Washington Laboratories, Ltd.

FCC & Industry Canada Certification Test Report
for the
ATEQ Corporation
VT60

TJB-ATEQ-VTXX
6034A-ATEQVTXX

WLL JOB# **8785/6**
March 2006

Prepared for:

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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 VT60.

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 NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

The ATEQ Corporation VT60 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 VT60 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:	P008609
Quotation Number:	62203

1.4 Test Dates

Testing was performed on the following date(s):	January 19 to February 15, 2006

1.5 Test and Support Personnel

Washington Laboratories, LTD	Greg Snyder, James Ritter
Client Representative	Mike Crimmings

2 Equipment Under Test

2.1 EUT Identification & Description

The ATEQ Corporation VT60 is an instrument used to read data from smart valves mounted on vehicle tires. The VT60 uses a 125kHz interrogating signal to "wake-up" the smart valve. The tire data is then retrieved and displayed on the VT60. The VT 60 is powered by an internal rechargeable battery pack.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	ATEQ Corporation
FCC ID:	TJB-ATEQ-VTXX
IC:	6034A-ATEQVTXX
Model:	VT60
FCC Rule Parts:	§15.209
Industry Canada:	RSS-210 and RSS-GEN
Frequency Range:	125kHz
Maximum Field Strength:	101.5dBµV/m (at 3m)
Occupied Bandwidth:	8.18kHz
Keying:	Manual
Type of Information:	Data
Number of Channels:	1
Power Output Level	Fixed
Antenna Connector	Integral Antenna
Interface Cables:	USB for data retrieval and programming
Power Source & Voltage:	Internal 4.2V Lithium-Ion battery rechargeable from an AC/DC 24V power adapter

2.2 Test Configuration

The VT60 was configured with a Mean Well ES25U24 AC adapter.

2.3 Testing Algorithm

The VT60 was placed into a continuous transmit mode for testing purposes. 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 NIST NVLAP (NVLAP Lab Code: 200066-0) 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. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5\ (2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.

3 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 2. Test Equipment List

WLL Asset #	Manufacturer Model/Type	Function	Cal. Due
00073	HP 8568B	SPECTRUM ANALYZER	6/30/2006
00069	HP 85650A	QUASI-PEAK ADAPTER	6/30/2006
00071	HP 85685A	RF PRESELECTOR	6/30/2006
00125	SOLAR 8028-50-TS-BNC	LISN	1/31/2007
00126	SOLAR 8028-50-TS-BNC	LISN	1/31/2007
00007	ARA LPB-2520	BICONILOG ANTENNA	12/20/2006
00074	HEWLETT-PACKARD 8593A	SPECTRUM ANALYZER	10/04/2006
00168	HEWLETT-PACKARD 8563A	SPECTRUM ANALYZER	4/27/2006
N/A	ROHDE & SCHWARZ HFH2-Z2	LOOP ANTENNA	3/13/2006

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 3 lists the measured 20dB bandwidth.

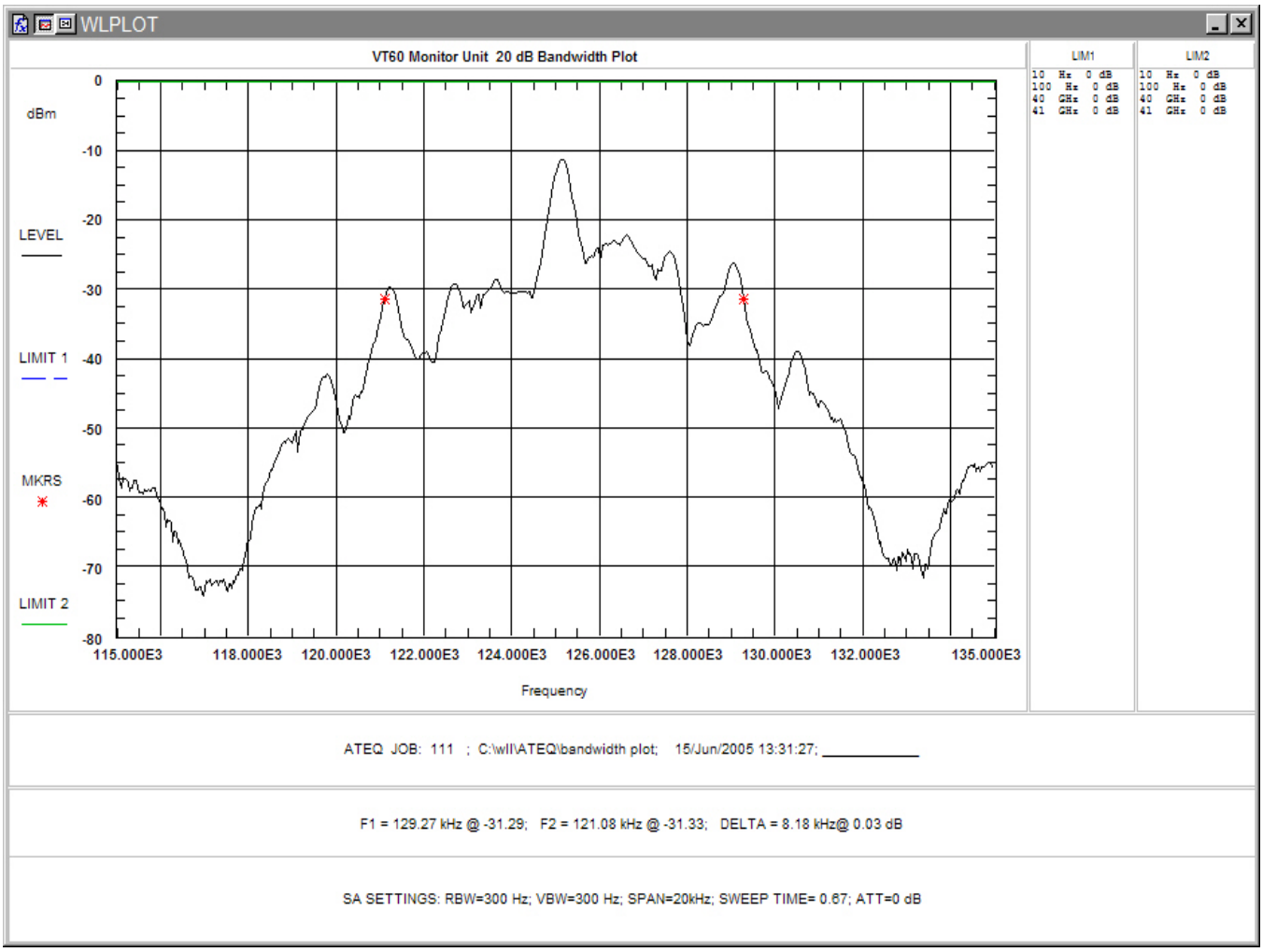

Figure 1. Occupied Bandwidth

Table 3 provides a summary of the Occupied Bandwidth Results.

Table 3. Occupied Bandwidth Results

Frequency	Bandwidth
125kHz	8.18kHz

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

4.2.1 Requirements

The VT60 is a hand-held device that is used near vehicle tires. Charging is done while the device is not in use for reading valve data. However, conducted emissions testing was performed as there is no mechanism to disable the possibility of transmission during the charging mode.

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

Table 4 provides the test results for phase and neutral line power line conducted emissions.

Table 4. AC Line Conducted Emissions Test Data

LINE 1 - NEUTRAL

Frequency (MHz)	Level QP (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Limit QP (dBµV)	Level Corr (dBµV)	Margin QP (dB)	Level AVG (dBµV)	Cable Loss (dB)	Level Corr (dBµV)	Limit AVG (dBµV)	Margin AVG (dB)
0.179	43.0	10.2	0.0	64.5	63.5	-11.3	27.5	10.2	37.7	54.5	-16.8
0.225	38.4	10.2	0.0	62.6	58.8	-14.1	26.5	10.2	36.7	52.6	-16.0
0.360	31.4	10.1	0.0	58.7	51.7	-17.2	30.1	10.1	40.2	48.7	-8.5
0.405	30.2	10.1	0.0	57.8	50.5	-17.4	26.3	10.1	36.4	47.8	-11.3
0.721	27.3	10.2	0.0	56.0	47.8	-18.5	24.0	10.2	34.2	46.0	-11.8
2.575	24.2	10.6	0.1	56.0	45.3	-21.2	19.5	10.6	30.1	46.0	-15.9
4.239	27.8	10.7	0.1	56.0	49.3	-17.5	19.9	10.7	30.8	46.0	-15.4
7.587	21.8	11.0	0.2	60.0	43.9	-27.2	18.4	11.0	29.6	50.0	-20.6

LINE 2 - PHASE

Frequency (MHz)	Level QP (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Limit QP (dBµV)	Level Corr (dBµV)	Margin QP (dB)	Level AVG (dBµV)	Cable Loss (dB)	Level Corr (dBµV)	Limit AVG (dBµV)	Margin AVG (dB)
0.179	43.2	10.2	0.0	64.5	53.4	-11.1	35.3	10.2	45.5	54.5	-9.0
0.225	37.6	10.2	0.0	62.6	47.8	-14.9	29.5	10.2	39.7	52.6	-13.0
0.360	33.3	10.1	0.0	58.7	43.4	-15.3	31.9	10.1	42.0	48.7	-6.7
0.405	30.7	10.1	0.0	57.8	40.8	-16.9	28.5	10.1	38.6	47.8	-9.1
0.721	26.9	10.2	0.0	56.0	37.1	-18.9	24.9	10.2	35.1	46.0	-10.9
2.575	28.4	10.6	0.1	56.0	39.0	-17.0	25.3	10.6	35.9	46.0	-10.1
4.239	24.7	10.7	0.1	56.0	35.6	-20.6	20.6	10.7	31.5	46.0	-14.7
7.587	17.5	11.0	0.2	60.0	28.7	-31.5	11.0	11.0	22.2	50.0	-28.0

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 measurement at the fundamental was made at 3m while the harmonics and spurious up to 30MHz were made a 2m or 1m. This was done to improve the identity of the detected emission.

The emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
125k – 30MHz	9kHz	>10 kHz
30M – 1000MHz	120kHz	>100 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.

Table 7. Radiated Emission Test Data, Fundamental Frequency Data

Frequency (MHz)	Ant. Angle Deg	Pos.	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)	Notes
0.250	320	Y	1.0	42.0	19.2	0.2	61.4	1174.4	96000.0	-38.2	2m
0.376	320	Y	1.0	43.0	19.2	0.2	62.4	1325.3	63863.8	-33.7	2m
0.622	320	Y	1.0	44.7	19.6	0.3	64.6	1708.0	3860.4	-7.1	1m
0.875	320	X	1.0	41.5	19.5	0.4	61.4	1177.6	2742.9	-7.3	1m
1.125	340	X	1.0	37.5	19.6	0.5	57.6	756.1	2133.3	-9.0	1m
1.377	340	X	1.0	34.7	19.5	0.5	54.7	544.1	1742.9	-10.1	1m
1.633	320	X	1.0	32.8	19.5	0.5	52.8	439.0	1469.7	-10.5	1m
0.125	0	Y	1.0	81.7	19.6	0.2	101.5	118590.4	192000.0	-4.2	3m
1.878	320	X	1.0	30.5	19.5	0.6	50.6	338.0	3000.0	-19.0	1m
2.124	340	X	1.0	28.5	19.5	0.6	48.6	269.2	3000.0	-20.9	1m
2.376	340	X	1.0	27.8	19.5	0.6	47.9	249.1	3000.0	-21.6	1m
2.625	340	X	1.0	27.1	19.5	0.6	47.2	230.3	3000.0	-22.3	1m
2.876	340	X	1.0	26.0	19.5	0.7	46.2	203.4	3000.0	-23.4	1m
3.125	340	X	1.0	25.8	19.5	0.7	46.0	199.1	3000.0	-23.6	1m

<30MHz normalized to 3m (40dB/decade)

Position: X = →
Y = ↑
Z = ●

Table 8. Radiated Emission Test Data, Low Frequency Data (<1GHz)

Freq (MHz)	Polarity H/V	Az Deg	Ant. Hght (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)
30.000	V	213.0	1.0	14.8	20.8	1.1	36.7	68.3	100.0	-3.3
37.370	V	166.0	1.0	16.4	15.2	1.2	32.8	43.7	100.0	-7.2
41.030	V	170.0	1.0	15.8	12.6	1.2	29.6	30.2	100.0	-10.4
48.360	V	65.0	1.4	18.9	8.4	1.3	28.5	26.7	100.0	-11.5
73.904	V	89.0	1.1	20.9	8.0	1.6	30.5	33.5	100.0	-9.5
79.648	V	195.0	1.0	23.8	7.7	1.7	33.2	45.6	100.0	-6.8
80.014	V	74.0	1.2	18.7	7.7	1.7	28.1	25.3	100.0	-11.9
84.032	V	138.0	1.3	17.0	7.5	1.7	26.2	20.3	100.0	-13.8
160.000	V	331.0	1.0	13.2	12.2	2.4	27.8	24.4	150.0	-15.8
210.040	V	4.0	1.3	16.4	10.5	2.7	29.6	30.2	150.0	-13.9
216.040	V	294.0	1.9	10.3	10.6	2.7	23.7	15.3	200.0	-22.3
300.000	V	139.0	1.0	7.1	13.5	3.4	24.0	15.8	200.0	-22.1
340.000	V	269.0	1.5	9.1	14.1	3.6	26.8	21.9	200.0	-19.2
350.062	V	202.0	1.1	12.5	14.4	3.6	30.6	33.7	200.0	-15.5
360.083	V	162.0	1.3	20.1	14.8	3.7	38.6	85.2	200.0	-7.4
440.000	V	115.0	1.4	7.0	16.8	4.2	28.0	25.0	200.0	-18.1
470.070	V	134.0	2.7	7.6	17.5	4.3	29.4	29.6	200.0	-16.6
37.370	H	165.0	4.0	8.1	15.2	1.2	24.5	16.8	100.0	-15.5
73.904	H	165.0	2.7	17.5	8.0	1.6	27.1	22.7	100.0	-12.9
160.000	H	81.0	3.3	18.5	12.2	2.4	33.1	45.0	150.0	-10.5
180.050	H	242.0	1.6	17.6	11.2	2.5	31.3	36.7	150.0	-12.2
190.000	H	229.0	1.8	13.0	11.3	2.5	26.8	22.0	150.0	-16.7
210.040	H	270.0	1.7	23.0	10.5	2.7	36.2	64.5	150.0	-7.3
216.040	H	268.0	1.7	13.1	10.6	2.7	26.5	21.1	200.0	-19.5
220.072	H	283.0	1.8	17.4	10.8	2.8	31.0	35.4	200.0	-15.0
300.000	H	184.0	1.6	6.4	13.5	3.4	23.3	14.6	200.0	-22.8
320.000	H	173.0	3.2	7.7	14.0	3.5	25.2	18.2	200.0	-20.8
340.000	H	135.0	1.4	16.5	14.1	3.6	34.2	51.3	200.0	-11.8
350.062	H	294.0	1.3	12.8	14.4	3.6	30.9	34.9	200.0	-15.2
360.083	H	158.0	1.1	22.1	14.8	3.7	40.6	107.2	200.0	-5.4
390.070	H	209.0	2.8	7.5	15.2	3.9	26.6	21.3	200.0	-19.5
440.000	H	233.0	2.0	9.5	16.8	4.2	30.5	33.3	200.0	-15.6
470.070	H	254.0	1.9	11.8	17.5	4.3	33.6	48.1	200.0	-12.4

