1 Introduction

1.1 Compliance Statement

The ATEQ Corporation VT55 complies with the limits for an Intentional Radiator device under FCC Part 15.209 and Industry Canada RSS-210.

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed in accordance with 2003 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	ATEQ Corporation 42000 Koppernick Road Suite A4 Canton, MI 48187
Purchase Order Number:	P009981
Quotation Number:	64425

1.4 Test Dates

Testing was performed on the following date(s):	September 3-4, 2008

1.5 Test and Support Personnel

Washington Laboratories, LTD	James Ritter
Client Representative	Guy Dewailly

2 Equipment Under Test

2.1 EUT Identification & Description

The ATEQ Corporation VT55 is a handheld instrument used to read data from smart valves mounted on vehicle tires. The VT55 uses a 125kHz interrogating signal to "wake-up" the smart valve. The tire data is then retrieved and displayed on the VT55. The VT55 is powered by an internal rechargeable battery pack. The reception frequencies are: 433 MHz or 315 MHz (RF).

The purpose of the VT55 is to:

- Test the RKE signal strength
- Retrieve data from the tire pressure sensor.
- Verify the identities of each tire pressure sensor mounted on vehicle wheels
- Assist a technician to reset TPM system on vehicle.

The instrument interacts with the tire pressure sensor without contact through wireless communication

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	ATEQ Corporation
FCC ID:	TJB-ATEQ-VT5X
IC:	6034A-ATEQVT5X
Model:	VT55
FCC Rule Parts:	§15.209
Industry Canada:	RSS-210 and RSS-GEN
Frequency Range:	125kHz Fixed
Keying:	Manual
Type of Information:	Data
Number of Channels:	1
Power Output Level	Fixed
Maximum Field Strength:	98.8dBµV/m (at 3m)
Occupied Bandwidth:	12.58kHz
Modulation:	ASK/OOD
Emission Designator:	12K6K1D
TX Spurious:	150MHz 58.6 uV/m @ 3 meters
RX Spurious:	150MHz 58.6 uV/m @ 3 meters
Antenna Connector	Integral Antenna
Interface Cables:	USB and RJ45(RS232) for installation of firmware upgrades
Power Source & Voltage:	Internal 4.2V Lithium-Ion battery rechargeable from an AC/DC 24V power adapter

2.2 Test Configuration

The VT55 was tested a standalone unit. No cables were attached as the USB and RJ45 connections are only for momentary firmware upgrades. A charger unit was supplied to recharge the battery and is not used when the unit is in operation.

2.3 Testing Algorithm

The VT55 was placed into a continuous transmit mode via testing software. The unit was tested in three different orthogonal planes.

Worst case emission levels are provided in the test results data.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by the American Association for Laboratory Accreditation (A2LA) under Certificate 2675.01 as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSL Z540-2-1997 with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

Equation 1: Standard Uncertainty

$$u_c = \pm\sqrt{\frac{a^2}{div_a^{\ 2}} + \frac{b^2}{div_b^{\ 2}} + \frac{c^2}{div_c^{\ 2}} + \ldots\ldots}$$

where u_c = standard uncertainty

a, b, c,.. = individual uncertainty elements

$div_{a,\ b,\ c}$ = the individual uncertainty element divisor based on the probability distribution

divisor = 1.732 for rectangular distribution

divisor = 2 for normal distribution

divisor = 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

where U = expanded uncertainty

k = coverage factor

$k \leq 2$ for 95% coverage (ANSI/NCSL Z540-2 Annex G)

u_c = standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is not used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 2 below.

Table 2: Expanded Uncertainty List

Scope	Standard(s)	Expanded Uncertainty
Conducted Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	2.63 dB
Radiated Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	4.55 dB

3 Test Equipment

Table 3 shows a list of the test equipment used for measurements along with the calibration information.

Table 3. Test Equipment List

WLL Asset #	Manufacturer Model/Type	Function	Cal. Due
00644	SUNOL SCIENCE JB1	BICONALOG ANTENNA	11/27/2009
00004	ARA, DRG-118/A	ANTENNA, DRG, 1-18GHZ	02/02/2009
00069	HP, 85650A	ADAPTER, QP	07/09/2009
00073	HP, 8568B	ANALYZER, SPECTRUM	07/08/2009
00071	HP, 85685A	PRESELECTOR, RF	07/09/2009
00069	HP, 85650A	ADAPTER, QP	07/09/2009
00066	HP, 8449B	PRE-AMPLIFIER, RF. 1-26.5GHZ	07/15/2009
00618	HP 8563A	ANALYZER, SPECTRUM	03/07/2009
00031	EMCO, 6502	ANTENNA, ACTIVE LOOP	02/28/2010

4 Test Results

4.1 Occupied Bandwidth: (FCC Part §2.1049, IC RSS-GEN Section 4.4)

Occupied bandwidth was performed by placing the receive loop antenna near the antenna of the EUT. The 20dB bandwidth was then determined form the received signal displayed on the spectrum analyzer. At full modulation, the occupied bandwidth was measured as shown in Figure 1. Table 4 lists the measured 20dB bandwidth.

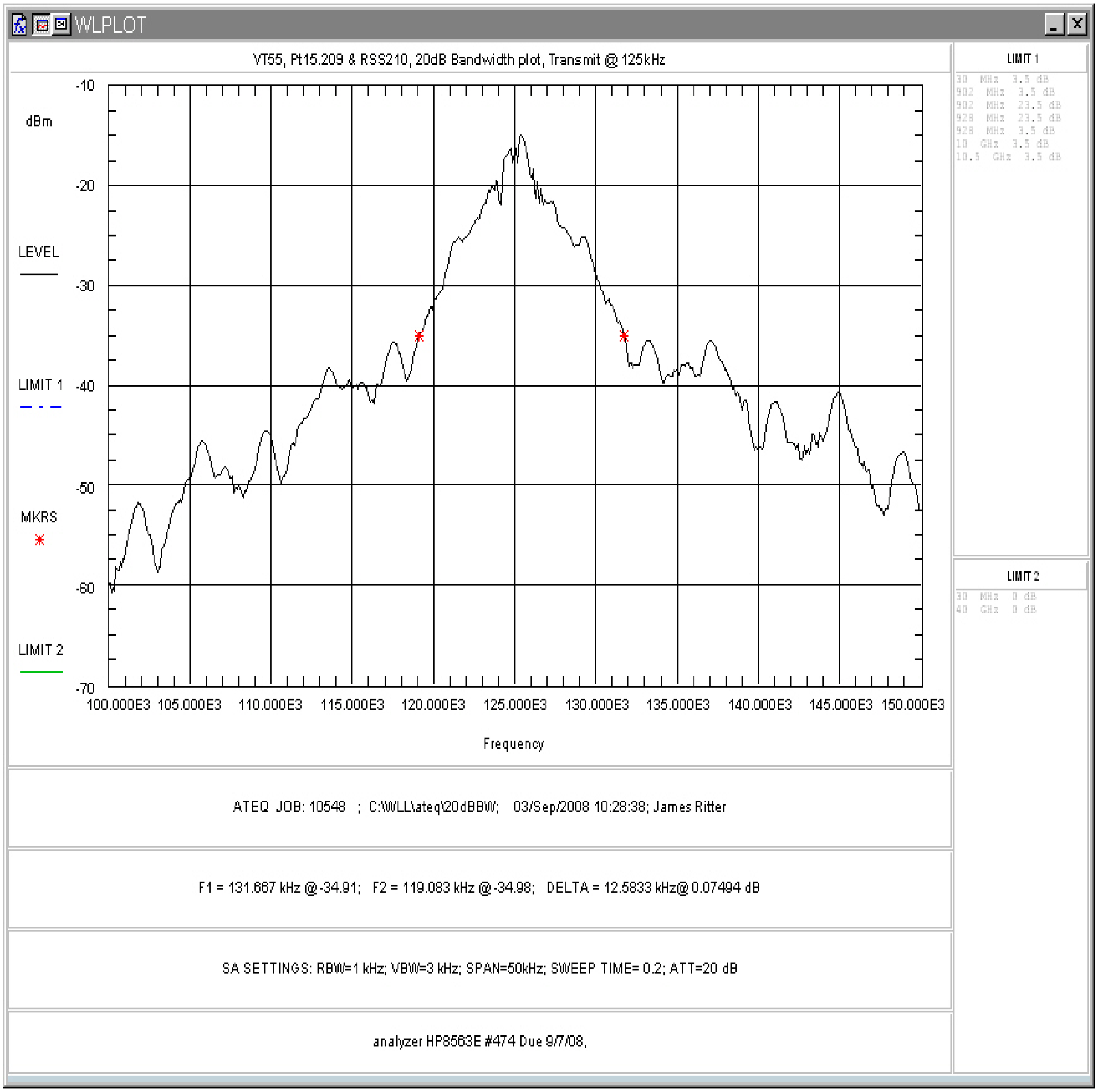

Figure 1. Occupied Bandwidth

Table 4. Occupied Bandwidth Results

Frequency	Bandwidth
125kHz	12.58kHz

4.2 AC Line Conducted Emissions (FCC Part 15.207, IC RSS-GEN Section 7.2.2)

4.2.1 Requirements

The VT55 is a hand-held device that is used near vehicle tires. Charging is done while the device is not in use for.

The following are the limits as specified in FCC §15.207 and Section 7.2.2 of RSS-GEN.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

4.2.2 Test Procedure

The EUT was placed on an 80 cm high 1 X 1.5 m non-conductive table above a ground plane. Power to the EUT was provided through a Solar Corporation 50 Ω/50 μH Line Impedance Stabilization Network bonded to a 3 X 2 meter ground plane. The LISN has its AC input supplied from a filtered AC power source. The peripherals were placed on the table in accordance with ANSI C63.4-2003. Power and data cables were moved about to obtain maximum emissions.

The 50 Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 150 kHz to 30 MHz were measured. The detector function was set to quasi-peak, peak, or average as appropriate, and the resolution bandwidth during testing was at least 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth.

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed.

4.2.3 Test Data

As declared by the manufacturer, the unit will not be charged in an operational mode. Therefore, this test was not performed.

4.3 Radiated Spurious Emissions: (FCC Part §2.1053 and RSS-210 Section 2.6)

The EUT must comply with the requirements for radiated emissions per the limits specified in §15.209 and Tables 2 and 3 of RSS-210.

The following tables list the emission limits:

Table 5. General Field Strength for Transmitters at Frequencies Above 30MHz

Frequency (MHz)	Field Strength µV/m at 3m (Watts, E.I.R.P.)
	Transmitters
30-88	100 (3 nW)
88-216	150 (6.8 nW)
216-960	200 (12 nW)
Above 960	500 (75 nW)

Table 6. General Field Strength for Transmitters at Frequencies Below 30MHz

Frequency (fundamental or spurious)	Field Strength µV/m	Magnetic H-Field µA/m	Measurement Distance
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in Hz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1.705-30 MHz	30	N/A	30

4.3.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. For frequencies below 30MHz the receiving loop antenna was rotated about its vertical axis to determine the maximum emissions. For emissions testing above 30MHz receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-2003. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

Measurements performed below 30MHz were made at a test distance closer than specified. The measurements were made at 3m and the limit adjusted by 80dB for limits specified at 300m or 40dB for limits specified at 30m. The emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
125k – 30MHz	9kHz	>10 kHz
30M – 1000MHz	120kHz	>120 kHz

The limits in the following table for the emissions below 30MHz were adjusted to the appropriate distance using the inverse distance square formula of 40dB per decade of measurement distance.

The EUT was tested in 3 orthogonals each 3 antenna orientations below 30MHz and 2 antenna orientations above 30MHz

Table 7. Radiated Emission Test Data, Fundamental Frequency Data

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
Unit Upright										
0.125	X	200.0	1.0	82.6	11.1	0.4	94.1	50778.1	192000.0	-11.6
0.125	Y	240.0	1.0	72.7	11.1	0.4	84.2	16243.4	192000.0	-21.5
0.125	Z	180.0	1.0	80.4	11.1	0.4	91.9	39416.3	192000.0	-13.8
0.250	X	180.0	1.0	42.4	10.9	0.5	53.8	491.1	96000.0	-45.8
0.250	Y	270.0	1.0	44.5	10.9	0.5	55.9	625.4	96000.0	-43.7
0.250	Z	180.0	1.0	45.7	10.9	0.5	57.1	718.0	96000.0	-42.5
0.375	X	180.0	1.0	43.5	10.9	0.6	55.0	561.6	64000.0	-41.1
0.375	Y	190.0	1.0	36.2	10.9	0.6	47.7	242.3	64000.0	-48.4
0.375	Z	180.0	1.0	41.0	10.9	0.6	52.5	421.1	64000.0	-43.6
0.500	X	190.0	1.0	39.4	10.9	0.6	50.9	352.2	4800.0	-22.7
0.500	Y	180.0	1.0	32.9	10.9	0.6	44.4	166.6	4800.0	-29.2
0.500	Z	180.0	1.0	38.7	10.9	0.6	50.2	324.9	4800.0	-23.4
0.875	X	200.0	1.0	31.9	10.9	0.7	43.5	149.7	2742.9	-25.3
1.000	X	190.0	1.0	30.0	11.1	0.7	41.8	123.7	2400.0	-25.8
1.000	Y	180.0	1.0	30.2	11.1	0.7	42.0	126.6	2400.0	-25.6
1.250	X	180.0	1.0	31.6	11.1	0.8	43.5	148.8	1920.0	-22.2
1.250	Y	190.0	1.0	31.0	11.1	0.8	42.9	138.9	1920.0	-22.8
1.250	Z	190.0	1.0	30.1	11.1	0.8	42.0	125.2	1920.0	-23.7
2.000	X	170.0	1.0	28.1	11.0	0.9	40.0	99.5	3000.0	-29.6
Unit Flat										
0.125	X	270.0	1.0	86.7	11.1	0.4	98.2	81409.7	192000.0	-7.5
0.125	Y	190.0	1.0	83.7	11.1	0.4	95.2	57633.7	192000.0	-10.5
0.125	Z	300.0	1.0	76.9	11.1	0.4	88.4	26343.7	192000.0	-17.3
0.250	X	120.0	1.0	48.7	10.9	0.5	60.1	1014.2	96000.0	-39.5
0.250	Y	200.0	1.0	46.3	10.9	0.5	57.7	769.4	96000.0	-41.9
0.250	Z	90.0	1.0	44.8	10.9	0.5	56.2	647.3	96000.0	-43.4
0.375	X	270.0	1.0	43.0	10.9	0.6	54.5	530.2	64000.0	-41.6
0.375	Y	180.0	1.0	44.3	10.9	0.6	55.8	615.8	64000.0	-40.3
0.375	Z	200.0	1.0	39.6	10.9	0.6	51.1	358.4	64000.0	-45.0
0.500	X	90.0	1.0	39.9	10.9	0.6	51.4	373.0	4800.0	-22.2
0.500	Y	190.0	1.0	38.8	10.9	0.6	50.3	328.7	4800.0	-23.3

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
0.500	Z	180.0	1.0	35.8	10.9	0.6	47.3	232.7	4800.0	-26.3
0.875	X	270.0	1.0	32.0	10.9	0.7	43.6	151.4	2742.9	-25.2
0.875	Y	180.0	1.0	31.8	10.9	0.7	43.4	147.9	2742.9	-25.4
1.000	X	270.0	1.0	31.0	11.1	0.7	42.8	138.8	2400.0	-24.8
1.250	X	270.0	1.0	32.4	11.1	0.8	44.3	163.2	1920.0	-21.4
Unit On Side										
0.125	X	90.0	1.0	87.3	11.1	0.4	98.8	87232.1	192000.0	-6.9
0.125	Y	45.0	1.0	79.3	11.1	0.4	90.8	34727.7	192000.0	-14.9
0.125	Z	180.0	1.0	81.0	11.1	0.4	92.5	42235.4	192000.0	-13.2
0.250	X	270.0	1.0	48.4	10.9	0.5	59.8	979.8	96000.0	-39.8
0.250	Y	180.0	1.0	46.6	10.9	0.5	58.0	796.4	96000.0	-41.6
0.250	Z	220.0	1.0	46.0	10.9	0.5	57.4	743.2	96000.0	-42.2
0.375	X	90.0	1.0	44.2	10.9	0.6	55.7	608.7	64000.0	-40.4
0.375	Y	170.0	1.0	39.6	10.9	0.6	51.1	358.4	64000.0	-45.0
0.375	Z	180.0	1.0	40.1	10.9	0.6	51.6	379.7	64000.0	-44.5
0.500	X	270.0	1.0	41.1	10.9	0.6	52.6	428.3	4800.0	-21.0
0.500	Y	270.0	1.0	38.4	10.9	0.6	49.9	313.9	4800.0	-23.7
0.500	Z	180.0	1.0	36.7	10.9	0.6	48.2	258.1	4800.0	-25.4
0.875	X	90.0	1.0	34.2	10.9	0.7	45.8	195.0	2742.9	-23.0
1.000	X	270.0	1.0	33.4	11.1	0.7	45.2	183.0	2400.0	-22.4
1.000	Y	180.0	1.0	30.1	11.1	0.7	41.9	125.1	2400.0	-25.7
1.250	X	90.0	1.0	30.5	11.1	0.8	42.4	131.1	1920.0	-23.3

<30MHz normalized to 3m (40dB/decade) (loop antenna position shown below)

Position: X = →

Y = ↑

Z = ●

Table 8. Radiated Emission Test Data, Low Frequency Data (>30MHz)

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
Unit Upright										
33.400	V	90.0	1.1	9.2	17.6	0.5	27.2	23.0	100.0	-12.8
36.820	V	180.0	1.2	11.9	15.0	0.5	27.5	23.6	100.0	-12.5
79.995	V	270.0	1.0	16.9	7.7	1.4	26.0	20.0	100.0	-14.0
140.000	V	0.0	1.7	17.2	12.7	1.8	31.7	38.5	150.0	-11.8
149.980	V	180.0	1.6	15.5	11.8	1.9	29.2	28.7	150.0	-14.4
210.000	V	160.0	1.8	15.7	10.9	2.3	28.9	27.8	150.0	-14.7
240.000	V	160.0	1.8	17.8	11.3	2.4	31.6	37.8	200.0	-14.5
250.000	V	190.0	2.1	17.4	11.6	2.5	31.5	37.6	200.0	-14.5
440.000	V	180.0	1.0	11.9	16.5	3.3	31.7	38.5	200.0	-14.3
140.000	H	270.0	2.4	17.8	12.7	1.8	32.3	41.2	150.0	-11.2
150.000	H	90.0	2.5	17.3	11.8	1.9	31.0	35.3	150.0	-12.6
Unit on side										
33.400	V	90.0	1.1	9.2	17.6	0.5	27.2	23.0	100.0	-12.8
36.820	V	180.0	1.2	11.9	15.0	0.5	27.5	23.6	100.0	-12.5
79.995	V	270.0	1.0	16.9	7.7	1.4	26.0	20.0	100.0	-14.0
140.000	V	0.0	1.7	17.2	12.7	1.8	31.7	38.5	150.0	-11.8
149.980	V	180.0	1.6	15.5	11.8	1.9	29.2	28.7	150.0	-14.4
210.000	V	160.0	1.8	15.7	10.9	2.3	28.9	27.8	150.0	-14.7
240.000	V	160.0	1.8	17.8	11.3	2.4	31.6	37.8	200.0	-14.5
250.000	V	190.0	2.1	17.4	11.6	2.5	31.5	37.6	200.0	-14.5
440.000	V	180.0	1.0	11.9	16.5	3.3	31.7	38.5	200.0	-14.3
140.000	H	270.0	2.4	17.8	12.7	1.8	32.3	41.2	150.0	-11.2
150.000	H	90.0	2.5	17.3	11.8	1.9	31.0	35.3	150.0	-12.6
Unit flat										
33.400	V	0.0	1.2	7.7	17.6	0.5	25.7	19.4	100.0	-14.3
140.000	V	270.0	1.5	15.0	12.7	1.8	29.5	29.9	150.0	-14.0
150.000	V	270.0	1.3	17.6	11.8	1.9	31.3	36.5	150.0	-12.3
130.000	H	180.0	3.2	13.3	13.8	1.8	28.9	27.7	150.0	-14.7
140.000	H	180.0	2.5	19.5	12.7	1.8	34.0	50.1	150.0	-9.5
150.000	H	170.0	1.7	21.7	11.8	1.9	35.4	58.6	150.0	-8.2
160.000	H	0.0	2.1	17.8	11.5	1.9	31.2	36.3	150.0	-12.3
170.000	H	180.0	1.6	20.5	11.5	2.1	34.1	50.4	150.0	-9.5
220.000	H	90.0	1.4	17.6	11.1	2.3	31.0	35.6	200.0	-15.0
240.000	H	90.0	1.5	17.3	11.3	2.4	31.1	35.7	200.0	-15.0
280.010	H	270.0	1.2	14.8	13.6	2.7	31.1	35.8	200.0	-14.9
290.000	H	180.0	1.3	15.4	13.6	2.7	31.7	38.7	200.0	-14.3
410.000	H	0.0	1.2	15.8	15.9	3.2	34.9	55.3	200.0	-11.2
200.000	H	0.0	1.8	18.7	12.3	2.2	33.2	45.7	150.0	-10.3
390.000	H	0.0	1.2	14.8	15.7	3.1	33.6	47.7	200.0	-12.4