TÜVRheinland®
Precisely Right.

CONFIRMATION

of Product Conformity (QAL1)

Approved AMS:	LasIR
Manufacturer:	Unisearch Associates Inc. 96 Bradwick Drive Concord On L4K 1K8 Canada
Test Institute:	TÜV Rheinland Energie und Umwelt GmbH

This is to certify that the AMS has been tested and found to comply with:

EN 15267-1: 2009, EN 15267-2: 2009, EN 15267-3: 2007 and EN 14181: 2004

The approval of the measuring equipment subject to the above mentioned conditions was authorized by the German relevant body.
This confirmation is valid up to the official announcement in the Federal Gazette, but no longer than 6 months from the date of issue (see also the following pages).

TÜV Rheinland Energie und Umwelt GmbH
Cologne, 21 June 2013

i. A. Dipl.-Ing. R. Steinhagen

i. A. Dipl.-Ing. C. Röllig

www.umwelt-tuv.de / www.eco-tuv.com teu@umwelt-tuv.de Tel. +49 221 806-5200	TÜV Rheinland Energie und Umwelt GmbH Am Grauen Stein 51105 Cologne
Accreditation according to EN ISO/IEC 17025 and certified according to ISO 9001:2008.	

DECLARATION OF CONFORMITY

This Verification Certificate is hereby issued to the named GRANTEE and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below:

APPPLICATION OF COUNCIL DIRECTIVE(S):	**89/336/EEC - The EMC Directive**
APPLICANT:	Unisearch Associates Inc.
Equipment Type:	Electrical Equipment for Measurement, Control and Laboratory Use
Product Name:	LASIR
Model No.:	R-Series
Year of manufacture:	2006
Serial # :	

I, the undersigned, hereby, declare that the above device has been tested and found to comply with the following standard(s):

STANDARD(S) TO WHICH CONFORMITY IS DECLARED:	• **CISPR 11:2004 / EN 55011:2003, CLASS A, GROUP 1** - Limits and methods of measurements of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment. • **EN 61326:1997+A1:1998+A2:2001 (IEC 61326:2002)** - Electrical Equipment for Measurement, Control and Laboratory use- Electromagnetic Compatibility.
Test Laboratories:	Ultratech Engineering Labs Inc. Inc. 3000 Bristol Circle Oakville, Ontario, Canada L6H 6G4

Applicant:		**Legal Representative in Europe:**
Signature:		*Signature:*
Full Name:		*Full Name:*
Title:		*Title:*
Full Address:	96 Bradwick Drive Concord, Ontario Canada, L4K 1K8	*Full Address:*
Phone No.:	905-669-3547 ext. 362	*Phone No.:*
		Email Address:

Summary of Applicable Test Results

STANDARD	DESCRIPTION	SEVERITY APPLIED	PERFORMANCE CRITERIA MET	PERFORMANCE CRITERIA ALLOWED
IEC 61000-4-2 EN 61000-4-2	Electrostatic Discharge	▪ 4 kV Contact Discharge (Direct & Indirect) ▪ 8 kV Air Discharge	A A	B B
IEC 61000-4-3 EN61000-4-3 ENV 50204	Radiated RF Immunity	▪ 10 V/m, 80-1000 MHz, 1 kHz 80% AM Modulation ▪ 10 V/m. 900MHz, 200Hz Pulse Modulation	A A	A A
IEC 61000-4-4 EN 61000-4-4	Electrical Fast Transient	▪ ± 2kV on AC Lines ▪ ± 1 kV on I/O Lines > 3m	A A	B B
EN 61000-4-5 EN 61000-4-5	Surge Withstand Immunity	▪ ± 2 kV Common & ±1 kV Differential on AC Lines ▪ 1 kV Common model on I/O Lines > 30 m	A A	B B
IEC 61000-4-6 EN 61000-4-6	Conducted RF Immunity	▪ 3 V, 0.15-80 MHz, 1kHz 80% AM modulation on AC Lines ▪ 3 V, 0.15-80 MHz, 1kHz 80% AM modulation on I/O Lines	A A	A A
IEC 61000-4-8 EN 61000-4-8	Magnetic Field Immunity	▪ 50 Hz / 60 Hz, 30 A/m	A	A
IEC 61000-4-11 EN 61000-4-11	▪ Dips on AC Lines	▪ 100% for 0.5 cycles	A	C
IEC 61000-3-2 EN61000-3-2	Harmonic Current Emissions	▪ Class A ▪	PASS	PASS
IEC 61000-3-3 EN61000-3-3	Voltage Fluctuation and Flicker in Low-Voltage Supply Systems	▪ Voltage Fluctuation ▪ Flicker	PASS PASS	PASS PASS

VERIFICATION CERTIFICATE

NOT TRANSFERABLE

June 3, 2005

Unisearch Associates Inc.
96 Bradwick Drive
Concord, Ontario
Canada, L4K 1K8

Our File No.: UNI021-EN326-1

This Verification Certificate is hereby issued to the named GRANTEE and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below:

GRANTEE'S NAME:	**Unisearch Associates Inc.**
PRODUCT UNDER TEST:	**LASIR**
MODEL NO.:	**R-Series**
EQUIPMENT TYPE:	**Electrical Equipment for Measurement, Control and Laboratory Use**
APPLICABLE STANDARD:	**EN 61326:1997+A1:1998+A2:2001 (IEC 61326:2002) - Electrical Equipment for Measurement, Control and Laboratory Use- Electromagnetic Compatibility**

Note(s): *See attached report, UltraTech's File No.:* UNI021-EN326-1, *dated* June 3, 2005 *for details and conditions of Verification Compliance.*

Approved by: Tri M. Luu, P.Eng.
V.P. – Engineering

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050
Website: www.ultratech-labs.com Email: vic@ultratech-labs.com, Email: tri.luu@sympatico.ca

VERIFICATION CERTIFICATE

NOT TRANSFERABLE

This Verification Certificate is hereby issued to the named GRANTEE and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below:

GRANTEE:	Unisearch Associates Inc.
Address:	96 Bradwick Drive Concord, Ontario Canada, L4K 1K8
Contact Person:	Mr. Farhad Zibapour Phone #: 905-669-3547 ext. 362 Fax #: 905-669-8652 Email Address: zibapour@unisearch-associates.com
Equipment Type:	Class A, Group 1 - Industrial, Scientific and Medical Equipment
Product Name:	LASIR
Model No.:	R-Series
Year of manufacture:	2006
The above product was tested by UltraTech Engineering Labs Inc. and found to comply with:	European CISPR 11:2004 / EN 55011:1998 +A1:1999 & A2:2002

- **Note(s):** *See attached report, UltraTech's File No.:* UNI021-CISPR11A, *dated* June 3, 2005 *for details and conditions of Verification Compliance.*

Approved by: Tri M. Luu, P.Eng.
V.P. – Engineering

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THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

ETV

EPA
U.S. Environmental Protection Agency

Battelle
. . . Putting Technology To Work

ETV Joint Verification Statement

TECHNOLOGY TYPE:	**TUNABLE DIODE LASER (TDL) Gases Monitor**		
APPLICATION:	**MONITORING GASES EMISSION**		
TECHNOLOGY NAME:	**LasIR TDL Monitor**		
COMPANY:	**UNISEARCH Associates Inc.**		
ADDRESS:	**96 Bradwick Drive**		
	Concord, Ontario	**PHONE:**	**905-669-3547**
	Canada L4K1K8	**FAX:**	**905-669-8652**
WEB SITE:	**http://www.unisearch-associates.com**		
E-MAIL:	**gmckay@unisearch-associates.com**		

The U.S. Environmental Protection Agency (EPA) has created the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by substantially accelerating the acceptance and use of improved and cost-effective technologies. ETV seeks to achieve this goal by providing high quality, peer reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations; stakeholder groups which consist of buyers, vendor organizations, and permitters; and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

The Advanced Monitoring Systems (AMS) Center, one of 12 technology areas under ETV, is operated by Battelle in cooperation with EPA's National Exposure Research Laboratory. AMS has recently evaluated the performance of optical open-path monitors used to determine pollutants in outdoor air. This verification statement provides a summary of the test results for the UNISEARCH LasIR TDL Open-Path Monitor.

VERIFICATION TEST DESCRIPTION

The verification test described in this report was designed to challenge the LasIR in a manner similar to that which would be experienced in field operations. An optically transparent gas cell filled with known concentrations of a target gas (ammonia, HF, or methane) was inserted into the optical path of the monitor, simulating a condition where the target gas would be present in the ambient air. The monitor was challenged with a target gas, and the resulting measurement was compared to the known concentration of the target gas. The gases were measured in a fixed sequence over three days at a Battelle outdoor test site near West Jefferson, Ohio.

The target gases were measured at different concentrations, path lengths, integration times, and source intensities to assess the minimum detection limit (MDL), source strength linearity, concentration linearity, accuracy, precision, and sensitivity to atmospheric interferences of the LasIR. The MDL was calculated for each target gas by supplying pure nitrogen to the test cell the optical path of the monitor and taking a series of 25 measurements using an integration time of either 1 or 5 minutes. Source strength linearity was investigated by measuring the effects of reducing the source intensity on the monitor's performance. Concentration linearity was investigated by challenging the monitor with each target gas at concentrations ranging between 40 and 800 ppm while the path length and integration time were kept constant. Accuracy and precision of the monitor relative to the gas standards were verified by introducing known concentrations of the target gas into the cell. The effects of interfering gases were established by supplying the gas cell with a target gas and varying the distance (path length) between the source and detector.

Quality assurance (QA) oversight of verification testing was provided by Battelle and EPA. Battelle QA staff conducted a technical systems audit and a data quality audit of 10% of the test data. Battelle testing staff conducted a performance evaluation audit, which was reviewed by QA staff. EPA QA staff conducted an independent on-site technical system audit.

TECHNOLOGY DESCRIPTION

The LasIR uses a TDL to measure concentrations of HF, HCl, CH_4, H_2, CO, CO_2 , NH_3, C_2H_2, C_2H_4, NO, and NO_2. The LasIR controller houses the laser, its temperature and current control circuits, a reference cell used to lock the absorption feature to line center, an audit cell into which a known concentration of the gas being measured may be introduced for calibration purposes, and a computer to operate the system and process and store the measurement data. The controller can be placed indoors or outdoors and is connected by a fiber optic cable to the measurement sensors, which can be located kilometers away. A number of sensors can be operated from the controller simultaneously. The response of the system for most gases is in the range of a few parts per million per meter.The light from the laser, which is mounted, with its focusing optics, in a thermoelectric cooler, is transferred by a fiber optic cable to a telescope, through the open path, onto a retroreflector, and back to the telescope. About 10% of the light is split off before entering the telescope and directed through a small internal cell containing the gas being measured and then to the reference detector. This reference signal is used to lock the laser to the selected absorption feature and may also act as a transfer calibration standard.

VERIFICATION OF PERFORMANCE

Minimum Detection Limit: The LasIR exhibited detection limits of 0.09 and 1.21 ppm*m for methane, 0.13 to 0.23 ppm*m for HF, and 1.05 to 13.7 ppm*m for ammonia. In these field tests, there was no strong trend in detection limits with either path length or integration time for the target gases.

Source Strength Linearity: The tests of the LasIR to determine the effects of source strength showed that there was no consistent degradation of the monitor's performance with a decrease in source strength of up to 72%. The LasIR showed a maximum deviation of 0.019 ppm at a path-average concentration of approximately 0.454 ppm over 220 meters, under this range of source reduction.

Concentration Linearity: The concentration linearity results showed that the LasIR had a response slope of 1.00 and an r^2 value of 1.00 for methane over a gas cell concentration range of 40 to 800 ppm; a response slope of 0.71 and an r^2 value of 0.96 for HF over a gas cell concentration of 66 to 549 ppm; and a slope of 1.17 and an r^2 value of 0.99 for ammonia over a gas cell concentration of 75 to 494 ppm. In the case of the HF measurements, it should be noted that the HF concentration was determined by impinger sampling downstream of the optical cell. The potential for loss of HF introduces an uncertainty of about 30% in this comparison.

Accuracy: The percent relative accuracy for methane ranged between 0.02 and 12.2% at a 1.5-meter path length used to minimize the effect of atmospheric methane. The HF percent relative accuracy ranged between 5.1 and 28.7%, at a path length of 220 meters. The percent relative accuracy for ammonia ranged between 3.66 and 19.7% at the 220-meter path length.

Precision: Using a path length of 220 meters for HF and ammonia and 1.5 meters for methane, the LasIR exhibited precision in repetitive measurements of 0.63% RSD for methane, 1.19% RSD for HF, and 1.84% RSD for ammonia at target gas cell concentrations of 800, 549, and 494 ppm, respectively.

Interferences: Analysis of the effects of ambient water vapor and carbon dioxide on the LasIR's measurements showed no consistent effect of these species on the accuracy of measurement for methane and HF. The MDL for HF was reduced slightly with increased levels of H_2O and CO_2 in the light path.

Gabor J. Kovacs	Date
Vice President	
Environmental Sector	
Battelle	

Gary J. Foley	Date
Director	
National Exposure Research Laboratory	
Office of Research and Development	
U.S. Environmental Protection Agency	