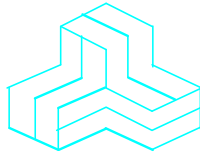


# ENGINEERING TEST REPORT



**HF Transceiver**  
**Model: IC-F8101**  
**FCC ID: AFJ350000**

*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 90**

**UltraTech's File No.: 16ICOM427\_FCC90**

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

Date: May 26, 2016

Report Prepared by: Dan Huynh

Tested by: Wei Wu

Issued Date: May 26, 2016

Test Dates: April 29 , 2016

- The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.
- This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.

## UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4  
Tel.: (905) 829-1570 Fax.: (905) 829-8050  
Website: [www.ultratech-labs.com](http://www.ultratech-labs.com), Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Email: [tri@ultratech-labs.com](mailto:tri@ultratech-labs.com)



91038



1309



46390-2049



NVLAP LAB  
CODE 200093-0



AT-1945



SL2-IN-E-  
1119R



CA2049



TL363\_B



TPTDP  
DA1300

## TABLE OF CONTENTS

<b>EXHIBIT 1. INTRODUCTION .....</b>	<b>1</b>
1.1. SCOPE .....	1
1.2. RELATED SUBMITTAL(S)/GRANT(S) .....	1
1.3. NORMATIVE REFERENCES .....	1
<b>EXHIBIT 2. PERFORMANCE ASSESSMENT .....</b>	<b>2</b>
2.1. CLIENT INFORMATION .....	2
2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION .....	2
2.3. EUT'S TECHNICAL SPECIFICATIONS .....	3
2.4. LIST OF EUT'S PORTS .....	3
2.5. ANCILLARY EQUIPMENT .....	4
<b>EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS .....</b>	<b>5</b>
3.1. CLIMATE TEST CONDITIONS .....	5
3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS .....	5
<b>EXHIBIT 4. SUMMARY OF TEST RESULTS .....</b>	<b>6</b>
4.1. LOCATION OF TESTS .....	6
4.2. APPLICABILITY & SUMMARY OF EMISSION TEST RESULTS .....	6
4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES .....	6
<b>EXHIBIT 5. MEASUREMENTS, EXAMINATIONS &amp; TEST DATA FOR EMC EMISSIONS .....</b>	<b>7</b>
5.1. RF POWER OUTPUT [§ 2.1046, 90.205] .....	7
5.2. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS [§ 2.1053, 2.1057, 90.210] .....	8
<b>EXHIBIT 6. TEST EQUIPMENT LIST .....</b>	<b>11</b>
<b>EXHIBIT 7. MEASUREMENT UNCERTAINTY .....</b>	<b>12</b>
7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY .....	12

---

### ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: 16ICOM427\_FCC90

May 26, 2016

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

## EXHIBIT 1. INTRODUCTION

### 1.1. SCOPE

<b>Reference:</b>	FCC Parts 2 and 90
<b>Title:</b>	Code of Federal Regulations (CFR), Title 47 Telecommunication – Parts 2 and 90
<b>Purpose of Test:</b>	To obtain FCC Certification Authorization for Radio operating in the Frequency Band 1.6 - 30 MHz. Class II Permissive change on electric parts: MAIN-A unit, DSP1 unit, DSP2 unit, PA-A unit, MIC-A unit and the DISPLAY-A unit are replaced.
<b>Test Procedures:</b>	ANSI C63.26

### 1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

### 1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	2016	Code of Federal Regulations – Telecommunication
ANSI C63.4	2014	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
ANSI C63.26	2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
TIA/EIA 603, Edition D	2010	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

## ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: 16ICOM427\_FCC90  
May 26, 2016

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

## EXHIBIT 2. PERFORMANCE ASSESSMENT

### 2.1. CLIENT INFORMATION

APPLICANT	
<b>Name:</b>	Icom Incorporated
<b>Address:</b>	1-1-32, Kamiminami Hirano-ku, Osaka Japan, 547-0003
<b>Contact Person:</b>	Mr. Hideji Fujishima Phone #: +81 6 6794 7783 Fax #: +81 6 6794 7785 Email Address: <a href="mailto:world_support@icom.co.jp">world_support@icom.co.jp</a>

MANUFACTURER	
<b>Name:</b>	Icom Incorporated
<b>Address:</b>	1-1-32, Kamiminami Hirano-ku, Osaka Japan, 547-0003
<b>Contact Person:</b>	Mr. Hideji Fujishima Phone #: +81 6 6794 7783 Fax #: +81 6 6794 7785 Email Address: <a href="mailto:world_support@icom.co.jp">world_support@icom.co.jp</a>

### 2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

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

<b>Brand Name:</b>	ICOM Incorporated
<b>Product Name:</b>	HF Transceiver
<b>Model:</b>	IC-F8101
<b>Serial Number:</b>	00000008
<b>Type of Equipment:</b>	Licensed Non-Broadcast Station Transmitter
<b>Power Supply Requirement:</b>	13.8 Vdc nominal
<b>Transmitting/Receiving Antenna Type:</b>	Non-integral
<b>Primary User Functions of EUT:</b>	HF Transceiver

#### ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: 16ICOM427\_FCC90

May 26, 2016

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

### 2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Fixed/mobile
Intended Operating Environment:	Commercial, Industrial or Business
Power Supply Requirement:	13.8 VDC nominal
RF Output Power Rating:	125, 50 and 10 Watts (J3E, A1A) 75, 50 and 10 Watts(J2B, F1B) 30, 12.5 and 3 Watts (A3E)
Operating Frequency Range:	1.6 - 30 MHz
RF Output Impedance:	50 $\Omega$
Occupied Bandwidth (99%):	J3E: 2.16 kHz A1A: 0.200 kHz J2B: 0.862 kHz F1B: 1.022 kHz A3E: 5.411 kHz
Emission Designation:	2K80J3E, 100HA1A, 2K80J2B, 2K80F1B and 6K00A3E
Antenna Connector Type:	Female HF

### 2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Shielded/Non-shielded
1	DC Power Connector	1	4-pin connector, 2-wire	Non-shielded cable
2	Fan Connector	1	2-pin connector	Non-shielded cable
3	Speaker Jack	1	Mini jack	Shielded
4	Accessory Connector ATU	1	DB9	Shielded
5	Accessory Connector ACC	1	DB15	Shielded
6	USB Connector	1	USB	Shielded
7	Antenna Connector	1	UHF	Shielded
8	Ground Terminal	1	wire	Non-shielded cable

#### ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: 16ICOM427\_FCC90

May 26, 2016

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

## 2.5. 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:	Controller (Front Panel)
Brand Name:	Icom Inc.
Model Name or Number:	RMK-6
Serial Number:	00000021

Ancillary Equipment # 2	
Description:	Cooling fans
Brand Name:	Icom Inc.
Model Name or Number:	CFU-F8100
Serial Number:	N/A

Ancillary Equipment # 3	
Description:	External speaker
Brand Name:	Icom Inc.
Model Name or Number:	SP-35
Serial Number:	N/A

Ancillary Equipment # 4	
Description:	Hand Microphone
Brand Name:	Icom Inc.
Model Name or Number:	HM-193
Serial Number:	N/A

Ancillary Equipment # 5	
Description:	Automatic Antenna Tuner
Brand Name:	Icom Inc.
Model Name or Number:	AT-140
Serial Number:	N/A

### ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: 16ICOM427\_FCC90  
May 26, 2016

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

### EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

#### 3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

<b>Temperature:</b>	21°C
<b>Humidity:</b>	51%
<b>Pressure:</b>	102 kPa
<b>Power Input Source:</b>	13.8 VDC nominal

#### 3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

<b>Operating Modes:</b>	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
<b>Special Test Software:</b>	N/A
<b>Special Hardware Used:</b>	N/A
<b>Transmitter Test Antenna:</b>	The EUT is tested with the antenna port terminated to a 50 Ohm RF Load.

Transmitter Test Signals	
<b>Frequency Band(s):</b>	1.6 - 30 MHz
<b>Test Frequencies:</b> (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	1.71, 17.45, 29.75 MHz

## EXHIBIT 4. SUMMARY OF TEST RESULTS

### 4.1. 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 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site has 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 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2017-04-04.

### 4.2. APPLICABILITY & SUMMARY OF EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Applicability (Yes/No)
2.1046, 90.205	RF Power Output	Yes
2.1047(a) & 90.242(b)(8)	Modulation Characteristics - Audio Frequency Response	N/A
2.1047(b) & 90.210	Modulation Characteristics - Modulation Limiting	N/A
2.1049, 90.209 & 90.210	Emission Limitation & Emission Mask	N/A
2.1051, 2.1057, 90.210	Spurious Emissions at Antenna Terminal	N/A
2.1053, 2.1057, 90.210	Field Strength of Spurious Emissions	Yes
2.1055, 90.213	Frequency Stability	N/A
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	N/A

### 4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

#### 4.3.1. 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: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: 16ICOM427\_FCC90  
May 26, 2016

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



## EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

### 5.1. RF POWER OUTPUT [§ 2.1046, 90.205]

#### 5.1.1. Limits

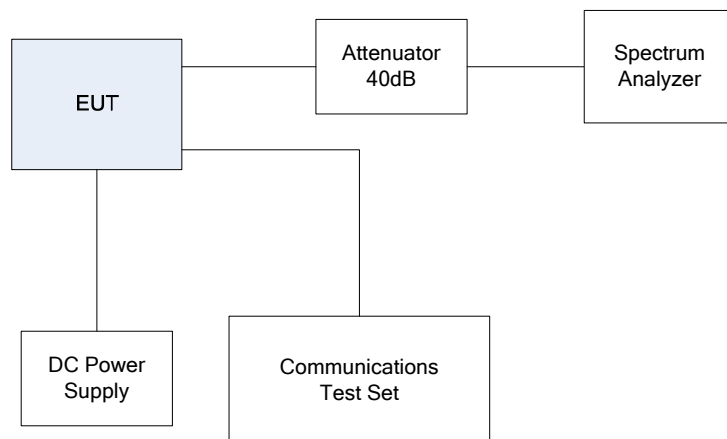
Please refer to FCC 47 CFR 90.205 for detailed limit specifications:

- a) Below 25 MHz. For single sideband operations (J3E emission), the maximum transmitter peak envelope power is 1000 watts.
- b) 25–50 MHz. The maximum transmitter output power is 300 watts.

#### 5.1.2. Method of Measurements

ANSI C63.26-2015, Section 5.2

#### 5.1.3. Test Arrangement



#### 5.1.4. Test Data

Operating Mode: J3E					
Power Level	Frequency (MHz)	Measured Peak Power		Power Rating	
		(W)	(dBm)	(W)	(dBm)
High	1.710	93.11	49.69	125	50.97
	17.450	133.35	51.25	125	50.97
	29.750	130.62	51.16	125	50.97

### ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: 16ICOM427\_FCC90

May 26, 2016

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

5.2. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS [§ 2.1053, 2.1057, 90.210]

5.2.1. Limits

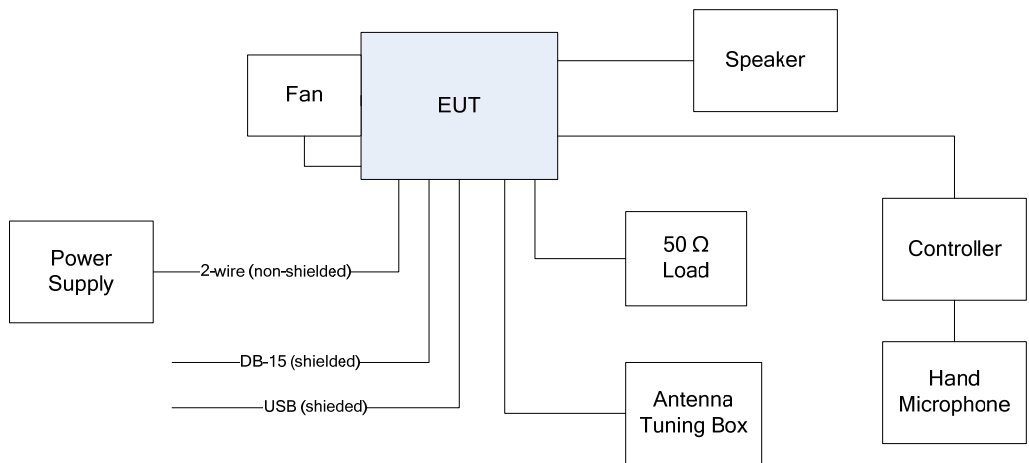
Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Attenuation Limit (dBc)
§ 90.210 (a) & (b)	At least $43 + 10 \log (P)$ dB

5.2.2. Method of Measurements

ANSI C63.26-2015, Section 5.5.

5.2.3. Test Arrangement



#### 5.2.4. Test Data

**Remarks:**

- The emissions were scanned from 0.01 to 1000 MHz; all spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- The J3E emissions, set at maximum power, are chosen to be tested for worst case.

<b>Test Frequency:</b>		1.71 MHz				
<b>Test Frequency Range:</b>		10 kHz - 1000 MHz				
<b>Power</b> conducted :		49.69 dBm				
<b>Limit:</b>		-13 dBm				
Frequency (MHz)	RF Peak Level @ 3m (dB $\mu$ V/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured (dBm)	Limit (dBm)	Margin (dB)
0.01 -1000	*	Peak	V/H	*	-13	*
* Spurious emissions are more than 20dB below the specified limit						

<b>Test Frequency:</b>		17.45 MHz				
<b>Test Frequency Range:</b>		10 kHz - 1000 MHz				
<b>Power</b> conducted :		51.25 dBm				
<b>Limit:</b>		-13 dBm				
Frequency (MHz)	RF Peak Level @ 3m (dB $\mu$ V/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured (dBm)	Limit (dBm)	Margin (dB)
0.01 -1000	*	Peak	V/H	*	-13	*
* Spurious emissions are more than 20dB below the specified limit						

<b>Test Frequency:</b>		29.75 MHz				
<b>Test Frequency Range:</b>		10 kHz - 1000 MHz				
<b>Power</b> conducted :		51.16 dBm				
<b>Limit:</b>		-13 dBm				
Frequency (MHz)	RF Peak Level @ 3m (dBµV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP measured (dBm)	Limit (dBm)	Margin (dB)
89.25	69.60	Peak	V	-29.26	-13	-16.26
119.00	75.61	Peak	V	-24.87	-13	-11.87
148.75	74.94	Peak	V	-24.22	-13	-11.22
178.50	75.75	Peak	V	-23.81	-13	-10.81
208.25	68.86	Peak	V	-31.11	-13	-18.11

**ULTRATECH GROUP OF LABS**

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: 16ICOM427\_FCC90

May 26, 2016

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

## EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU	100398	20 Hz – 26.5 GHz	14 Sep 2017
Attenuator (40dB)	Aeroflex/Weinschel	53-40-34	MN917	DC-1 GHz	Cal. on use.
High Pass Filter	Mini Circuit	SHP 25+	--	Cut off 200 MHz	Cal. on use.
High Pass Filter	Mini Circuit	SHP 50+	--	Cut off 200 MHz	Cal. on use.
High Pass Filter	Mini Circuit	SHP 200	--	Cut off 200 MHz	Cal. on use.
Power supply	Tenma	72-7295	490300297	1-40V DC 5A	Cal. on use.
RF Communication Test Set	Hewlett Packard	8920B	US39064699	30MHz-1GHz	30 Jan 2017
Attenuator	Aeroflex/Weinschel	23-20-34	BH7876	DC-18 GHz	Cal. on use.
Loop antenna	EMCO	6502	9104-2611	10KHz - 30MHz	05 Nov 2016
Antenna	ETS	93148	1101	200-2000 MHz	14 Jul 2016
Biconical Antenna	ETS	3110B	3379	20-200MHz	11 Sep 2016
Preamplifier	Com-power	PA-103A	161243	10-1000MHz	10 Jun 2016
Horn antenna	EMCO	3117	19425	1-18GHz	17 Jun 2017
Preamplifier	Com-power	PA-118A	551016	500MHz-18GHz	06 Jan 2017

### ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: 16ICOM427\_FCC90

May 26, 2016

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 CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

### 7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	Measured (dB)	Limit (dB)
<b>u<sub>c</sub></b>	<b>Combined standard uncertainty:</b> $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	<b>± 2.39</b>	<b>± 2.6</b>
<b>U</b>	<b>Expanded uncertainty U:</b> $U = 2u_c(y)$	<b>± 4.79</b>	<b>± 5.2</b>

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	Measured (dB)	Limit (dB)
<b>u<sub>c</sub></b>	<b>Combined standard uncertainty:</b> $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	<b>± 2.39</b>	<b>± 2.6</b>
<b>U</b>	<b>Expanded uncertainty U:</b> $U = 2u_c(y)$	<b>± 4.78</b>	<b>± 5.2</b>

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	Measured (dB)	Limit (dB)
<b>u<sub>c</sub></b>	<b>Combined standard uncertainty:</b> $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	<b>± 1.87</b>	<b>Under consideration</b>
<b>U</b>	<b>Expanded uncertainty U:</b> $U = 2u_c(y)$	<b>± 3.75</b>	<b>Under consideration</b>

## ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: 16ICOM427\_FCC90  
May 26, 2016

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