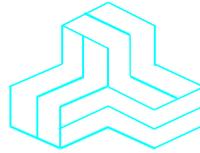


ENGINEERING TEST REPORT



VHF Marine Transceiver
Model No.: IC-M2A
FCC ID: AFJIC-M2A

Applicant: **Icom Incorporated**
1-1-32, Kamiminami
Hirano-Ku, Osaka
Japan, 547-0003

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, PARTS 2 and 80

UltraTech's File No.: ICOM32-FTX

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

Date:



Report Prepared by: Dan Huynh

Tested by: Hung Trinh, RFI/EMI Technician

Issued Date: November 5, 2001

Test Dates: October 13 - 15, 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.....	1
EXHIBIT 2.	INTRODUCTION	2
2.1.	SCOPE	2
2.2.	RELATED SUBMITTAL(S)/GRANT(S)	2
2.3.	NORMATIVE REFERENCES	2
EXHIBIT 3.	PERFORMANCE ASSESSMENT	3
3.1.	CLIENT INFORMATION	3
3.2.	EQUIPMENT UNDER TEST (EUT) INFORMATION	3
3.3.	EUT'S TECHNICAL SPECIFICATIONS	4
3.4.	LIST OF EUT'S PORTS	4
EXHIBIT 4.	EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS	5
4.1.	CLIMATE TEST CONDITIONS.....	5
4.2.	OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS.....	5
EXHIBIT 5.	SUMMARY OF TEST RESULTS	6
5.1.	LOCATION OF TESTS	6
5.2.	APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS	6
5.3.	MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES	6
EXHIBIT 6.	MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS.....	7
6.1.	TEST PROCEDURES	7
6.2.	MEASUREMENT UNCERTAINTIES	7
6.3.	MEASUREMENT EQUIPMENT USED.....	7
6.4.	ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER.....	7
6.5.	RF POWER OUTPUT [47 CFR §§ 2.1046 & 80.215].....	8
6.5.1.	<i>Limits @ FCC 80.215</i>	8
6.5.2.	<i>Method of Measurements</i>	8
6.5.3.	<i>Test Equipment List</i>	8
6.5.4.	<i>Test Arrangement</i>	8
6.5.5.	<i>Test Data</i>	9
6.6.	AUDIO FREQUENCY RESPONSE [47 CFR §§ 2.1047(A) & 80.213]	10
6.6.1.	<i>Limits @ 47 CFR §§ 2.1047(a) & 80.213</i>	10
6.6.2.	<i>Method of Measurements</i>	10
6.6.3.	<i>Test Equipment List</i>	10
6.6.4.	<i>Test Arrangement</i>	10
6.6.5.	<i>Test Data</i>	11
6.7.	MODULATION LIMITING [47 CFR §§ 2.1047(B) & 80.213]	13
6.7.1.	<i>Limits @ 47 CFR §80.213</i>	13
6.7.2.	<i>Method of Measurements</i>	13
6.7.3.	<i>Test Equipment List</i>	13
6.7.4.	<i>Test Arrangement</i>	13

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 #: ICOM32-FTX
November 5, 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)

6.7.5.	Test Data.....	14
6.8.	OCCUPIED BANDWIDTH AND EMISSION LIMITATIONS/MASKS [47 CFR §§2.1049, 80.205 & 80.211]	16
6.8.1.	Limits @ 47 CFR §80.211(f)	16
6.8.2.	Method of Measurements.....	16
6.8.3.	Test Equipment List	16
6.8.4.	Test Arrangement	16
6.8.5.	Test Data.....	17
6.9.	SPURIOUS EMISSIONS AT ANTENNA TERMINAL [47 CFR § 2.1051].....	21
6.9.1.	Limits @ 47 CFR § 80.211(f)	21
6.9.2.	Method of Measurements.....	21
6.9.3.	Test Equipment List	21
6.9.4.	Test Arrangement	21
6.9.5.	Test Data.....	22
6.10.	FIELD STRENGTH OF SPURIOUS RADIATION [47 CFR §2.1051].....	30
6.10.1.	Limits @ 47 CFR § 80.211(f)	30
6.10.2.	Method of Measurements.....	30
6.10.3.	Test Equipment List	30
6.10.4.	Test Arrangement	30
6.10.5.	Test Data.....	31
6.11.	FREQUENCY STABILITY [47 CFR §§ 2.1055 & 80.209].....	33
6.11.1.	Limits @ 47 CFR §80.209.....	33
6.11.2.	Method of Measurements.....	33
6.11.3.	Test Equipment List	33
6.11.4.	Test Arrangement	33
6.11.5.	Test Data.....	34
6.12.	RF RADIATION EXPOSURE EVALUATION [47 CFR §§ 2.1093 & 80.227].....	35
EXHIBIT 7.	MEASUREMENT UNCERTAINTY.....	36
7.1.	RADIATED EMISSION MEASUREMENT UNCERTAINTY	36
EXHIBIT 8.	MEASUREMENT METHODS.....	37
8.1.	CONDUCTED POWER MEASUREMENTS	37
8.2.	RADIATED POWER MEASUREMENTS (ERP & EIRP) USING SUBSTITUTION METHOD	38
8.2.1.	Maximizing RF Emission Level (E-Field).....	38
8.2.2.	Measuring the EIRP of Spurious/Harmonic Emissions Using Substitution Method	39
8.3.	EMISSION MASK	41
8.4.	SPURIOUS EMISSIONS (CONDUCTED)	41
8.5.	FREQUENCY STABILITY	42

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 #: ICOM32-FTX
November 5, 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 (OK)
--	Test Report	<ul style="list-style-type: none"> • 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 	OK
1	Test Setup Photos	Radiated Emissions Test Setup Photos	OK
2	External EUT Photos	IC-M2A External Photos	OK
3	Internal EUT Photos	IC-M2A Internal Photos	OK
4	Cover Letters	<ul style="list-style-type: none"> • 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
5	Attestation Statements	--	--
6	ID Label/Location Info	<ul style="list-style-type: none"> • ID Label • Location of ID Label 	OK
7	Block Diagram(s)	IC-M2A Block Diagram	OK
8	Schematic Diagram(s)	IC-M2A Schematics	OK
9	Parts List/Tune Up Info	<ul style="list-style-type: none"> • IC-M2A Parts List • Alignment 	OK
10	Operational Description	Circuit Description	OK
11	RF Exposure Info	SAR Test Report	OK
12	Users Manual	VHF Marine Transceiver IC-M2A Instruction Manual	OK

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 #: ICOM32-FTX
November 5, 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:	47 CFR Parts 2 and 80
Title:	Telecommunication – 47 Code of Federal Regulations, Parts 2 & 80
Purpose of Test:	To gain FCC Certification Authorization for Radio operating in the frequency band 156.050 - 157.425 MHz (25 kHz Channel Spacing).
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 SUBMITTAL(S)/GRANT(S)

None

2.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19, 80-End	2000	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: yhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: ICOM32-FTX
November 5, 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:	Icom Incorporated
Address:	1-1-32, Kamiminami Hirano-Ku, Osaka Japan, 547-0003
Contact Person:	Mr. Takashi Aoki Phone #: +81-66-793-5302

MANUFACTURER	
Name:	Icom Incorporated
Address:	1-1-32, Kamiminami Hirano-Ku, Osaka Japan, 547-0003
Contact Person:	Mr. Takashi Aoki Phone #: +81-66-793-5302

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:	Icom Incorporated
Product Name:	VHF Marine Transceiver
Model Name or Number:	IC-M2A
Serial Number:	Test Sample
Type of Equipment:	Licensed Non-Broadcast Transmitter Held to Face
External Power Supply:	N/A
Transmitting/Receiving Antenna Type:	Non-integral

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 #: ICOM32-FTX
November 5, 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:	<input checked="" type="checkbox"/> Portable <input type="checkbox"/> Mobile <input type="checkbox"/> Base station (fixed use)
Intended Operating Environment:	<input checked="" type="checkbox"/> Commercial <input checked="" type="checkbox"/> Light Industry & Heavy Industry
Power Supply Requirement:	7.2 Vdc (Icom Ni-Cd battery pack)
RF Output Power Rating:	1, 3 and 5 Watts (Switchable)
Operating Frequency Range:	156.050 – 157.425 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	25 kHz
Class of Emission:	G3E
Emission Designation*:	16K0G3E
Occupied Bandwidth (99%):	14.43 kHz
Antenna Connector Type:	J Connector
Antenna Description:	Manufacturer: Icom Type: 1/4 wave whip antenna (Rubber Duck antenna) Model: FA-SC56A Frequency Range: 150-174Mhz In/Out Impedance: 50 Ohms Gain: Less than 0dB

* For an average case of commercial telephony, the Necessary Bandwidth is calculated as follows:

For FM Voice Modulation:

Channel Spacing = 25 kHz, D = 5 kHz max., K = 1, M = 3 kHz

$$B_n = 2M + 2DK = 2(3) + 2(5)(1) = \underline{16 \text{ kHz}}$$

Emission Designation: 16K0G3E

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	Antenna Connector	1	J Connector	N/A

NOTE:

Ports of the EUT which in normal operation were connected to ancillary equipment through interconnecting cables via a representative interconnecting cable to simulate the input/output characteristics. RF input/output was correctly terminated to the 50 Ω RF Load.

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 #: ICOM32-FTX
November 5, 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:	7.2 Vdc (Icom Ni-Cd battery pack)

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	None
Special Hardware Used:	None
Transmitter Test Antenna:	The EUT is tested with the transmitter antenna fitted for intended use or terminated with 50 Ω load.

Transmitter Test Signals	
Frequency Band(s):	Near lowest and near highest frequencies of each frequency band(s) that the transmitter covers:
<ul style="list-style-type: none"> ▪ 156.050 - 157.425 MHz 	<ul style="list-style-type: none"> ▪ 156.050 and 157.425 MHz
Transmitter Wanted Output Test Signals:	
<ul style="list-style-type: none"> ▪ RF Power Output (measured maximum output power): ▪ Normal Test Modulation: ▪ Modulating Signal Source: 	<ul style="list-style-type: none"> 5 Watts FM modulation with 2.5 kHz sine wave signal. External

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 #: ICOM32-FTX
November 5, 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.

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 site 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: August 8, 2001.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

47 CFR SECTIONS	TEST REQUIREMENTS	APPLICABILITY (YES/NO)
2.1046 & 80.215	RF Power Output	Yes
2.1047(a) & 80.213	Audio Frequency Response	Yes
2.1047(b) & 80.213	Modulation Limiting	Yes
2.1049, 80.205 & 80.211	Occupied Bandwidth & Emission Limitations/Masks	Yes
2.1051 & 2.1057	Spurious Emissions at Antenna Terminal	Yes
2.1053 & 2.1057	Field Strength of Spurious Radiation	Yes
2.1055 & 80.209	Frequency Stability	Yes
2.1093 & 80.227	Radiofrequency Radiation Exposure Evaluation	Yes

VHF Marine Transceiver, Model No.: IC-M2A, by Icom Incorporated has also been tested and found to comply with FCC Part 15, Subpart B - Radio Receivers and Class A 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

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 #: ICOM32-FTX
November 5, 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 #: ICOM32-FTX
November 5, 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 [47 CFR §§ 2.1046 & 80.215]

6.5.1. Limits @ FCC 80.215

Please refer to 47 CFR §80.215 for details

6.5.2. Method of Measurements

Refer to Exhibit 8, section 8.1 (conducted) and 8.2 (radiated) of this report for measurement details

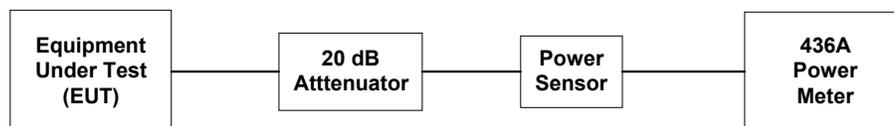
- The transmitter terminal was coupled to the power meter through a 20 dB attenuator
- Power of the transmitter channel near the lowest and highest of each frequency block/band were measured using the power meter, and the reading was corrected by added the calibrated attenuator's attenuation value and 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
Power Meter	Hewlett Packard	436A	1725A02249	10 kHz – 50 GHz, sensor dependent
Power Sensor	Hewlett Packard	8481A	2702A68983	10 MHz – 18 GHz
Attenuator(s)	Bird	...	...	DC – 22 GHz
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz – 26.5 GHz
Attenuator(s)	Weinschel Corp	24-20-34	BJ2357	DC – 8.5 GHz
Dipole Antenna	EMCO	3121C	8907-440	30 MHz – 1 GHz
Dipole Antenna	EMCO	3121C	8907-434	30 MHz – 1 GHz
Synthesized RF Signal Generator	Gigatronc	6061A	5130408	10kHz – 1050 MHz

6.5.4. Test Arrangement

- Power at RF Output Terminals



- For ERP test arrangement, refer to section 8.2 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 #: ICOM32-FTX
November 5, 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 Power (dBm)	Power Rating (dBm)
High Power			
Lowest, CH 01A	156.050	37.2	37.0
Highest, CH 88A	157.425	37.2	37.0
Low Power			
Lowest, CH 01A	156.050	29.4	30.0
Highest, CH 88A	157.425	29.4	30.0

ERP Using Substitution Method

Frequency (MHz)	Peak E-Field @ 3m (dBμV/m)	Antenna Polarization (V/H)	Power From Signal GEN. Ps (dBm)	Substitution Antenna Gain Gd (dBi)	Measured ERP = Ps+Gd-2.15 (dBm)	Measured EIRP = ERP+2.15 (dBm)
High Power						
156.050	129.05	V	32.90	1.37	32.12	34.27
156.050	131.95	H	35.13	1.37	34.35	36.50
157.425	130.57	V	33.70	1.37	32.92	35.07
157.425	131.83	H	34.90	1.37	34.12	36.27
Low Power						
156.050	120.59	V	24.44	1.37	23.66	25.81
156.050	123.33	H	26.42	1.37	25.64	27.79
157.425	121.75	V	25.13	1.37	24.35	26.50
157.425	123.43	H	26.48	1.37	25.70	27.85

* The above readings are the maximum value obtained with EUT oriented in three different orthogonal positions

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 #: ICOM32-FTX
November 5, 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. AUDIO FREQUENCY RESPONSE [47 CFR §§ 2.1047(a) & 80.213]

6.6.1. Limits @ 47 CFR §§ 2.1047(a) & 80.213

No limit is required by FCC for audio frequency response. However, FCC recommends the Audio Frequency Response to be tested to show the roll-off curve at 3 kHz.

Recommended Limits: The attenuation of lowpass filter between the frequencies of 3 KHz and 20 KHz shall be greater than the attenuation at 1KHz by at least: $60\text{Log}_{10}(f/3)$ decibels where "f" is the frequency in KHz. At frequency above 20 KHz, the attenuation shall be 50 dB greater than the attenuation at 1 KHz.

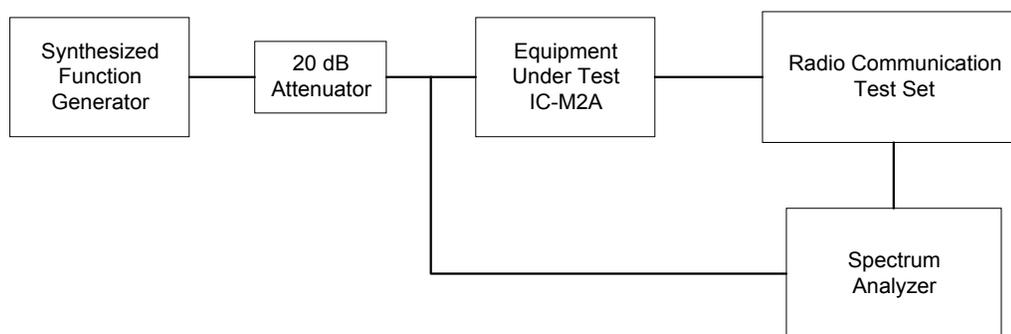
6.6.2. Method of Measurements

The rated audio input signal was applied to the input of the audio lowpass filter (or of all modulation stages) using an audio oscillator, this input signal level and its corresponding output signal were then measured and recorded using the FFT (Audio) spectrum analyzer. Tests were repeated at different audio signal frequencies from 0 to 50 kHz.

6.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
FFT (audio) Spectrum Analyzer	Advantest	R9211E	82020336	10 mHz – 100 kHz, 1 MHz Input Impedance
Radio Communication Test Set	Marconi Instruments	2955	132037/226	400kHz - 1000 MHz
Synthesized Function Generator	Stanford Research Systems	DS345	34591	1μHz – 30.2 MHz

6.6.4. 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 #: ICOM32-FTX
November 5, 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)

6.6.5. Test Data

Audio Frequency Response of All Modulation Stages

FREQUENCY (kHz)	AUDIO IN (dBV)	AUDIO OUT (dBV)	ATTEN. (OUT - IN) (dB)	ATTEN. wrt. 1 kHz (dB)
0.10	-47.9	-76.4	-28.5	-41.2
0.20	-47.9	-70.0	-22.1	-34.8
0.40	-47.9	-51.5	-3.6	-16.3
0.60	-47.9	-42.7	5.2	-7.5
0.80	-47.9	-39.8	8.1	-4.6
1.00	-47.9	-35.2	12.7	0.0
1.50	-47.9	-30.2	17.7	5.0
2.00	-47.9	-28.5	19.4	6.7
2.50	-47.9	-27.9	20.0	7.3
3.00	-47.9	-28.6	19.3	6.6
3.50	-47.9	-31.1	16.8	4.1
4.00	-47.9	-34.4	13.5	0.8
4.50	-48.1	-38.1	10.0	-2.7
5.00	-48.1	-41.6	6.5	-6.2
6.00	-48.1	-44.6	3.5	-9.2
7.00	-48.1	-53.1	-5.0	-17.7
8.00	-48.1	-57.9	-9.8	-22.5
9.00	-48.1	-62.1	-14.0	-26.7
10.00	-48.1	-66.2	-18.1	-30.8
15.00	-48.1	<-90.0	<-41.9	<-54.6
20.00	-48.1	<-90.0	<-41.9	<-54.6
22.00	-48.1	<-90.0	<-41.9	<-54.6
24.00	-48.1	<-90.0	<-41.9	<-54.6
26.00	-48.1	<-90.0	<-41.9	<-54.6
28.00	-48.1	<-90.0	<-41.9	<-54.6
30.00	-48.1	<-90.0	<-41.9	<-54.6
40.00	-48.1	<-90.0	<-41.9	<-54.6
50.00	-48.1	<-90.0	<-41.9	<-54.6

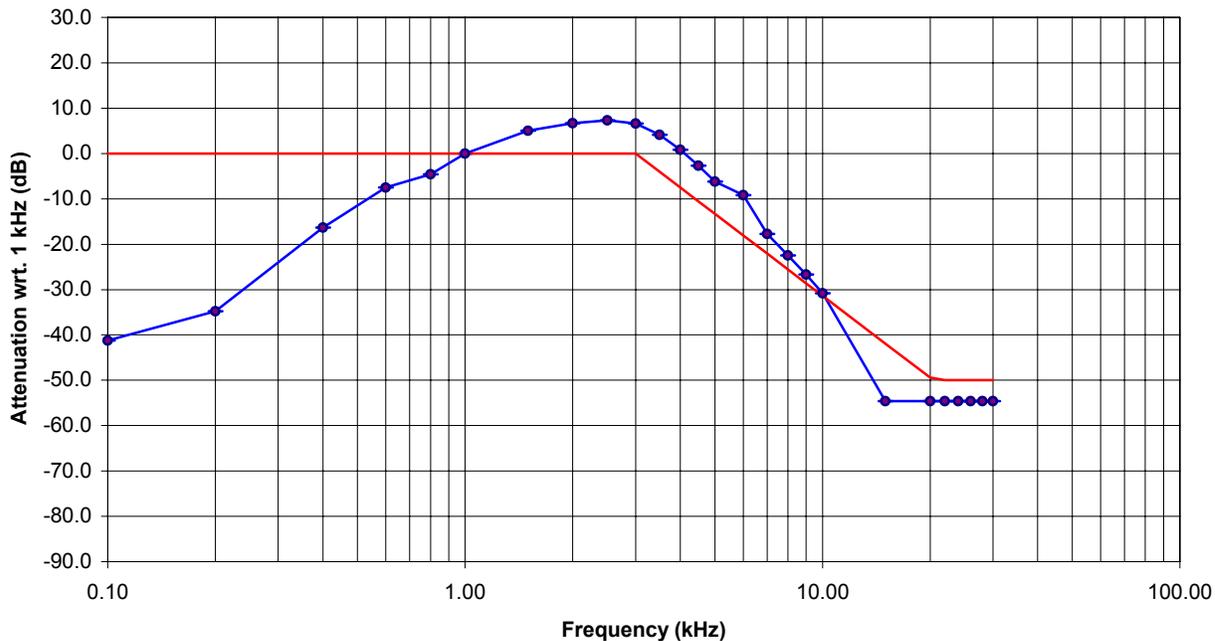
ULTRATECH GROUP OF LABS

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 #: ICOM32-FTX
November 5, 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)

Audio Frequency Repsonse of All Moduation Stages [47 CFR § 2.1047(a)]
Icom VHF Marine Transceiver, Model IC-M2A, FCC ID: AFJIC-M2A



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 #: ICOM32-FTX
November 5, 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. MODULATION LIMITING [47 CFR §§ 2.1047(b) & 80.213]

6.7.1. Limits @ 47 CFR §80.213

The EUT shall be installed with a modulation limiter which limits the deviation of the FM carrier less than manufacturer's setting provided that the rf output spectrum must meet the required MASK

Recommendation:

- 5 kHz for 25 kHz Channel Spacing System

6.7.2. Method of Measurements

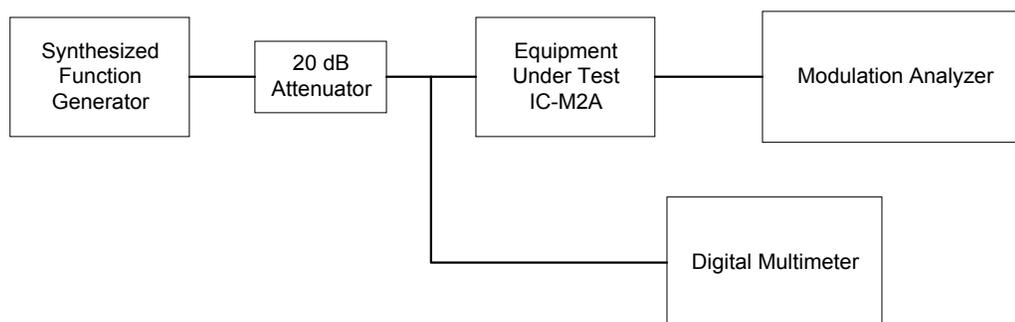
For Audio Transmitter:- The carrier frequency deviation was measured with the tone input signal level varied from 0 Vp to audio input rating level plus 16 dB at frequencies 0.1, 0.5, 1.0, 3.0 and 5.0 kHz. The maximum deviation was recorded at each test condition.

For Data Transmitter with Maximum Frequency Deviation set by Factory:- The EUT was set at maximum frequency deviation, and its peak frequency deviation was then measured using EUT's internal random data source.

6.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Synthesized Function Generator	Stanford Research Systems	DS345	34591	1μHz – 30.2 MHz
Digital Multimeter	Fluke	8050A	4525045	20 Hz – 50 kHz
Modulation Analyzer	Hewlett Packard	8901B	3226A04606	150 kHz – 1300 MHz

6.7.4. 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 #: ICOM32-FTX
November 5, 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)

6.7.5. Test Data

▪ **Voice Modulation Limiting:**

MODULATING SIGNAL LEVEL (mVrms)	PEAK FREQUENCY DEVIATION (kHz) at the following modulating frequency:					MAXIMUM LIMIT (kHz)
	0.1 kHz	0.5 kHz	1.0 kHz	3.0 kHz	5.0 kHz	
1	0.3	0.5	0.9	3.3	0.8	5
2	0.3	0.8	1.6	3.3	0.8	5
4	0.3	1.5	3.2	3.8	0.8	5
6	0.4	2.1	3.9	3.8	0.8	5
8	0.4	2.7	4.1	3.8	0.8	5
10	0.5	3.4	4.1	3.8	0.8	5
20	0.5	4.0	4.3	3.8	0.8	5
30	0.8	4.1	4.4	3.8	0.8	5
40	0.9	4.2	4.5	3.8	0.8	5
50	1.0	4.3	4.5	3.8	0.8	5
60	1.3	4.4	4.5	3.8	0.8	5
70	1.3	4.4	4.5	3.8	0.8	5
80	1.3	4.5	4.5	3.8	0.8	5
90	2.0	4.5	4.5	3.8	0.8	5
100	2.5	4.5	4.5	3.8	0.8	5
110	2.7	4.5	4.5	3.8	0.8	5

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 #: ICOM32-FTX
November 5, 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)

Voice Signal Input Level = STD MOD Level + 16 dB = 11.5 dB(mVrms) + 16 = **27.5 dB(mVrms)**

MODULATING FREQUENCY (KHz)	PEAK FREQUENCY DEVIATION (KHz)	MAXIMUM LIMIT (KHz)
0.1	3.7	5
0.2	4.7	5
0.4	4.5	5
0.6	4.4	5
0.8	4.4	5
1.0	4.4	5
1.2	4.3	5
1.4	4.3	5
1.6	4.3	5
1.8	4.3	5
2.0	4.3	5
2.5	4.2	5
3.0	4.2	5
3.5	3.8	5
4.0	2.8	5
4.5	1.9	5
5.0	1.3	5
6.0	0.9	5
7.0	0.5	5
8.0	0.3	5
9.0	0.2	5
10.0	0.2	5

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 #: ICOM32-FTX
November 5, 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. OCCUPIED BANDWIDTH AND EMISSION LIMITATIONS/MASKS [47 CFR §§2.1049, 80.205 & 80.211]

6.8.1. Limits @ 47 CFR §80.211(f)

- (1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;
- (2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

6.8.2. Method of Measurements

Refer to Exhibit 8, section 8.3 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



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 #: ICOM32-FTX
November 5, 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)

6.8.5. Test Data

6.8.5.1. Occupied Bandwidth

Frequency (MHz)	99 % Emission Bandwidth (kHz)
156.050	14.43
157.425	14.00

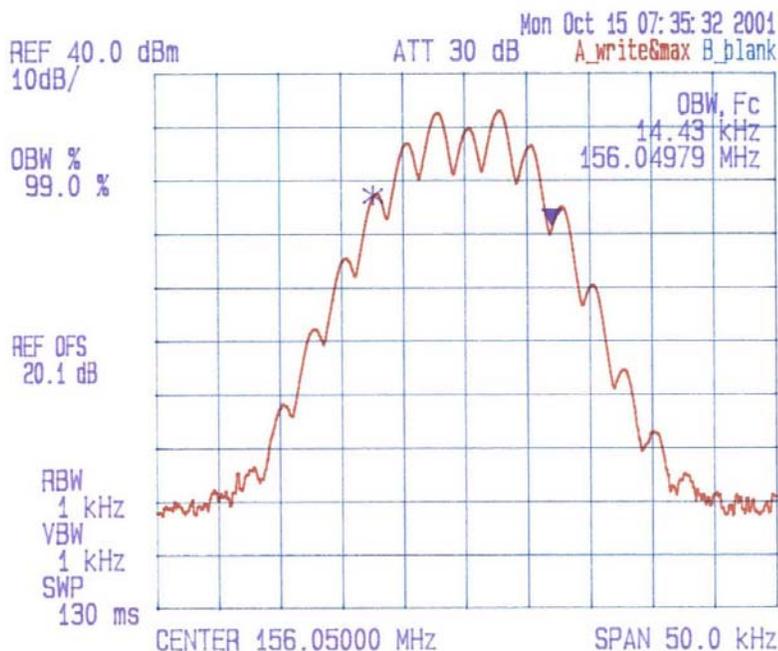
*Refer to the following test data plots # 1 – 2 for details:

Plot #1
99% Emission Bandwidth
Carrier Frequency: 156.050 MHz (CH 01A)
Power Output: 5.2 W
Modulation: FM with 2.5 Sine Wave Signal



ICOM AMERICA INC.
VHF MARINE TRANSCEIVER, MODEL: IC-M2A
Channel: 1A, Tx Freq: 156.05 MHz, Output Power: 5.2 W
Modulation: FM Modulation with 2.5 kHz Sine Wave signal, Freq. Dev: 4.2 kHz
99 % OBW

Date: Oct. 15, 2001
Tested by: Hung Trinh



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 #: ICOM32-FTX
November 5, 2001

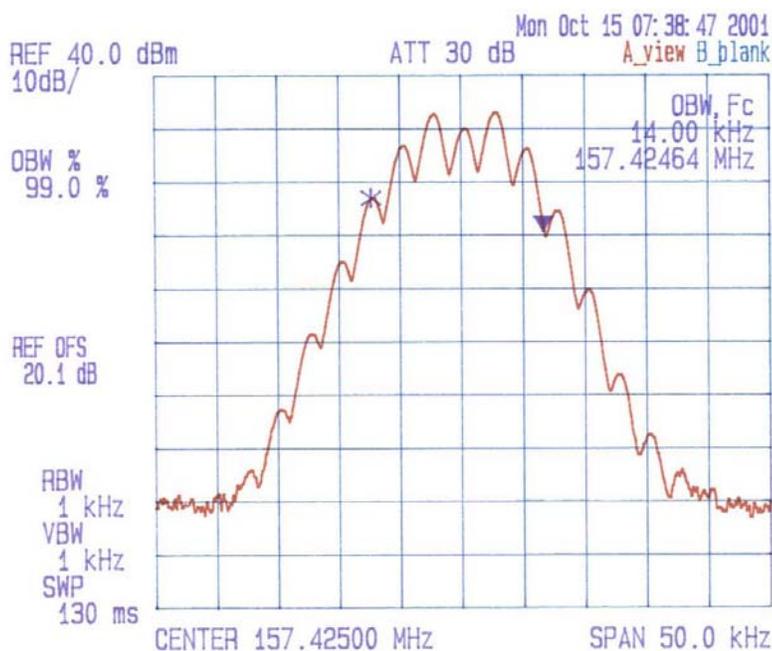
- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
- Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
- Recognized/Listed by FCC (USA)
- All test results contained in this engineering test report are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

Plot #2
99% Emission Bandwidth
Carrier Frequency: 157.425 MHz (CH 88A)
Power Output: 5.2 W
Modulation: FM with 2.5 Sine Wave Signal



ICOM AMERICA INC.
VHF MARINE TRANSCEIVER, MODEL: IC-M2A
Channel: 88A, Tx Freq.: 157.425 MHz, Output Power: 5.2 W
Modulation: FM Modulation with 2.5 kHz Sine Wave signal, Freq. Dev.: 4.3 kHz
99 % OBW

Date: Oct 15 2001
Tested by: Hung Trinh



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 #: ICOM32-FTX
November 5, 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)

6.8.5.2. Emission Limitations/Masks

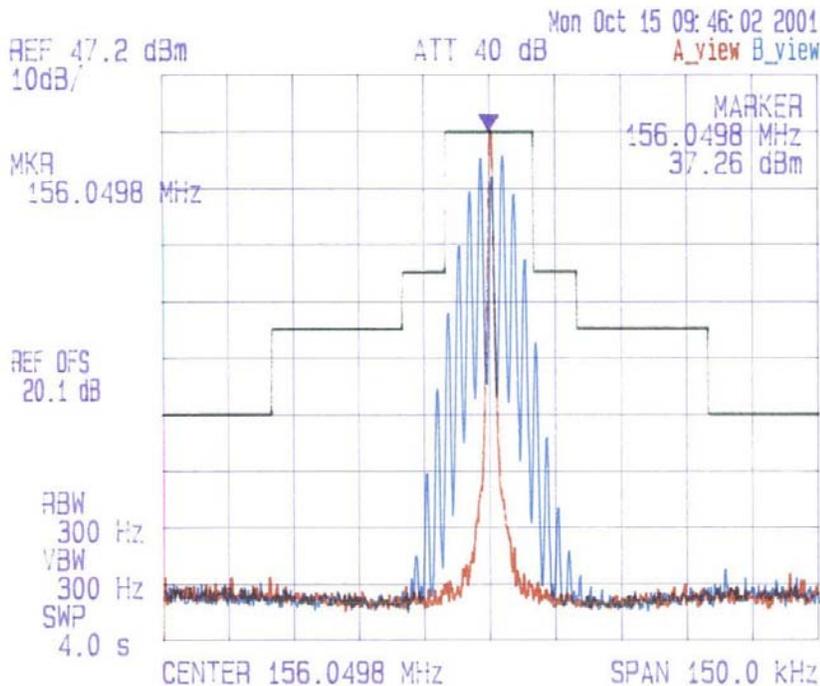
Complies with 47 CFR §80.211(f) Emission Limitations or Mask specification. Refer to the following test data plots # 3 – 4 for details:

Plot #3
Emission Limitations/Masks
Carrier Frequency: 156.050 MHz (CH 01A)
Power Output: 5.2 W
Modulation: FM with 2.5 Sine Wave Signal



ICOM AMERICA INC.
VHF MARINE TRANSCEIVER, MODEL: IC-M2A
Channel: 1A, Tx Freq: 156.05 MHz, Output Power: 5.2 W
Modulation: FM Modulation with 2.5 kHz Sine Wave signal, Freq. Dev.: 4.2 kHz
EMISSION MASK B

Date: Oct. 15 2001
Tested by: Hung Trinh



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 #: ICOM32-FTX
November 5, 2001

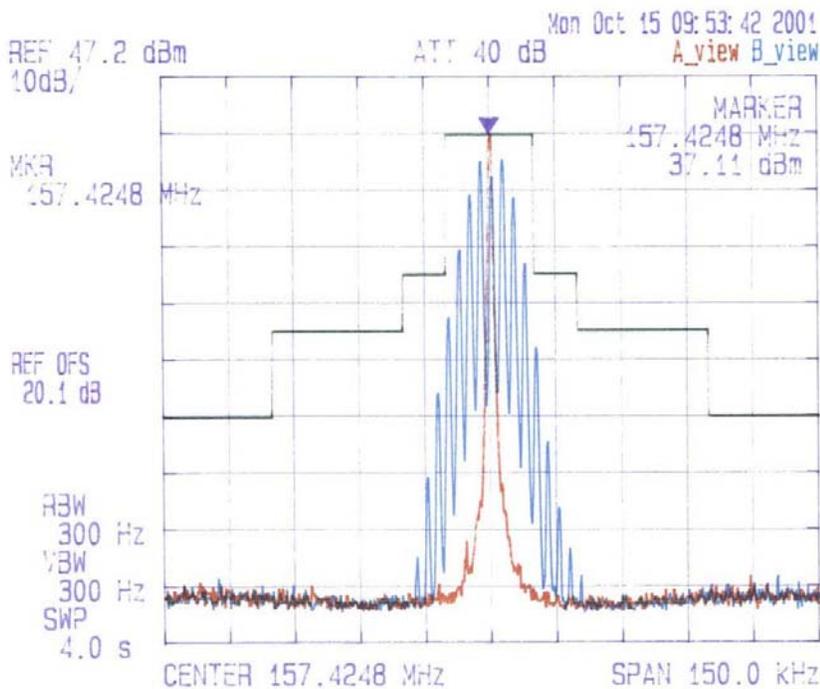
- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
- Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
- Recognized/Listed by FCC (USA)
- All test results contained in this engineering test report are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

Plot #4
Emission Limitations/Masks
Carrier Frequency: 157.425 MHz (CH 88A)
Power Output: 5.2 W
Modulation: FM with 2.5 Sine Wave Signal



ICOM AMERICA INC.
VHF MARINE TRANSCEIVER, MODEL: IC-M2A
Channel: 88A, Tx Freq.: 157.425 MHz, Output Power: 5.2 W
Modulation: FM Modulation with 2.5 kHz Sine Wave signal, Freq. Dev.: 4.2 kHz
EMISSION MASK B

Date: Oct. 15, 2001
Tested by: Hung Trinh



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 #: ICOM32-FTX
November 5, 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. SPURIOUS EMISSIONS AT ANTENNA TERMINAL [47 CFR § 2.1051]

6.9.1. Limits @ 47 CFR § 80.211(f)

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

FCC Rules	Frequency Range	Attenuation Limit (dBc)
80.211(f)	10 MHz to Lowest frequency of the radio to 10 th harmonic of the highest frequency of the radio	43+10log ₁₀ (mean power in watt)

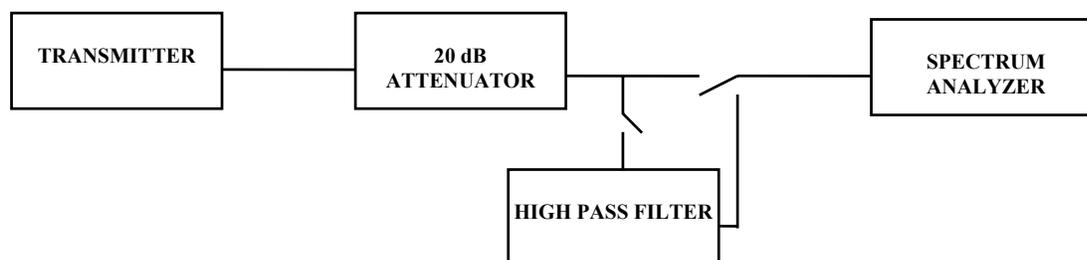
6.9.2. Method of Measurements

Refer to Exhibit 8 section 8.4 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
High Pass Filter	Mini-Circuits	SHP-250	--	Cut-off Frequency at 225 MHz
High Pass Filter	Mini-Circuits	SHP-600	--	Cut-off Frequency at 560 MHz

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 #: ICOM32-FTX
 November 5, 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. Test Data

▪ Near Lowest Frequency (156.050 MHz)

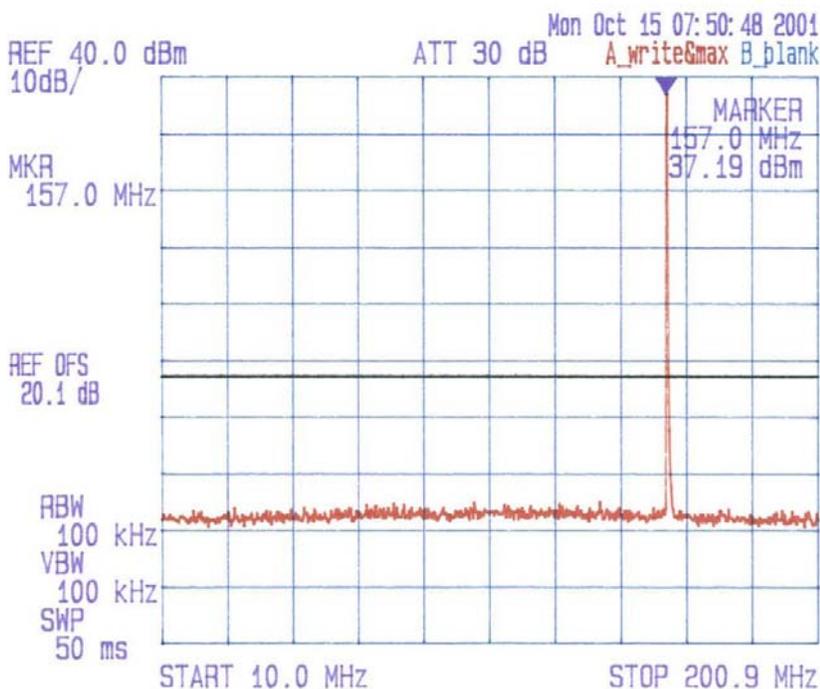
The emissions were scanned from 10 MHz to 2 GHz and no emissions were found within 20 dB below the limits. Refer to the following test data plots #5 – 8 for details:

Plot #5
Spurious Emissions at Antenna Terminal
Carrier Frequency: 156.050 MHz (CH 01A)
Power Output: 5.2 W (High Power)
Modulation: FM with 2.5 Sine Wave Signal



ICOM AMERICA INC.
VHF MARINE TRANSCEIVER, MODEL: IC-M2A
Channel: A, Tx Frequency: 156.05 MHz, Output Power: 5.2 W
Mod.: FM Modulation with 2.5 kHz Sine Wave signal, Freq. Dev: 4.3 kHz
TRANSMITTER ANTENNA POWER CONDUCTED

Date: Oct. 15 2001
Tested by: Hung Trinh



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 #: ICOM32-FTX
November 5, 2001

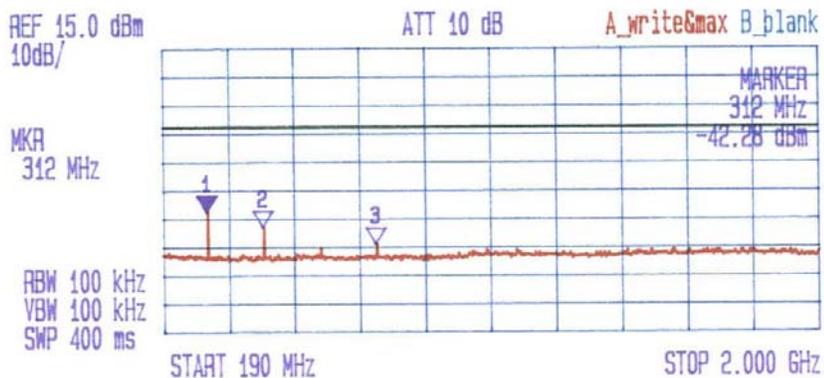
- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
- Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
- Recognized/Listed by FCC (USA)
- All test results contained in this engineering test report are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

Plot #6
Spurious Emissions at Antenna Terminal
Carrier Frequency: 156.050 MHz (CH 01A)
Power Output: 5.2 W (High Power)
Modulation: FM with 2.5 Sine Wave Signal



ICOM AMERICA INC.
VHF MARINE TRANSCEIVER, MODEL: IC-M2A
Channel: 1A, Tx Frequency: 156.050 MHz, Output Power: 5.2 W
Mod.: FM Modulation with 2.5 kHz Sine Wave signal, Freq. Dev.: 4.3 kHz
TRANSMITTER ANTENNA POWER CONDUCTED

Date: Oct. 15, 2001
Tested by: Hung Trinh



*** Multi Marker List ***

No. 1:	312 MHz	-42.28 dBm	A
No. 2:	467 MHz	-47.88 dBm	A
No. 3:	780 MHz	-53.97 dBm	A
No. 4:			
No. 5:			
No. 6:			
No. 7:			
No. 8:			
Δ:			

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 #: ICOM32-FTX
November 5, 2001

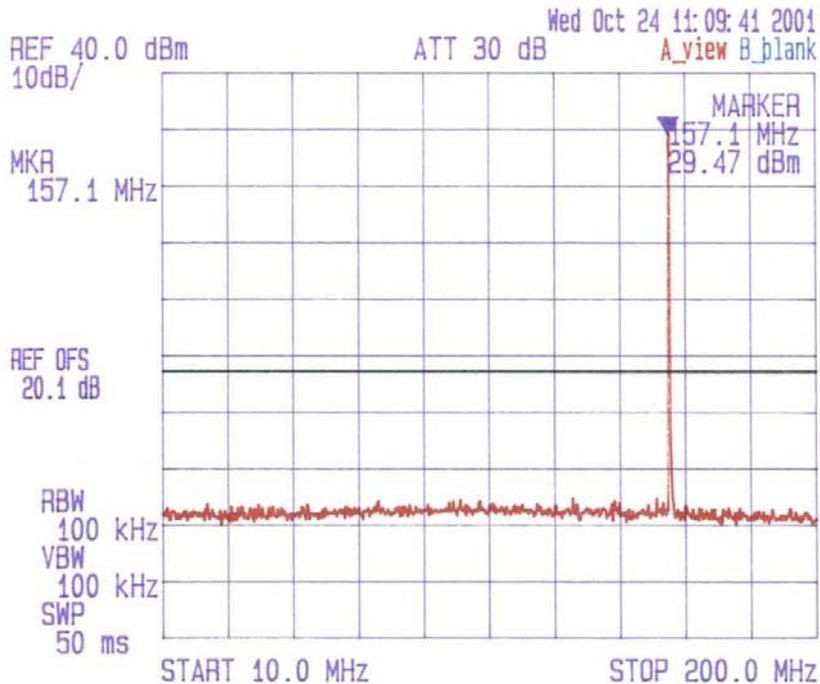
- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
- Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
- Recognized/Listed by FCC (USA)
- All test results contained in this engineering test report are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

Plot #7
Spurious Emissions at Antenna Terminal
Carrier Frequency: 156.050 MHz (CH 01A)
Power Output: 0.871W (Low Power)
Modulation: FM with 2.5 Sine Wave Signal



ICOM AMERICA INC.
VHF MARINE TRANSCEIVER, MODEL: IC-M2A
Channel: 1A, Tx Frequency: 156.050 MHz, Output Power: 0.871 W
Mod.: FM Modulation with 2.5 kHz Sine Wave signal, Freq. Dev.: 4.2 kHz
TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS

Date: Oct. 24 2001
Tested by: Hung Trinh



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 #: ICOM32-FTX
November 5, 2001

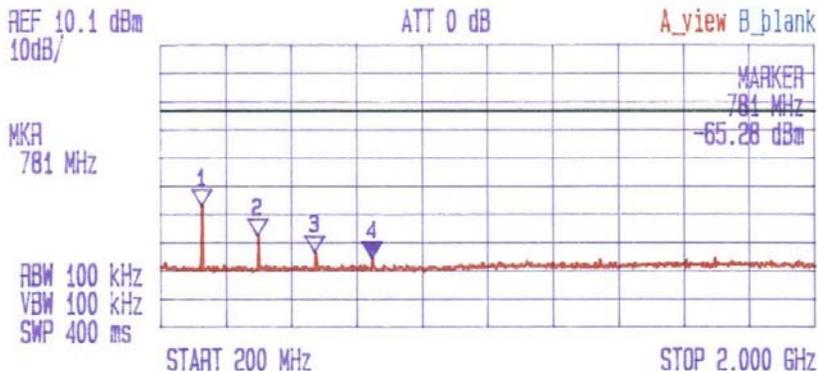
- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
- Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
- Recognized/Listed by FCC (USA)
- All test results contained in this engineering test report are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

Plot #8
Spurious Emissions at Antenna Terminal
Carrier Frequency: 156.050 MHz (CH 01A)
Power Output: 0.871W (Low Power)
Modulation: FM with 2.5 Sine Wave Signal



ICOM AMERICA INC.
VHF MARINE TRANSCEIVER, MODEL: IC-M2A
Channel: 1A, Tx Frequency: 156.05 MHz, Output Power: 0.871 W
Mod.: FM Modulation with 2.5 kHz Sine Wave signal, Freq. Dev.: 4.8 kHz
TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS

Date: Oct. 24 2001
Tested by: Hung Trinh



*** Multi Marker List ***

No. 1:	313 MHz	-46.74 dBm	A
No. 2:	467 MHz	-57.12 dBm	A
No. 3:	624 MHz	-63.18 dBm	A
No. 4:	781 MHz	-65.28 dBm	A
No. 5:			
No. 6:			
No. 7:			
No. 8:			
Δ:			

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 #: ICOM32-FTX
November 5, 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)

▪ **Near Highest Frequency (157.425 MHz)**

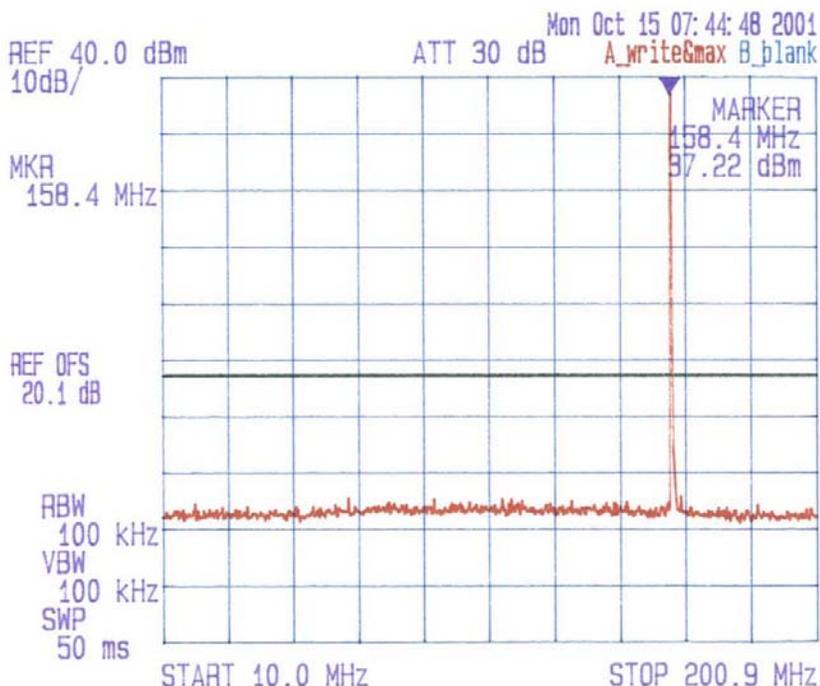
The emissions were scanned from 10 MHz to 2 GHz and no emissions were found within 20 dB below the limits. Refer to the following test data plots #9 – 12 for details:

Plot #9
Spurious Emissions at Antenna Terminal
Carrier Frequency: 157.425 MHz (CH 88A)
Power Output: 5.2 W (High Power)
Modulation: FM with 2.5 Sine Wave Signal



ICOM AMERICA INC.
VHF MARINE TRANSCEIVER, MODEL: IC-M2A
Channel: 88A, Tx Frequency: 157.425 MHz, Output Power: 5.2 W
Mod.: FM Modulation with 2.5 kHz Sine Wave signal, Freq. Dev.: 4.2 kHz
TRANSMITTER ANTENNA POWER CONDUCTED

Date: Oct 15 2001
Tested by: Hung Trinh



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 #: ICOM32-FTX
November 5, 2001

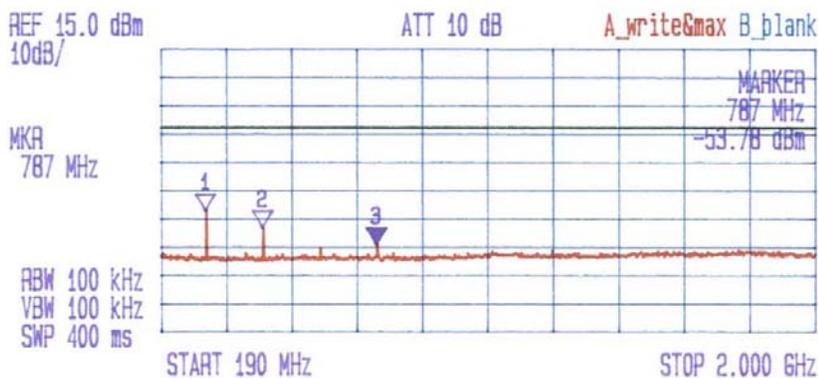
- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
- Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
- Recognized/Listed by FCC (USA)
- All test results contained in this engineering test report are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

Plot #10
Spurious Emissions at Antenna Terminal
Carrier Frequency: 157.425 MHz (CH 88A)
Power Output: 5.2 W (High Power)
Modulation: FM with 2.5 Sine Wave Signal



ICOM AMERICA INC.
VHF MARINE TRANSCEIVER, MODEL: IC-M2A
Channel: ~~88A~~, Tx Frequency: ~~157.425~~ MHz, Output Power: ~~5.2~~ W
Mod.: FM Modulation with 2.5 kHz Sine Wave signal, Freq. Dev.: ~~4.2~~ kHz
TRANSMITTER ANTENNA POWER CONDUCTED

Date: Oct. ~~15~~ 2001
Tested by: Hung Trinh



*** Multi Marker List ***

No. 1:	314 MHz	-41.84 dBm	A
No. 2:	472 MHz	-47.69 dBm	A
No. 3:	787 MHz	-53.78 dBm	A
No. 4:			
No. 5:			
No. 6:			
No. 7:			
No. 8:			
Δ:			

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 #: ICOM32-FTX
November 5, 2001

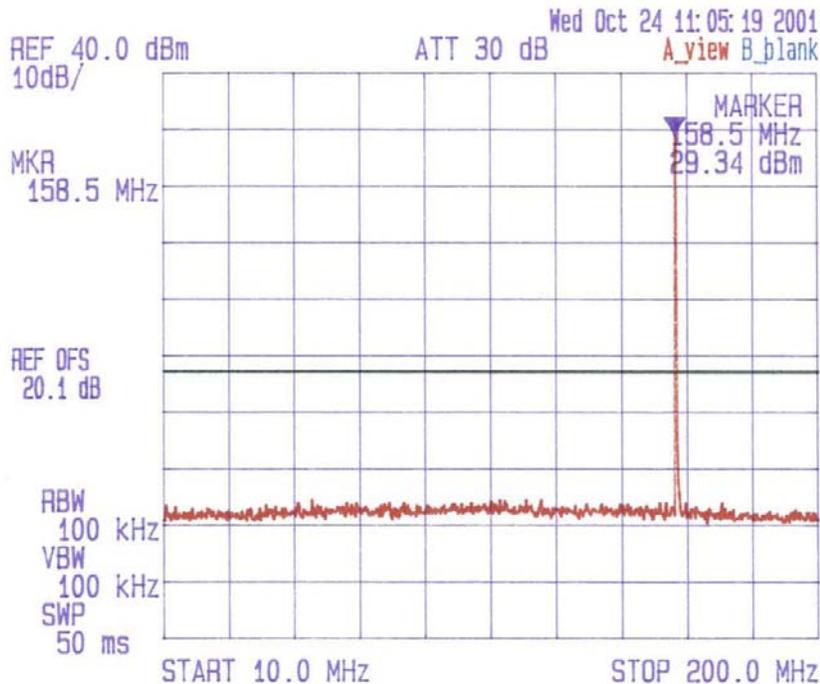
- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
- Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
- Recognized/Listed by FCC (USA)
- All test results contained in this engineering test report are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

Plot #11
Spurious Emissions at Antenna Terminal
Carrier Frequency: 157.425 MHz (CH 88A)
Power Output: 0.871 W (Low Power)
Modulation: FM with 2.5 Sine Wave Signal



ICOM AMERICA INC.
VHF MARINE TRANSCEIVER, MODEL: IC-M2A
Channel: D8A Tx Frequency: 157.425 MHz, Output Power: 0.871 W
Mod.: FM Modulation with 2.5 kHz Sine Wave signal, Freq. Dev.: 4.2 kHz
TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS

Date: Oct. 24, 2001
Tested by: Hung Trinh



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 #: ICOM32-FTX
November 5, 2001

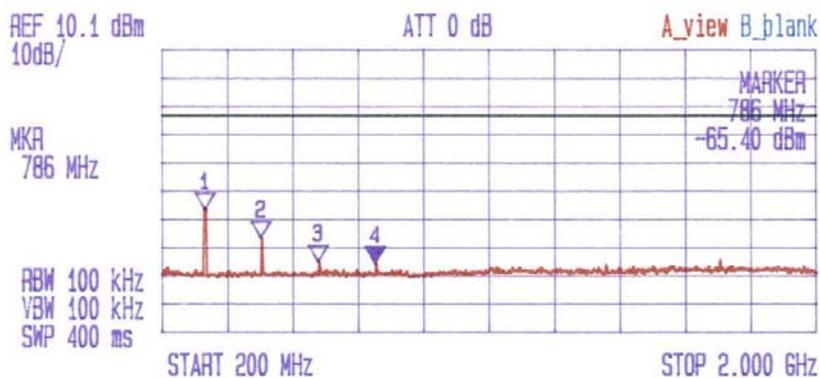
- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia), VCCI (Japan)
- Accredited by Industry Canada (Canada) under ACC-LAB (Europe/Canada MRA and APEC/Canada MRA)
- Recognized/Listed by FCC (USA)
- All test results contained in this engineering test report are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

Plot #12
Spurious Emissions at Antenna Terminal
Carrier Frequency: 157.425 MHz (CH 88A)
Power Output: 0.871 W (Low Power)
Modulation: FM with 2.5 Sine Wave Signal



ICOM AMERICA INC.
VHF MARINE TRANSCEIVER, MODEL: IC-M2A
Channel: ~~88A~~ Tx Frequency: ~~157.425~~ MHz, Output Power: ~~0.871W~~
Mod.: FM Modulation with 2.5 kHz Sine Wave signal, Freq. Dev.: ~~4.2~~ kHz
TRANSMITTER ANTENNA POWER CONDUCTED EMISSIONS

Date: Oct. ~~2001~~ 2001
Tested by: Hung Trinh



*** Multi Marker List ***

No. 1:	318 MHz	-45.96 dBm	A
No. 2:	473 MHz	-55.93 dBm	A
No. 3:	629 MHz	-64.78 dBm	A
No. 4:	786 MHz	-65.40 dBm	A
No. 5:			
No. 6:			
No. 7:			
No. 8:			
Δ:			

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 #: ICOM32-FTX
November 5, 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. FIELD STRENGTH OF SPURIOUS RADIATION [47 CFR §2.1053]

6.10.1. Limits @ 47 CFR § 80.211(f)

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

FCC Rules	Frequency Range	Attenuation Limit (dBc)
80.211(f)	10 MHz to Lowest frequency of the radio to 10 th harmonic of the highest frequency of the radio	43+10log ₁₀ (mean power in watt)

6.10.2. Method of Measurements

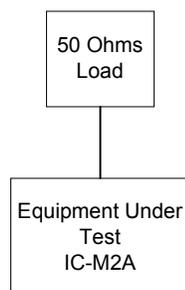
Refer to Exhibit 8 section 8.2 of this report for measurement details

6.10.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz to 32 GHz with external mixer for frequency above 32 GHz
Microwave Amplifier	Hewlett Packard	HP 83017A	3116A00661	1 GHz to 26.5 GHz
Active Loop Antenna	EMCO	6507	8906-1167	1 kHz – 30 MHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna with Mixer	EMCO	3160-09	1007	18 GHz – 26.5 GHz
Horn Antenna with Mixer	EMCO	3160-10	1001	26.5 GHz – 40 GHz

6.10.4. Test Arrangement

The following drawings show details of the test setup for radiated emissions 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 #: ICOM32-FTX
November 5, 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)

6.10.5. Test Data

▪ **Near Lowest Frequency (156.050 MHz)**

Carrier Frequency (MHz): 156.050 (CH 01A)
ERP (dBm): 34.35 (High Power)
Limit (dBc): -47.35

Frequency (MHz)	E-Field @3m (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP Measured by Substitution Method		Limit (dBc)	Margin (dB)
				(dBm)	(dBc)		
156.050	129.05	Peak	V	32.12	n/a	n/a	n/a
156.050	131.95	Peak	H	34.35	n/a	n/a	n/a
312.100	66.06	Peak	V	-34.59	-68.94	-47.35	-21.59
312.100	65.38	Peak	H	-35.49	-69.84	-47.35	-22.49
468.150	67.91	Peak	V	-33.52	-67.87	-47.35	-20.52
468.150	67.69	Peak	H	-35.96	-70.31	-47.35	-22.96
624.200	69.56	Peak	V	-29.86	-64.21	-47.35	-16.86
624.200	71.06	Peak	H	-29.45	-63.8	-47.35	-16.45

The emissions were scanned from 10 MHz to 2 GHz and all emissions within 30 dB below the limits were recorded.

Carrier Frequency (MHz): 156.050 (CH 01A)
ERP (dBm): 25.64 (Low Power)
Limit (dBc): -38.64

Frequency (MHz)	E-Field @3m (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured by Substitution Method		Limit (dBc)	Margin (dB)
				(dBm)	(dBc)		
156.050	120.59	Peak	V	23.66	n/a	n/a	n/a
156.050	123.33	Peak	H	25.64	n/a	n/a	n/a
624.200	62.91	Peak	V	-34.20	-59.84	-38.64	-21.20
624.200	67.28	Peak	H	-36.20	-61.84	-38.64	-23.20

The emissions were scanned from 10 MHz to 2 GHz and all emissions within 30 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 #: ICOM32-FTX
November 5, 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)

▪ **Near Highest Frequency (157.425 MHz)**

Carrier Frequency (MHz): 157.425 (CH 88A)
ERP (dBm): 34.12 (High Power)
Limit (dBc): -47.12

Frequency (MHz)	E-Field @3m (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP Measured by Substitution Method		Limit (dBc)	Margin (dB)
				(dBm)	(dBc)		
157.425	130.57	Peak	V	32.92	n/a	n/a	n/a
157.425	131.83	Peak	H	34.12	n/a	n/a	n/a
314.850	66.81	Peak	V	-34.62	-68.74	-47.12	-21.62
314.850	66.75	Peak	H	-32.49	-66.61	-47.12	-19.49
472.275	67.38	Peak	V	-33.61	-67.73	-47.12	-20.61
472.275	63.25	Peak	H	-38.02	-72.14	-47.12	-25.02
629.700	66.69	Peak	V	-32.89	-67.01	-47.12	-19.89
629.700	68.19	Peak	H	-34.62	-68.74	-47.12	-21.62

The emissions were scanned from 10 MHz to 2 GHz and all emissions within 30 dB below the limits were recorded.

Carrier Frequency (MHz): 157.425 (CH 88A)
ERP (dBm): 25.70 (Low Power)
Limit (dBc): -38.70

Frequency (MHz)	E-Field @3m (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP Measured by Substitution Method		Limit (dBc)	Margin (dB)
				(dBm)	(dBc)		
157.425	121.75	Peak	V	24.35	n/a	n/a	n/a
157.425	123.43	Peak	H	25.70	n/a	n/a	n/a
629.700	65.22	Peak	V	-34.90	-60.60	-38.70	-21.90
629.700	65.97	Peak	H	-36.20	-61.90	-38.70	-23.20

The emissions were scanned from 10 MHz to 2 GHz and all emissions within 30 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 #: ICOM32-FTX
November 5, 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)

6.11. FREQUENCY STABILITY [47 CFR §§ 2.1055 & 80.209]

6.11.1. Limits @ 47 CFR §80.209

Please refer to 47 CFR §80.209(a) for details.

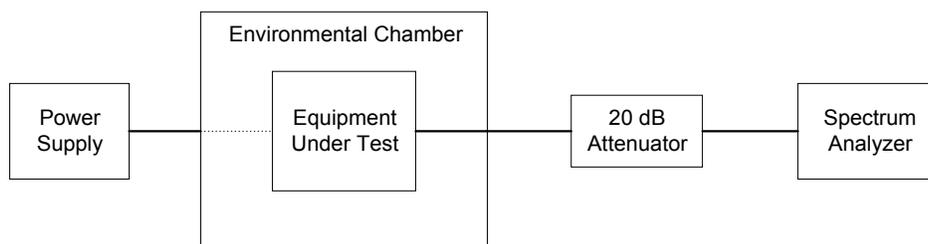
6.11.2. Method of Measurements

Refer to Exhibit 8, section 8.5 of this report for measurement details

6.11.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz to 32 GHz with external mixer for frequency above 32 GHz
Attenuator(s)	Bird	..	...	DC – 22 GHz
Temperature & Humidity Chamber	Tenney	T5	9723B	-40° to +60° C range
Power Supply	Kepeco	JQE36-8	4124926	--

6.11.4. 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 #: ICOM32-FTX
November 5, 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)

6.11.5. Test Data

Product Name: VHF Marine Transceiver
Model No.: IC-M2A
Center Frequency: 156.050 MHz
Full Power Level: 5 Watts (High Power)
Frequency Tolerance Limit: 10 ppm or 1560.5 Hz at 156.050 MHz
Max. Frequency Tolerance Measured: +360 Hz or 2.3 ppm
Input Voltage Rating: 7.5 VDC

CENTER FREQUENCY & RF POWER OUTPUT VARIATION			
Ambient Temperature (°C)	Supply Voltage (Nominal) Volts	Supply Voltage (85% of Nominal) Volts	Supply Voltage (115% of Nominal) Volts
	Hz	Hz	Hz
-20	+146	N/A	N/A
-10	+277	N/A	N/A
0	+360	N/A	N/A
+10	+360	N/A	N/A
+20	-7	-16	-21
+30	-7	N/A	N/A
+40	-97	N/A	N/A
+50	-133	N/A	N/A

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 #: ICOM32-FTX
November 5, 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)

6.12. RF RADIATION EXPOSURE EVALUATION [47 CFR §§ 2.1093 & 80.227]

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	Compliance with FCC Rules
SAR Tests for Portable Transmitters <ul style="list-style-type: none">Body / Brain Tissue	<ul style="list-style-type: none">Complies with Limits for Occupational/Controlled Exposure. Please refer to SAR test report for details.
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Please refer to User Manual for RF Exposure information to users.

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 #: ICOM32-FTX
November 5, 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 (+ 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: vhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: ICOM32-FTX
November 5, 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.

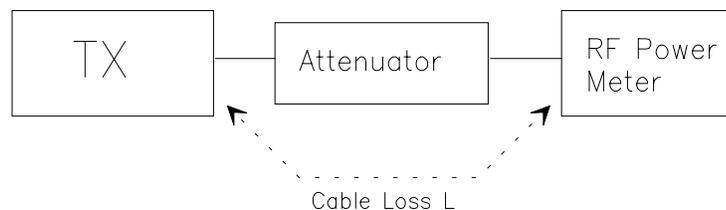
Step 2: Calculation of Average EIRP. See Figure 1

- 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:

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

{X = 1 for continuous transmission => $10\log(1/x) = 0$ 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 #: ICOM32-FTX
November 5, 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. RADIATED POWER MEASUREMENTS (ERP & EIRP) USING SUBSTITUTION METHOD

8.2.1. Maximizing RF Emission Level (E-Field)

- (a) The measurements were performed with full rf output power and modulation.
- (b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
- (c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
- (d) The BICONILOG antenna (20 MHz to 1 GHz) or HORN antenna (1 GHz to 18 GHz) was used for measuring.
- (e) 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

$E \text{ (dBuV/m)} = \text{Reading (dBuV)} + \text{Total Correction Factor (dB/m)}$

- (f) Set the EMI Receiver and #2 as follows:

Center Frequency: test frequency
Resolution BW: 100 kHz
Video BW: same
Detector Mode: positive
Average: off
Span: 3 x the signal bandwidth

- (g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
- (h) The transmitter was rotated through 360° about a vertical axis until a higher maximum signal was received.
- (i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
- (j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
- (k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
- (l) Repeat for all different test signal frequencies

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 #: ICOM32-FTX
November 5, 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)

8.2.2. 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)
(p) Repeat step (d) to (o) for different test frequency
(q) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(r) 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.

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 #: ICOM32-FTX
November 5, 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)

Figure 2

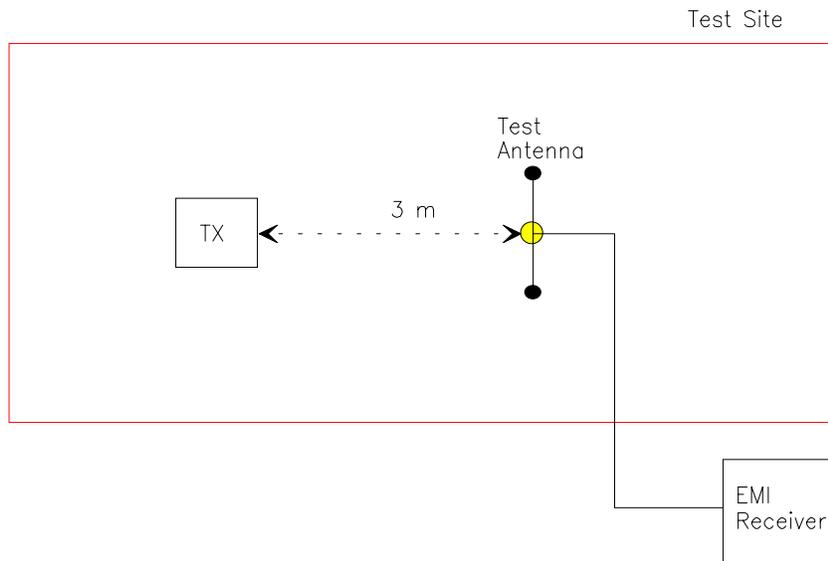
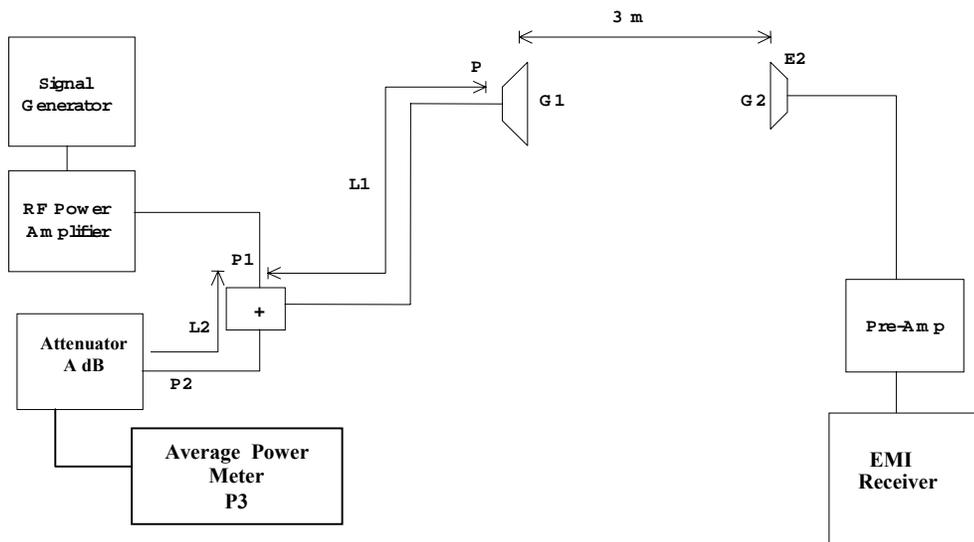


Figure 3



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 #: ICOM32-FTX
 November 5, 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. EMISSION MASK

Voice or Digital Modulation Through a Voice Input Port @ 2.1049(c)(1):- 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:

- (1) For 25 kHz Channel Spacing: RBW = 300 Hz
- (2) 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.

8.4. 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:

47 CFR § 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.

47 CFR § 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 #: ICOM32-FTX
November 5, 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)

8.5. FREQUENCY STABILITY

Refer to 47 CFR §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: vhk.ultratech@sympatico.ca, Website: <http://www.ultratech-labs.com>

File #: ICOM32-FTX
November 5, 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)