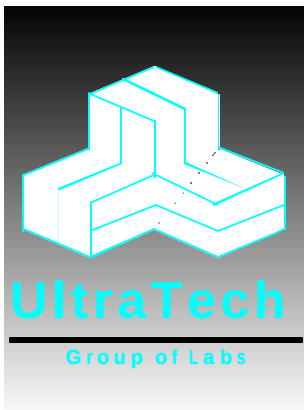




July 18, 2001

FEDERAL COMMUNICATIONS COMMISSION

7435 Oakland Mills Road
Columbia, MD 21046
USA

Subject: Type Acceptance Application under FCC CFR 47, Parts 2 and 90 (Subpart I) - Non-Broadcast Radio Transmitters Operating in the frequency bands 2450-2483.52 MHz.

Applicant: K&A Wireless, LLC
Product: VideoBlaster
Model: VBLAST2400
FCC ID: OPH-VBLAST2400

Dear Sir/Madam,

As appointed agent for **K&A Wireless, LLC**, we would like to submit the application to Federal Communications Commission for certification of the above product. Please review all necessary files uploaded to FCC OET site.

If you have any queries, please do not hesitate to contact us by our TOLL FREE number:

OUR TELEPHONE NO.: 1-877-765-4173

Yours truly,



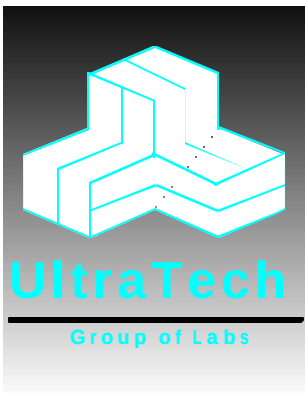
Tri Minh Luu, P. Eng.,
V.P., Engineering

TML/DH

Encl.

3000 Bristol Circle,
Oakville, Ontario, Canada
L6H 6G4

Telephone (905) 829-1570
Facsimile (905) 829-8050



July 18, 2001

K&A Wireless, LLC

2617 Juan Tabo, NE, Suite A
Albuquerque, NM
USA, 87112

Attn.: Mr. Kamil Agi

Subject: Certification Testing in accordance with FCC CFR 47, Parts 2 and 90 (Subpart I) - Non-Broadcast Radio Transmitters Operating in the frequency bands 2450-2483.52 MHz.

Product: VideoBlaster

Model: VBLAST2400

FCC ID: OPH-VBLAST2400

Dear Mr.Agi,

The product sample has been tested in accordance with **FCC CFR 47, Parts 2 and 90 (Subpart I) - Non-Broadcast Radio Transmitters Operating in the frequency bands 2450-2483.52 MHz**, and the results and observation were recorded in the engineering report, Our File No.: K&A-001F90

Enclosed you will find copy of the engineering report. If you have any queries, please do not hesitate to contact us.

Yours truly,



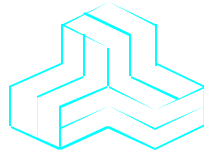
Tri Minh Luu, P.Eng
Vice President - Engineering

Encl.

3000 Bristol Circle,
Oakville, Ontario, Canada
L6H 6G4

Telephone (905) 829-1570
Facsimile (905) 829-8050

ENGINEERING TEST REPORT



VideoBlaster
Model No.: VBLAST2400
FCC ID: OPH-VBLAST2400

Applicant: **K&A Wireless, LLC**
2617 Juan Tabo, NE, Suite A
Albuquerque, NM
USA, 87112

Tested in Accordance With

Federal Communications Commission (FCC)
CFR 47, PARTS 2 and 90 (Subpart I)
Operating Frequency Band: 2450 – 2483.52 MHz

UltraTech's File No.: K&A-001F90

This Test report is Issued under the Authority of
Tri M. Luu, Professional Engineer,
Vice President of Engineering
UltraTech Group of Labs

Date: July 20, 2001



Report Prepared by: Tri M. Luu, P.Eng.

Tested by: Mr. Wayne Wu, EMI/EMC Engineer

Issued Date: July 18, 2001

Test Dates: July 06 -09, 2001

The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Telephone (905) 829-1570 Facsimile (905) 829-8050

Website: www.ultratech-labs.com Email: vhk.ultratech@sympatico.ca

TABLE OF CONTENTS

EXHIBIT 1. SUBMITTAL CHECK LIST.....	3
EXHIBIT 2. INTRODUCTION.....	4
2.1. SCOPE.....	4
2.2. RELATED SUBMITAL(S)/GRANT(S).....	4
2.3. NORMATIVE REFERENCES	4
EXHIBIT 3. PERFORMANCE ASSESSMENT.....	5
3.1. CLIENT INFORMATION.....	5
3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION	5
3.3. EUT'S TECHNICAL SPECIFICATIONS	6
3.4. LIST OF EUT'S PORTS.....	6
3.5. ANCILLARY EQUIPMENT	6
3.6. BLOCK DIAGRAM OF TEST SETUP	7
EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS.....	8
4.1. CLIMATE TEST CONDITIONS.....	8
4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS	8
EXHIBIT 5. SUMMARY OF TEST RESULTS	9
5.1. LOCATION OF TESTS	9
5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS.....	9
5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES.....	9
5.4. DEVIATION OF STANDARD TEST PROCEDURES	9
EXHIBIT 6. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS	10
6.1. TEST PROCEDURES.....	10
6.2. MEASUREMENT UNCERTAINTIES.....	10
6.3. MEASUREMENT EQUIPMENT USED:.....	10
6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER:.....	10
6.5. RF POWER OUTPUT @ FCC 2.1046 & 90.205.....	11
6.5.1. <i>Limits @ FCC 90.205(l)</i>	11
6.5.2. <i>Method of Measurements</i>	11
6.5.3. <i>Test Equipment List</i>	11
6.5.4. <i>Test Arrangement</i>	11
6.5.5. <i>Test Data</i>	12
CONDUCTED POWER.....	12
6.6. RF EXPOSURE REQUIRMENTS @ 1.1310 & 2.1091	13
6.7. FREQUENCY STABILITY @ FCC 2.1055 & 90.213	14
6.7.1. <i>Limits @ FCC 90.213</i>	14
6.7.2. <i>Method of Measurements</i>	14
6.7.3. <i>Test Equipment List</i>	14

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.7.4.	Test Arrangement	14
6.7.5.	Test Data	14
6.8.	EMISSION MASK @ FCC 2.1049, 90.208 & 90.210	15
6.8.1.	Limits @ FCC 90.209 & 90.210	15
6.8.2.	Method of Measurements	15
6.8.3.	Test Equipment List	15
6.8.4.	Test Arrangement	15
6.8.5.	Test Data	15
6.9.	TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS @ FCC 90.210	16
6.9.1.	Limits @ 90.210	16
6.9.2.	Method of Measurements	16
6.9.3.	Test Equipment List	16
6.9.4.	Test Arrangement	16
6.9.5.	Plots	17
6.9.6.	Test Data	17
6.10.	TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 90.210	18
6.10.1.	Limits @ FCC 90.210	18
6.10.2.	Method of Measurements	18
6.10.3.	Test Equipment List	18
	Test Data	19
EXHIBIT 7. MEASUREMENT UNCERTAINTY		21
7.1.	RADIATED EMISSION MEASUREMENT UNCERTAINTY	21
EXHIBIT 8. MEASUREMENT METHODS		22
8.1.	CONDUCTED POWER MEASUREMENTS	22
8.2.	MEASURING THE EIRP OF SPURIOUS/HARMONIC EMISSIONS USING SUBSTITUTION METHOD	23
8.3.	FREQUENCY STABILITY	25
8.4.	EMISSION MASK	26
8.5.	SPURIOUS EMISSIONS (CONDUCTED)	26

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check
--	Test Report	- Exhibit 1: Submittal check lists - Exhibit 2: Introduction - Exhibit 3: Performance Assessment - Exhibit 4: EUT Operation and Configuration during Tests - Exhibit 5: Summary of test Results - Exhibit 6: Measurement Data - Exhibit 7: Measurement Uncertainty - Exhibit 8: Measurement Methods	
1	Test Report - Plots of Measurement Data	Plots # 1to 18	
2	Test Setup Photos	Photos # 1 to 3	
3	External Photos of EUT	Photos # 1 to 3	
4	Internal Photos of EUT	Photos of 1 to 10	
5	Cover Letters	- Letter from Ultratech for Certification Request - Letter from the Applicant to appoint Ultratech to act as an agent - Letter from the Applicant to request for Confidentiality Filing	OK OK OK
6	Attestation Statements	Manufacturer's Declaration for Equipment Specifications, Installation (if it is professionally installed) and Production Quality Production Assurance.	N/A
7	ID Label/Location Info	ID Label Location of ID Label	
8	Block Diagrams	Block diagram # 1 of 1	
9	Schematic Diagrams	Schematic diagram # 1 of 1	OK
10	Parts List/Tune Up Info		
11	Operational Description		
12	RF Exposure Info		
13	Users Manual	Users Manual	OK

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 90
Title:	Telecommunication - Code of Federal Regulations, CFR 47, Parts 2 & 90
Purpose of Test:	To gain FCC Certification Authorization for Radio operating in the frequency bands 2450-2483.52 MHz .
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute 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.

2.2. RELATED SUBMITAL(S)/GRANT(S)

None

2.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	1999	Code of Federal Regulations – Telecommunication
ANSI C63.4	1992	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
CISPR 22 & EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1		Specification for Radio Disturbance and Immunity measuring apparatus and methods

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	K&A Wireless, LLC
Address:	2617 Juan Tabo, NE, Suite A Albuquerque, NM USA, 87112
Contact Person:	Mr. Kamil Agi Phone #: 505-338-2380 Fax #: 505-338-2380 Email Address: kagi@ka-wireless.com

MANUFACTURER	
Name:	K&A Wireless, LLC
Address:	2617 Juan Tabo, NE, Suite A Albuquerque, NM USA, 87112
Contact Person:	Mr. Kamil Agi Phone #: 505-338-2380 Fax #: 505-338-2380 Email Address: kagi@ka-wireless.com

3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	K&A Wireless, LLC
Product Name:	VideoBlaster
Model Name or Number:	VBLAST2400
Serial Number:	Pre-production
Type of Equipment:	Non-broadcast Radio Communication Equipment
External Power Supply:	6 Vdc battery
Transmitting/Receiving Antenna Type:	Non-integral Omni-directional, board-mounted disk antenna, Gain = 4 dBi nominal
Primary User Functions of EUT:	This modular radio transmitter is an FM video transmitter. It is integrated into the OEM Camera for Professional uses. The installation for this radio transmitter and its antenna into the FM Video camera is instructed by K&A Wireless in the way that its distance from the radio and antenna to the user's body and head no less than 4 cm for compliance with SAR limits for general uses.

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	[X] Portable [X] Mobile
Intended Operating Environment:	[X] Commercial
Power Supply Requirement:	6Vdc Alkaline battery
RF Output Power Rating:	28.5 dBm average (conducted) 35.4 dBm peak EIRP
Operating Frequency Range:	2450-2483.52 MHz
Number of Channel	2 channels (2459 MHz and 2475 MHz)
RF Output Impedance:	50 Ohms
Channel Spacing:	16 MHz
Occupied Bandwidth (99%):	4 MHz
Emission Designation*:	4M4F3F
Antenna Connector Type:	Non-integral Omni-directional, board-mounted disk antenna, Gain = 4 dBi nominal

3.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	RF Output port	1	SMA	Shielded 50 Ohm coaxial
2	Video input port	1	BNC	75 Ohm coaxial
3	DC input port	1	Permanently soldered wireleads	Non-shielded

3.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	Video Signal Generator
Brand name:	Fluke
Model Name or Number:	54200
Serial Number:	75 Ohm Coaxial
Connected to EUT's Port:	Video (NTSC) input

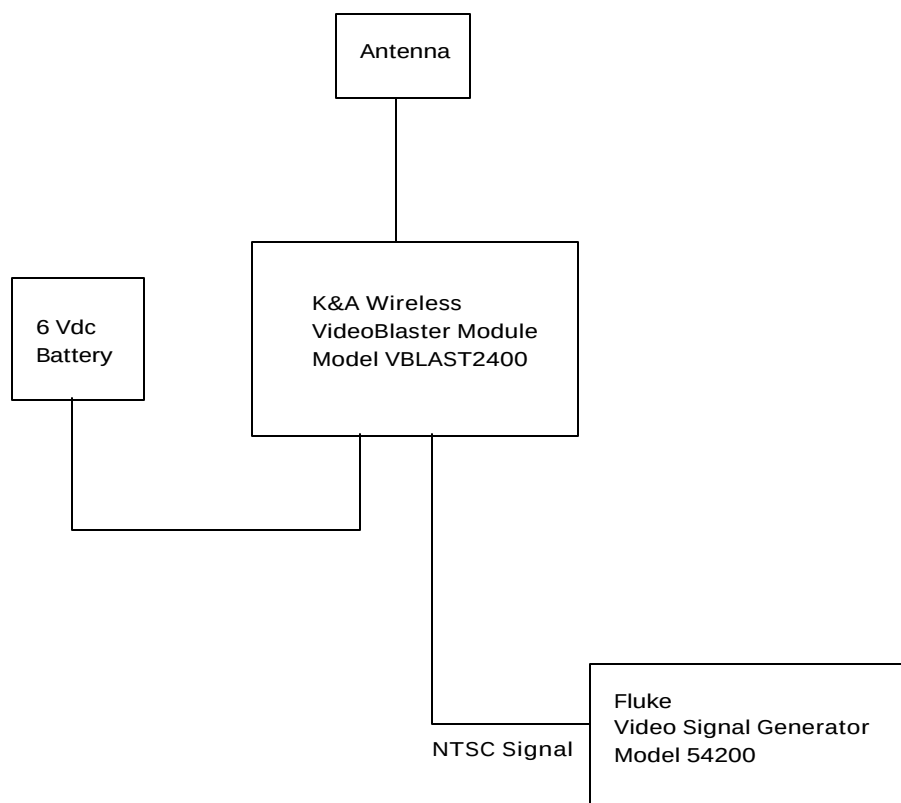
ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

3.6. BLOCK DIAGRAM OF TEST SETUP



This test equipment is removed from the test sit
to avoid interference with the measurements

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	6Vdc Alkaline battery

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier FM modulated with an external NTSC video signal
Special Test Software:	None
Special Hardware Used:	None
Transmitter Test Antenna:	The EUT is tested with the transmitter antenna port connected to its antenna

Transmitter Test Signals	
Frequency Band(s):	Near lowest, near middle & near highest frequencies in each frequency bands that the transmitter covers:
2450 – 2483.52 MHz band:	2459 & 2475 MHz
Transmitter Wanted Output Test Signals:	
RF Power Output (measured maximum output power):	28.5 dBm (conducted)
Normal Test Modulation	Video NTSC
Modulating signal source:	external

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 5. SUMMARY OF TEST RESULTS

5.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).
- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: May 02, 2001.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	APPLICABILITY (YES/NO)
90.205 & 2.1046	RF Power Output	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
90.213 & 2.1055	Frequency Stability	Yes
90.242(b)(8) & 2.1047(a)	Audio Frequency Response	Not applicable
90.210 & 2.1047(b)	Modulation Limiting	Not applicable
90.209 90.210 & 2.1049	Emission Limitation & Emission Mask	Yes
90.210, 2.1057 & 2.1051	Emission Limits - Spurious Emissions at Antenna Terminal	Yes
90.210, 2.1057 & 2.1053	Emission Limits - Field Strength of Spurious Emissions	Yes
VideoBlaster, Model No.: VBLAST2400, by K&A Wireless, LLC has also been tested and found to comply with FCC Part 15, Subpart B - Radio Receivers and Class B Digital Devices. The engineering test report has been documented and kept in file and it is available anytime upon FCC request.		

5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

5.4. DEVIATION OF STANDARD TEST PROCEDURES

None

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 6. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

6.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in Exhibit 8 of this report

6.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

6.3. MEASUREMENT EQUIPMENT USED:

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4:1992 and CISPR 16-1.

6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER:

The essential function of the EUT is to correctly communicate data to and from radios over RF link.

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.5. RF POWER OUTPUT @ FCC 2.1046 & 90.205

6.5.1. Limits @ FCC 90.205(I)

The maximum transmitter power is 5 Watts.

6.5.2. Method of Measurements

Refer to Exhibit 8, § 8.1 (Conducted) & 8.2 (Radiated) of this report for measurement details

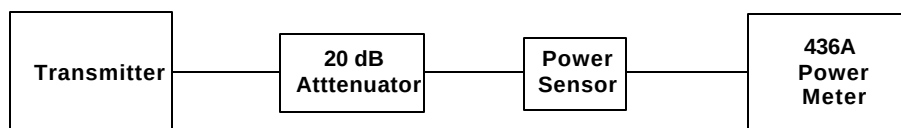
- The transmitter terminal was coupled to the power meter through a 20 dB attenuator
- Power of the transmitter channel near the lowest, middle and highest of each frequency block/band were measured using the power meter, and the reading was corrected by added the calibrated attenuator's attenuation value and cable loss.
- The RF Output was turned on with standard modulation applied.

6.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8546A	...	9 kHz to 5.6 GHz with built-in 30 dB Gain Pre-selector, QP, Average & Peak Detectors.
RF Amplifier	Com-Power	PA-102		1 MHz to 1 GHz, 30 dB gain nominal
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3155	9911-5955	1 GHz – 18 GHz
RF Signal Generator	Hewlett Packard	HP 83752B	3610A00457	0.01 – 20 GHz

6.5.4. Test Arrangement

Power at RF Power Output Terminals



For ERP test arrangement, refer to section 8.1 of this test report for details

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.5.5. Test Data

Conducted Power

Transmitter Channel Output	Fundamental Frequency (MHz)	Measured (Average) Power (dBm)	Power Rating (dBm)
Channel #1	2459	27.6	37.0
Channel #2	2475	28.5	37.0

ERP Using Substitution Method

Frequency (MHz)	Peak E-Field @ 3m (dBμV/m)	Antenna Polarization (V/H)	Peak Power From Signal GEN. Ps (dBm)	Substitution Antenna Gain G (dBi)	Measured Peak ERP = Ps+G-2.15 (dBm)	Measured Peak EIRP = Ps+G (dBm)
2459	128.2	V	26.2	9.2	33.3	35.4
2459	128.1	H	24.9	9.2	32.0	34.1
2475	127.9	V	25.8	9.2	32.9	35.0
2475	128.1	H	25.2	9.2	32.3	34.4

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.6. RF EXPOSURE REQUIRMENTS @ 1.1310 & 2.1091

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	Compliance with FCC Rules
SAR Tests for Portable Transmitters - Body Tissue - Brain Tissue	- Comply with SAR limits with body tissue with the distance of 4 cm from the EUT and its antenna to the phantom [Page # 3 of Installation Manual specifies the minimum RF Exposure Distance], please refer to SAR test report. - Page 10 of the Installation Manual specifies that the typical distance from the transmitter's antenna to head is about 13 inches. With this distance, the SAR value is not measurable, please refer to SAR test report
Installation instruction of the EUT and its antenna to OEM manufacturer for compliance with FCC SAR limits (1.6 W/Kg) for General Un-controlled Uses.	Please refer to page # 3 and 10 of the Installation Manual for installation instruction of the radio and its antenna for compliance with SAR requirements for general uses.

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.7. FREQUENCY STABILITY @ FCC 2.1055 & 90.213

6.7.1. Limits @ FCC 90.213

The frequency stability will be specified in the station authorization.

6.7.2. Method of Measurements

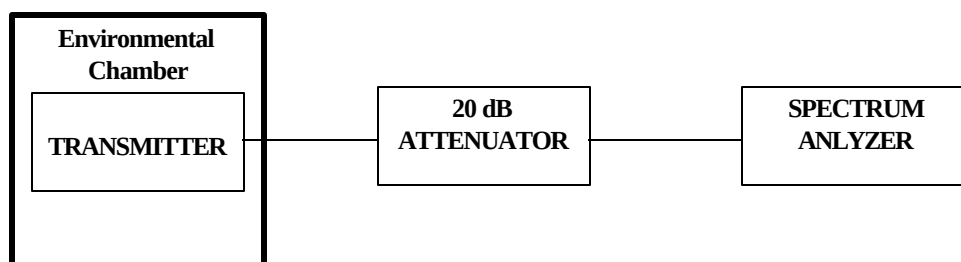
Refer to Exhibit 8, § 8.3 of this report for measurement details.

The frequency stability will be specified in the station authorization. For the purpose of compliance, the carrier frequency stability will be checked for out-of-band emissions at room temperature (20°C) and extreme temperatures (-30°C and +50°C).

6.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Attenuator(s)	Bird	..	...	DC – 22 GHz
Temperature & Humidity Chamber	Tenney	T5	9723B	-40° to +60 ° C range

6.7.4. Test Arrangement



6.7.5. Test Data

Conforms. At room temperature (20°C) and extreme temperature (-30°C and +50°C) conditions, the carrier frequencies were found to remain within the FCC permitted band 2450-2483.52 MHz. Please refer to Plots # 3 to 8 in Annex 1 for detailed measurements.

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.8. EMISSION MASK @ FCC 2.1049, 90.208 & 90.210

6.8.1. Limits @ FCC 90.209 & 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

Frequency Range (MHz)	FCC Applicable Mask
2450-2483.52	No emission is specified. The attenuation of $43 + 10 \cdot \log(P)$ in watts) outside the permitted band 2450-2483.52 MHz will be used for compliance evaluation.

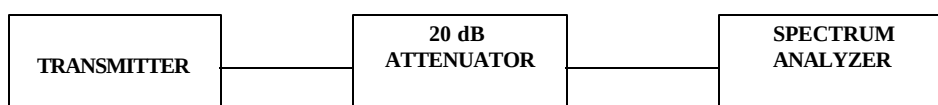
6.8.2. Method of Measurements

Refer to Exhibit 8, § 8.4 of this report for measurement details

6.8.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Attenuator(s)	Bird	..	...	DC – 22 GHz
Audio Oscillator	Hewlett Packard	HP 204C	0989A08798	DC to 1.2 MHz

6.8.4. Test Arrangement



6.8.5. Test Data

Conform. Tests were repeated at room temperature (20°C) and extreme temperatures (-30 °C and +50 °C)

Please refer to Plots # 3 through # 8 in Annex 1 for Details of measurements

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.9. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS @ FCC 90.210

6.9.1. Limits @ 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Frequency Range	Attenuation Limit (dBc)
90.210	10 MHz to Lowest frequency of the radio to 10 th harmonic of the highest frequency of the radio	$43+10*\log(P \text{ in Watts})$

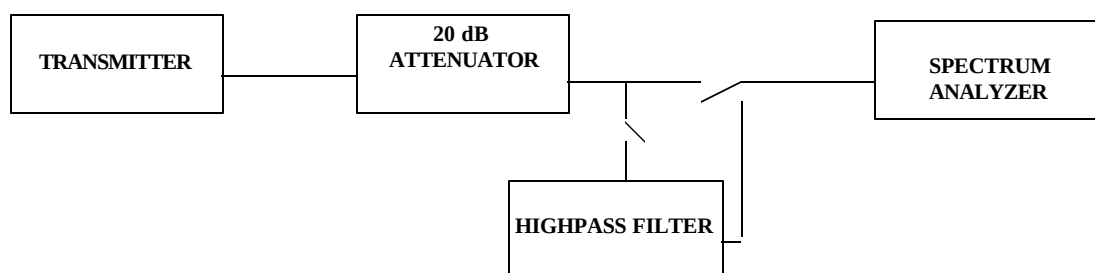
6.9.2. Method of Measurements

Refer to Exhibit 8 § 8.5 of this report for measurement details

6.9.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Attenuator(s)	Bird	..	...	DC – 22 GHz
Audio Oscillator	Hewlett Packard	HP 204C	0989A08798	DC to 1.2 MHz
Highpass Filter, Microphase	Microphase	CR220HID	IITI11000AC	Cut-off Frequency at 600 MHz, 1.3 GHz or 4 GHz

6.9.4. Test Arrangement



ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.9.5. Plots

Please refer to plots # 9 through # 14 in Annex 1 for details of measurements

6.9.6. Test Data

6.9.6.1. Channel #1 (2459 MHz)

Fundamental Frequency: 2459 MHz					
RF Output Power: 27.6 dBm (conducted)					
Modulation: FM modulation with NTSC Video signal					
FREQUENCY (MHz)	TRANSMITTER CONDUCTED ANTENNA EMISSIONS		LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
	(dBm)	(dBc)			
516.00	-23.6	-51.2	-40.6	-10.6	PASS
1961.00	-17.2	-44.8	-40.6	-4.2	PASS
2971.00	-18.6	-46.2	-40.6	-5.6	PASS
4918.00	-22.1	-49.7	-40.6	-9.1	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions within 20 dB below the limits were recorded.					

6.9.6.2. Channel # 2 (2475 MHz)

Fundamental Frequency: 2475 MHz					
RF Output Power: 28.5 dBm (conducted)					
Modulation: FM modulation with NTSC Video signal					
FREQUENCY (MHz)	TRANSMITTER CONDUCTED ANTENNA EMISSIONS		LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
	(dBm)	(dBc)			
509.00	-26.4	-54.9	-41.5	-13.4	PASS
1975.00	-21.9	-50.4	-41.5	-8.9	PASS
2971.00	-22.3	-50.8	-41.5	-9.3	PASS
4950.00	-22.3	-50.8	-41.5	-9.3	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions within 20 dB below the limits were recorded.					

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.10. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 90.210

6.10.1. Limits @ FCC 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Frequency Range	Attenuation Limit (dBc)
90.210	10 MHz to Lowest frequency of the radio to 10 th harmonic of the highest frequency of the radio	$43+10*\log(P \text{ in Watts})$

6.10.2. Method of Measurements

Refer to Exhibit 8, § 8.2 of this report for measurement details

6.10.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8546A	...	9 kHz to 5.6 GHz with built-in 30 dB Gain Pre-selector, QP, Average & Peak Detectors.
RF Amplifier	Com-Power	PA-102		1 MHz to 1 GHz, 30 dB gain nominal
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz, 30 dB nominal
Biconilog Antenna	EMCO	3142	10005	30 MHz to 2 GHz
Dipole Antenna	EMCO	3121C	8907-434	30 GHz – 1 GHz
Dipole Antenna	EMCO	3121C	8907-440	30 GHz – 1 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3155	9911-5955	1 GHz – 18 GHz
RF Signal Generator	Hewlett Packard	HP 83752B	3610A00457	0.01 – 20 GHz

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

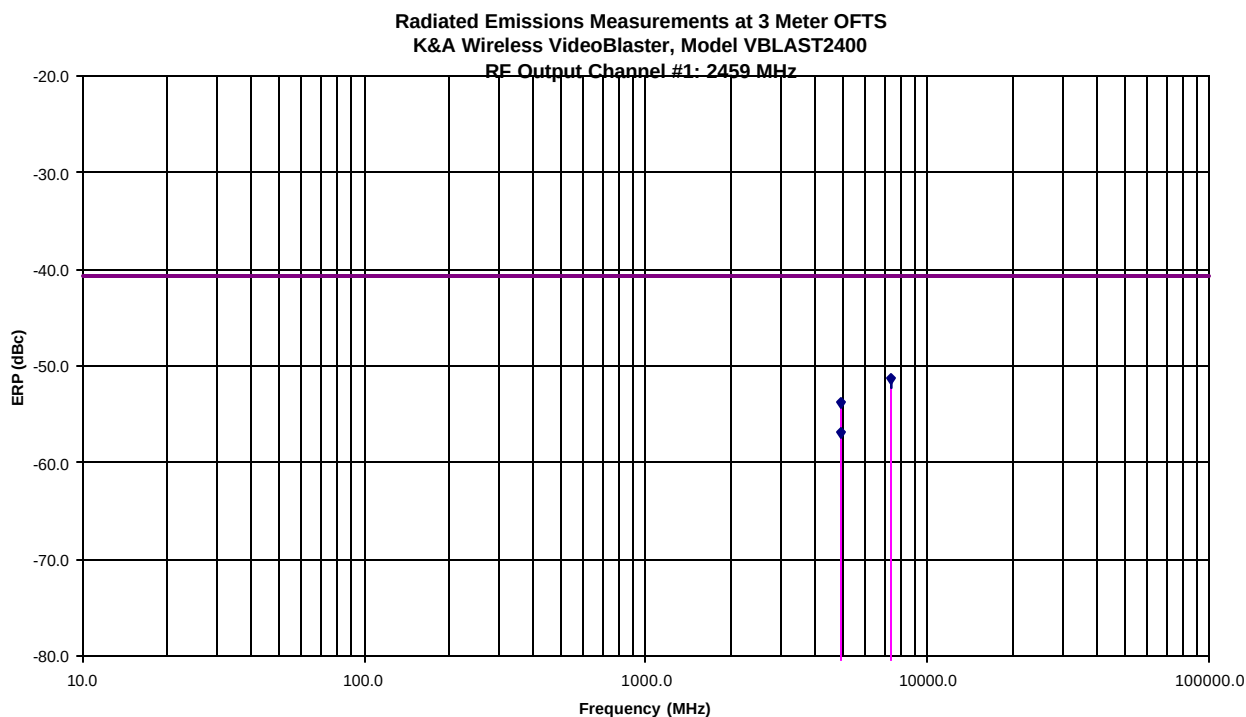
Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.10.4. Test Data

6.10.4.1. Near Lowest Frequency (2459 MHz)

Fundamental Frequency:		2459 MHz					
RF Output Power:		27.6dBm (conducted)					
Modulation:		FM modulation with 2.5 kHz sine wave signal					
FREQUENCY (MHz)	ERP measured by Substitution Method (dBm) (dBc)		EMI DETECTOR (Peak/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBc)	MARGIN (dB)	PASS/FAIL
2459.00	33.3	--	PEAK	V	--	--	PASS
2459.00	32.0	--	PEAK	H	--	--	PASS
4918.00	-20.4	-53.8	PEAK	V	-40.6	-13.2	PASS
4918.00	-23.5	-56.9	PEAK	H	-40.6	-16.3	PASS
7377.00	-18.5	-51.9	PEAK	V	-40.6	-11.3	PASS
7377.00	-17.9	-51.3	PEAK	H	-40.6	-10.7	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions within 20 dB below the limits were recorded.							



ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

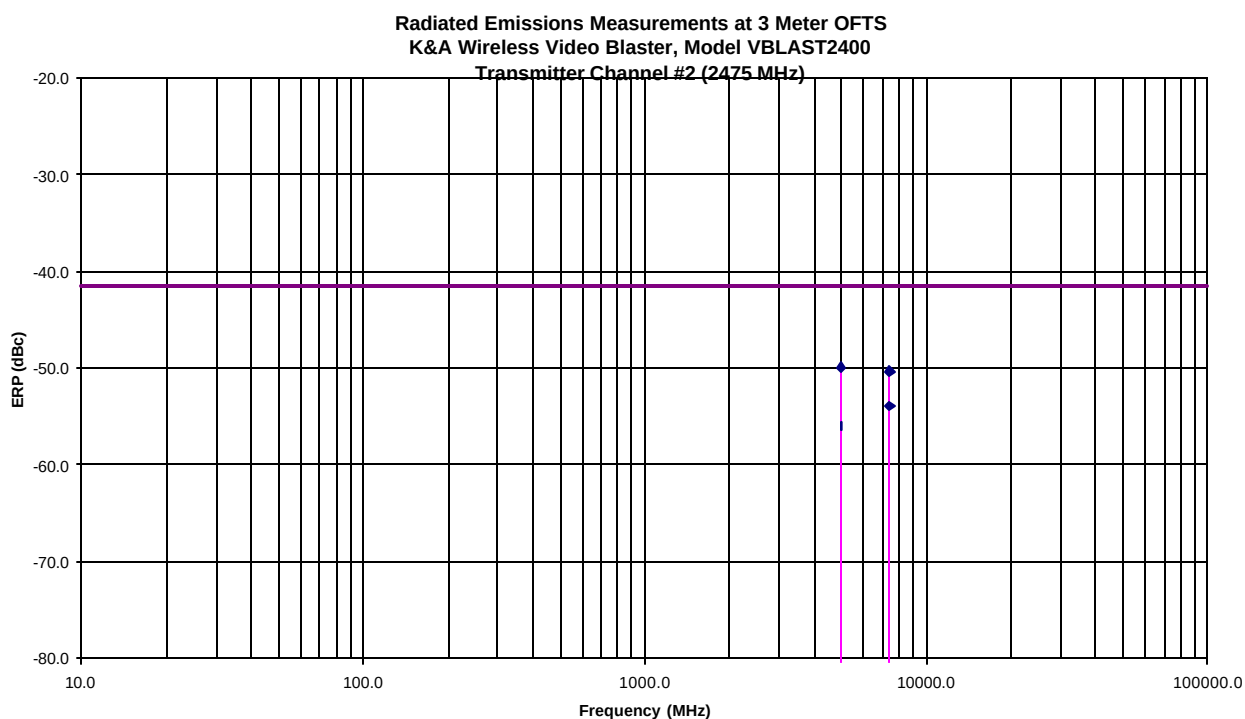
File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.10.4.2. Near Highest Frequency (2475 MHz)

Fundamental Frequency:		2459 MHz					
RF Output Power:		28.5dBm (conducted)					
Modulation:		FM modulation with 2.5 kHz sine wave signal					
FREQUENCY (MHz)	ERP measured by Substitution Method		EMI DETECTOR (Peak/QP)	ANTENNA POLARIZATION (H/V)	LIMIT (dBc)	MARGIN (dB)	PASS/ FAIL
2475.00	32.9	--	PEAK	V	--	--	PASS
2475.00	32.3	--	PEAK	H	--	--	PASS
4950.00	-17.0	-49.9	PEAK	V	-41.5	-8.4	PASS
4950.00	-23.0	-55.9	PEAK	H	-41.5	-14.4	PASS
7425.00	-17.4	-50.3	PEAK	V	-41.5	-8.8	PASS
7425.00	-21.0	-53.9	PEAK	H	-41.5	-12.4	PASS
The emissions were scanned from 10 MHz to 25 GHz and all emissions within 20 dB below the limits were recorded.							



ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY ($\pm$ dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	± 1.0	± 1.0
Cable Loss Calibration	Normal (k=2)	± 0.3	± 0.5
EMI Receiver specification	Rectangular	± 1.5	± 1.5
Antenna Directivity	Rectangular	$+0.5$	$+0.5$
Antenna factor variation with height	Rectangular	± 2.0	± 0.5
Antenna phase center variation	Rectangular	0.0	± 0.2
Antenna factor frequency interpolation	Rectangular	± 0.25	± 0.25
Measurement distance variation	Rectangular	± 0.6	± 0.4
Site imperfections	Rectangular	± 2.0	± 2.0
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67(\text{Bi}) 0.3 (\text{Lp})$ Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$	U-Shaped	$+1.1$ -1.25	± 0.5
System repeatability	Std. Deviation	± 0.5	± 0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	$+2.19 / -2.21$	$+1.74 / -1.72$
Expanded uncertainty U	Normal (k=2)	$+4.38 / -4.42$	$+3.48 / -3.44$

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 8. MEASUREMENT METHODS

8.1. CONDUCTED POWER MEASUREMENTS

The following shall be applied to the combination(s) of the radio device and its intended antenna(e).

- If the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
- The following method of measurement shall apply to both conducted and radiated measurements.

The radiated measurements are performed at the Ultratech Calibrated Open Field Test Site.

The measurement shall be performed using normal operation of the equipment with modulation.

Test procedure shall be as follows:

Step 1: Duty Cycle measurements if the transmitter's transmission is transient

Using a EMI Receiver with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;

The duty cycle of the transmitter, $x = \text{Tx on} / (\text{Tx on} + \text{Tx off})$ with $0 < x < 1$, is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.

Step 2: Calculation of Average EIRP. See Figure 1

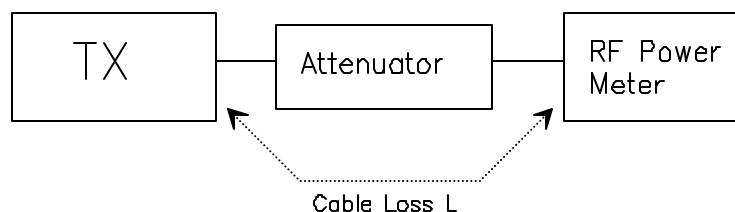
The average output power of the transmitter shall be determined using a wideband, calibrated RF average power meter with the power sensor with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);

The e.i.r.p. shall be calculated from the above measured power output "A", the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:

$$\text{EIRP} = A + G + 10\log(1/x)$$

$$\{ X = 1 \text{ for continuous transmission } \Rightarrow 10\log(1/x) = 0 \text{ dB} \}$$

Figure 1.



ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90

July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)

Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)

Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

8.2. MEASURING THE EIRP OF SPURIOUS/HARMONIC EMISSIONS USING SUBSTITUTION METHOD

- (a) Set the EMI Receiver (for measuring E-Field) and Receiver #2 (for measuring EIRP) as follows:

Center Frequency:	equal to the signal source
Resolution BW:	10 kHz
Video BW:	same
Detector Mode:	positive
Average:	off
Span:	3 x the signal bandwidth

- (b) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level

Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
 $E \text{ (dBuV/m)} = \text{Reading (dBuV)} + \text{Total Correction Factor (dB/m)}$

- (c) Select the frequency and E-field levels obtained in the Section 8.2.1 for ERP/EIRP measurements.

- (d) Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):

- DIPOLE antenna for frequency from 30-1000 MHz or
- HORN antenna for frequency above 1 GHz }.

- (e) Mount the transmitting antenna at 1.5 meter high from the ground plane.

- (f) Use one of the following antenna as a receiving antenna:

- DIPOLE antenna for frequency from 30-1000 MHz or
- HORN antenna for frequency above 1 GHz }.

- (g) If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.

- (h) Adjust both transmitting and receiving antenna in a VERTICAL polarization.

- (i) Tune the EMI Receivers to the test frequency.

- (j) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.

- (k) The transmitter was rotated through 360° about a vertical axis until a higher maximum signal was received.

- (l) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.

- (m) Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.

- (n) Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:

$$P = P1 - L1 = (P2 + L2) - L1 = P3 + A + L2 - L1$$

$$EIRP = P + G1 = P3 + L2 - L1 + A + G1$$

$$ERP = EIRP - 2.15 \text{ dB}$$

$$\text{Total Correction factor in EMI Receiver \# 2} = L2 - L1 + G1$$

Where: P: Actual RF Power fed into the substitution antenna port after corrected.

P1: Power output from the signal generator

P2: Power measured at attenuator A input

P3: Power reading on the Average Power Meter

EIRP: EIRP after correction

ERP: ERP after correction

- (o) Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)

Repeat step (d) to (o) for different test frequency

- (p) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90

July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)

Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)

Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

- (q) Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port.
Correct the antenna gain if necessary.:

Figure 2

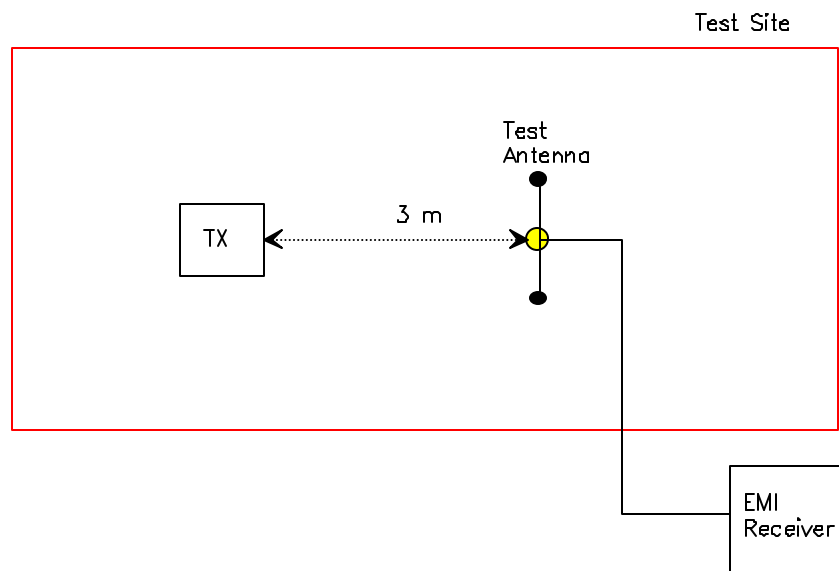
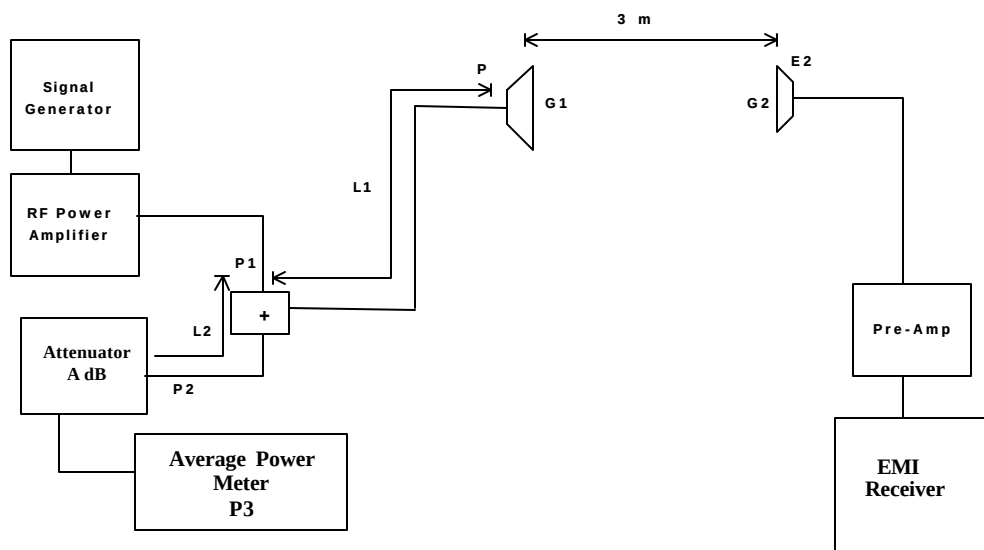


Figure 3



ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

8.3. FREQUENCY STABILITY

Refer to FCC @ 2.1055.

- (a) The frequency stability shall be measured with variation of ambient temperature as follows: From -30 to +50 centigrade except that specified in subparagraph (2) & (3) of this paragraph.
- (b) Frequency measurements shall be made at extremes of the specified temperature range and at intervals of not more than 10 centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short-term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stability circuitry need be subjected to the temperature variation test.
- (d) The frequency stability supply shall be measured with variation of primary supply voltage as follows:
 - (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
 - (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.
 - (3) The supply voltage shall be measured at the input to the cable normally provide with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.
- (e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment).

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

8.4. EMISSION MASK

Voice or Digital Modulation Through a Voice Input Port @ 2.1049(c)(i):- The transmitter was modulated by a 2.5 KHz tone signal at an input level 16 dB greater than that required to produce 50% modulation (e.g.: ± 2.5 KHz peak deviation at 1 KHz modulating frequency). The input level was established at the frequency of maximum response of the audio modulating circuit.

Digital Modulation Through a Data Input Port @ 2.1049(h):- Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the Emission Masks shall be shown for operation with any devices used for modifying the spectrum when such devices are operational at the discretion of the user.

The following EMI Receiver bandwidth shall be used for measurement of Emission Mask/Out-of-Band Emission Measurements:

For 25 kHz Channel Spacing: RBW = 300 Hz

For 12.5 kHz or 6.25 kHz Channel Spacings: RBW = 100 Hz

The all cases the Video Bandwidth shall be equal or greater than the measuring bandwidth.

8.5. SPURIOUS EMISSIONS (CONDUCTED)

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.1049, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the EMI Receiver controls set as RBW = 30 kHz minimum, VBW $\geq$ RBW and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC CFR 47, Para. 2.1057 - Frequency spectrum to be investigated:- The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10th harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.1051 - Spurious Emissions at Antenna Terminal:- The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of the harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: K&A-001F90
July 18, 2001

Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
Recognized/Listed by FCC (USA)

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)