

# ENGINEERING TEST REPORT



**HF/VHF/UHF Transceiver**  
**Model No.: IC-9100**

**FCC ID: AFJ318300**

*Applicant:*

**ICOM Incorporated**  
1-1-32, Kamiminami, Hirano-ku  
Osaka, Japan, 547-0003

***Tested in Accordance With***

**Federal Communications Commission (FCC)**  
**47 CFR, Part 15, Subpart B, Scanning Receivers**

**UltraTech's File No.: ICOM-266F15B121**

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

Date: January 24, 2011

Report Prepared by: Dan Huynh

Tested by: Wei Wu, Phuong Ngo and  
Satish Patel

Issued Date: January 24, 2011

Test Dates: January 14, 19 & 21, 2011

- 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: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Email: [tri@ultratech-labs.com](mailto:tri@ultratech-labs.com)

**FCC**

91038



1309



46390-2049



NvLap Lab Code 200093-0



SL2-IN-E-1119R



**Korea KCC-RRL**  
CA2049

## TABLE OF CONTENTS

|                   |                                                                                                                                |           |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>EXHIBIT 1.</b> | <b>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.</b> | <b>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         |
| 2.6.              | TEST SETUP BLOCK DIAGRAM.....                                                                                                  | 5         |
| <b>EXHIBIT 3.</b> | <b>EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS.....</b>                                                           | <b>6</b>  |
| 3.1.              | OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS .....                                                               | 6         |
| <b>EXHIBIT 4.</b> | <b>SUMMARY OF TEST RESULTS.....</b>                                                                                            | <b>7</b>  |
| 4.1.              | LOCATION OF TESTS.....                                                                                                         | 7         |
| 4.2.              | APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS.....                                                                      | 7         |
| 4.3.              | MODIFICATIONS REQUIRED FOR COMPLIANCE .....                                                                                    | 7         |
| <b>EXHIBIT 5.</b> | <b>MEASUREMENTS, EXAMINATIONS &amp; TEST DATA FOR EMC EMISSIONS .....</b>                                                      | <b>8</b>  |
| 5.1.              | TEST PROCEDURES .....                                                                                                          | 8         |
| 5.2.              | MEASUREMENT UNCERTAINTIES .....                                                                                                | 8         |
| 5.3.              | MEASUREMENT EQUIPMENT USED .....                                                                                               | 8         |
| 5.4.              | POWER LINE CONDUCTED EMISSIONS [§ 15.107(a)].....                                                                              | 9         |
| 5.5.              | RECEIVER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS [§15.111(a)].....                                                 | 12        |
| 5.6.              | SPURIOUS/HARMONIC RADIATED EMISSIONS FROM RECEIVER AND CLASS B UNINTENTIONAL<br>RADIATORS (DIGITAL DEVICES) [§ 15.109(a)]..... | 28        |
| 5.7.              | REQUIREMENTS FOR SCANNING RECEIVERS [§ 15.121] .....                                                                           | 36        |
| 5.8.              | SCANNING RECEIVERS CELLULAR BAND REJECTION [§ 15.121(b)].....                                                                  | 39        |
| <b>EXHIBIT 6.</b> | <b>TEST EQUIPMENTS LIST.....</b>                                                                                               | <b>42</b> |
| <b>EXHIBIT 7.</b> | <b>MEASUREMENT UNCERTAINTY.....</b>                                                                                            | <b>43</b> |
| 7.1.              | LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY.....                                                                           | 43        |
| 7.2.              | RADIATED EMISSION MEASUREMENT UNCERTAINTY.....                                                                                 | 43        |

## EXHIBIT 1. INTRODUCTION

### 1.1. SCOPE

|                                      |                                                                                                                                                                                                                                                                                                              |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reference:</b>                    | FCC Part 15, Subpart B, Sections 15.107, 15.109, 15.111 & 15.121                                                                                                                                                                                                                                             |
| <b>Title:</b>                        | Code of Federal Regulations (CFR), Title 47, Telecommunication, Part 15                                                                                                                                                                                                                                      |
| <b>Purpose of Test:</b>              | To gain FCC Certification Authorization for Scanning Receivers.                                                                                                                                                                                                                                              |
| <b>Test Procedures:</b>              | 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. |
| <b>Environmental Classification:</b> | Residential, Commercial, Industrial or Business environment.                                                                                                                                                                                                                                                 |

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

None.

### 1.3. NORMATIVE REFERENCES

| Publication                | Year | Title                                                                                                                                                               |
|----------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC CFR Parts 0-19, 80-End | 2009 | Code of Federal Regulations – Telecommunication                                                                                                                     |
| ANSI C63.4                 | 2003 | 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 C63.10                | 2009 | American National Standard for Testing Unlicensed Wireless Devices                                                                                                  |
| TIA/EIA 603, Edition C     | 2004 | 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 #: ICOM-266F15B121

January 24, 2011

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       |                                                                                                                                                        |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name:           | Icom Incorporated                                                                                                                                      |
| Address:        | 1-1-32, Kamiminami,<br>Hirano-ku, Osaka<br>Japan, 547-0003                                                                                             |
| Contact Person: | Mr. Takayuki Watanabe<br>Phone #: +81-66-793-5302<br>Fax #: +81-66-793-0013<br>Email Address: <a href="mailto:export@icom.co.jp">export@icom.co.jp</a> |

| MANUFACTURER    |                                                                                                                                                        |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name:           | Icom Incorporated                                                                                                                                      |
| Address:        | 1-1-32, Kamiminami<br>Hirano-ku, Osaka<br>Japan, 547-0003                                                                                              |
| Contact Person: | Mr. Takayuki Watanabe<br>Phone #: +81-66-793-5302<br>Fax #: +81-66-793-0013<br>Email Address: <a href="mailto:export@icom.co.jp">export@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.

|                       |                        |
|-----------------------|------------------------|
| Brand Name:           | ICOM Incorporated      |
| Product Name:         | HF/VHF/UHF Transceiver |
| Model Name or Number: | IC-9100                |
| Serial Number:        | Test sample            |
| Type of Equipment:    | HF/VHF/UHF Transceiver |
| Power Input Source:   | 13.8 VDC power supply  |

#### 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 #: ICOM-266F15B121

January 24, 2011

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

| RECEIVER                   |                                                                                           |
|----------------------------|-------------------------------------------------------------------------------------------|
| Equipment Type:            | Mobile                                                                                    |
| Power Supply Requirement:  | 13.8 VDC $\pm$ 15% (negative ground)                                                      |
| Operating Frequency Range: | 0.030 - 60.000 MHz, 136.000 - 174.000 MHz, 420.000 - 480.000 MHz, 1240.000 - 1320.000 MHz |
| RF Input Impedance:        | 50 $\Omega$                                                                               |

### 2.4. 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 [ANT1]                      | 1                         | PL-259           | N/A                                |
| 2           | Antenna Connector 1 [ANT2]                      | 1                         | PL-259           | N/A                                |
| 3           | 1200 MHz Band antenna Connector [1200MHz ANT]   | 1                         | Type-N           | N/A                                |
| 4           | Main Band External Speaker Jack [EXT-SP (MAIN)] | 1                         | Mini Jack        | Shielded                           |
| 5           | Sub Band External Speaker Jack [EXT-SP (SUB)]   | 1                         | Mini Jack        | Shielded                           |
| 6           | 430 MHz Antenna Connector [430MHz ANT]          | 1                         | Type-N           | N/A                                |
| 7           | 144 MHz Antenna Connector [144MHz ANT]          | 1                         | PL-259           | Shielded                           |
| 8           | DC Power Socket [DC 13.8V]                      | 1                         | 4 pin connector  | Non-Shielded                       |
| 9           | Tuner Control Socket [TUNER]                    | 1                         | 4 Wires          | Non-Shielded                       |
| 10          | Data1 Jack [DATA1]                              | 1                         | 2.5 mm Mini Jack | Shielded                           |
| 11          | Data2 Socket [DATA2]                            | 1                         | 6-pin DIN        | Shielded                           |
| 12          | Straight Key Jack [KEY]                         | 1                         | Mini Jack        | Shielded                           |
| 13          | ALC Input Jack [ALC]                            | 1                         | RCA              | Shielded                           |
| 14          | Send Control Jack [SEND]                        | 1                         | RCA              | Shielded                           |
| 15          | Accessory Socket [ACC]                          | 1                         | 13-pin DIN       | Shielded                           |
| 16          | CI-V remote Control Jack [REMOTE]               | 1                         | Mini Jack        | Shielded                           |
| 17          | USB Port [USB]                                  | 1                         | USB Type B       | Shielded                           |
| 18          | Headphone Jack [PHONES]                         | 1                         | Phone Jack       | Shielded                           |
| 19          | Electronic Keyer Jack [ELEC-KEY]                | 1                         | Phone Jack       | Shielded                           |
| 20          | Microphone Connector [MIC]                      | 1                         | 8-pin DIN        | Shielded                           |

#### 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 #: ICOM-266F15B121

January 24, 2011

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:

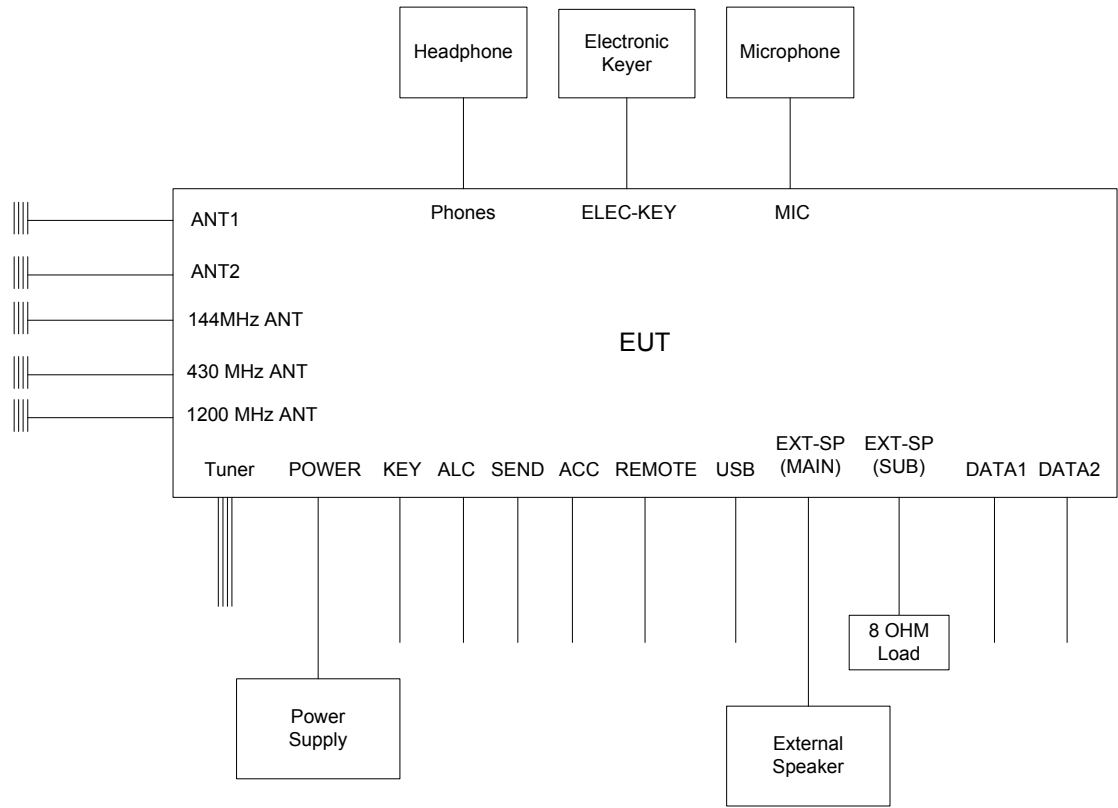
| Ancillary Equipment # 1 |                  |
|-------------------------|------------------|
| Description:            | External Speaker |
| Brand name:             | ICOM             |
| Model Name or Number:   | SP-21            |
| Cable Type:             | Shielded         |

| Ancillary Equipment # 2 |                    |
|-------------------------|--------------------|
| Description:            | Desktop Microphone |
| Brand name:             | ICOM               |
| Model Name or Number:   | SM-20              |
| Cable Type:             | Shielded           |

| Ancillary Equipment # 3 |                  |
|-------------------------|------------------|
| Description:            | Electronic Keyer |
| Brand name:             | ICOM             |
| Model Name or Number:   | N/A              |
| Cable Type:             | Non-Shielded     |

| Ancillary Equipment # 4 |           |
|-------------------------|-----------|
| Description:            | Headphone |
| Brand name:             | Sony      |
| Model Name or Number:   | MDR-Z500  |
| Cable Type:             | Shielded  |

2.6. TEST SETUP BLOCK DIAGRAM



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

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

|                               |                                                                      |
|-------------------------------|----------------------------------------------------------------------|
| <b>Operating Modes:</b>       | The receiver was operated in the normal intended mode during testing |
| <b>Special Test Software:</b> | None                                                                 |
| <b>Special Hardware Used:</b> | None                                                                 |
| <b>Receiver Test Antenna:</b> | The EUT was tested with its antenna port terminated to 50Ω           |

| Receiver Test Signals                                                                                                     |                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <b>Frequency Band(s):</b>                                                                                                 | 0.030 - 60.000 MHz<br>136.000 - 174.000 MHz<br>420.000 - 480.000 MHz<br>1240.000 - 1320.000 MHz                  |
| <b>Test Frequency(ies):</b><br>(Near lowest, near middle & near highest frequencies in the frequency range of operation.) | 30 MHz, 45 MHz, 60 MHz<br>136 MHz, 155 MHz, 174 MHz<br>420 MHz, 450 MHz, 480 MHz<br>1240 MHz, 1280 MHz, 1320 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.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- 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 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: 2011-05-01.

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

| FCC Part 15, Subpart B | Test Requirements                                                        | Compliance (Yes/No) |
|------------------------|--------------------------------------------------------------------------|---------------------|
| 15.107(a), Class B     | Power Line Conducted Emissions Measurements                              | Yes                 |
| 15.111(a)              | Receiver Antenna Power Conducted Emissions for Non-Integral Antenna Port | Yes                 |
| 15.109(a)              | Radiated Emissions from Scanning Receivers & Class B Digital Device      | Yes                 |
| 15.121                 | Requirements for Scanning Receivers                                      | Yes                 |

### 4.3. MODIFICATIONS REQUIRED FOR COMPLIANCE

None.

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

### **5.1. TEST PROCEDURES**

Please refer to Ultratech Test Procedures, File# ULTR-P001-2004 and for Test Procedures.

### **5.2. MEASUREMENT UNCERTAINTIES**

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. Please refer to Exhibit 7 for Measurement Uncertainties.

### **5.3. MEASUREMENT EQUIPMENT USED**

The measurement equipment used complied with the requirements contained in ANSI C63.10 and CISPR 16-1-1.

## 5.4. POWER LINE CONDUCTED EMISSIONS [§ 15.107(a)]

### 5.4.1. Limits

The equipment shall meet the limits of the following table:

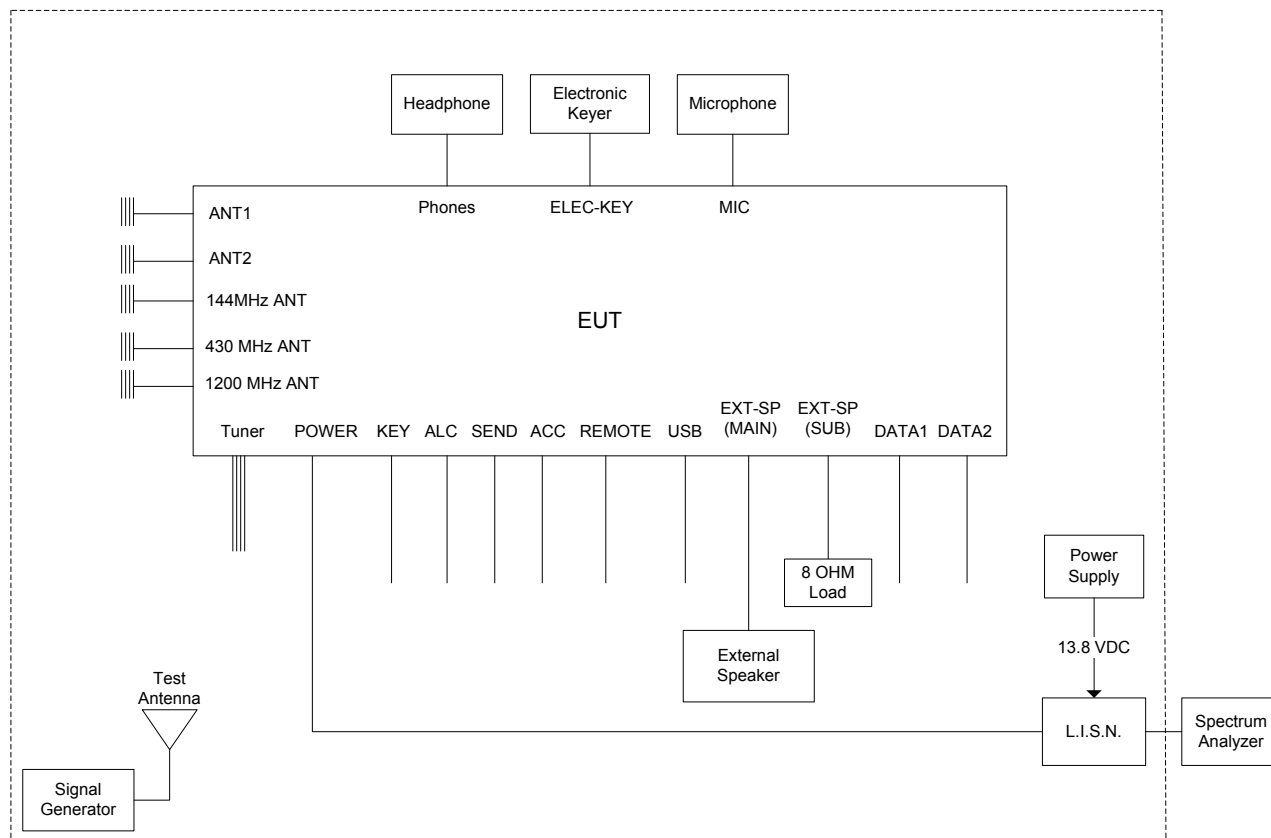
| Frequency of Emissions (MHz) | Class B Conducted Limit (dBµV) |           |
|------------------------------|--------------------------------|-----------|
|                              | Quasi-Peak                     | Average   |
| 0.15 to 0.5                  | 66 to 56*                      | 56 to 46* |
| 0.5 to 5                     | 56                             | 46        |
| 5 to 30                      | 60                             | 50        |

\* Decreasing linearly with logarithm of frequency

### 5.4.2. Method of Measurements

Refer to Ultratech Test Procedures ULTR-P001-200 & ANSI C63.4 for method of measurements.

### 5.4.3. Test Arrangement



## 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>

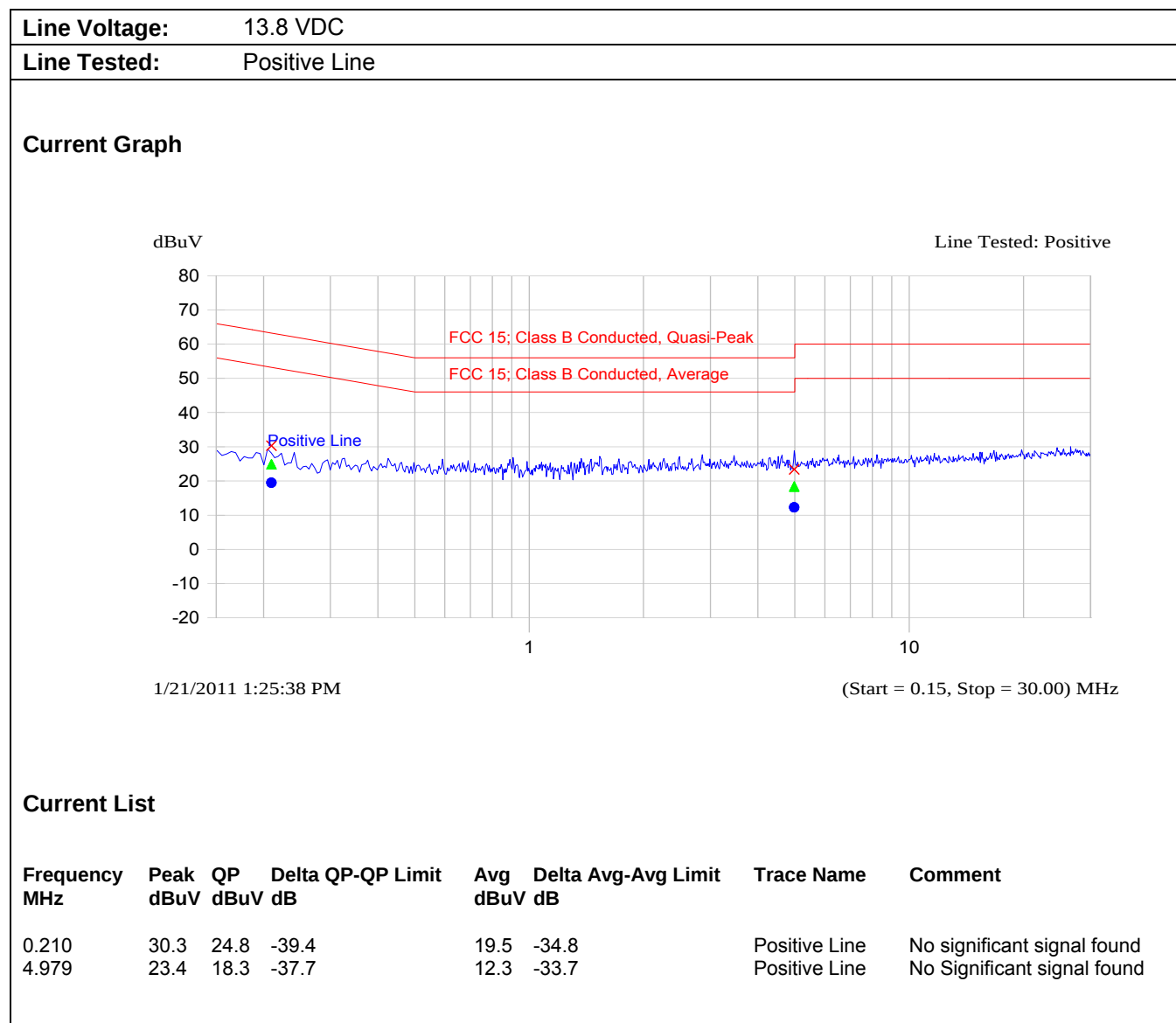
File #: ICOM-266F15B121

January 24, 2011

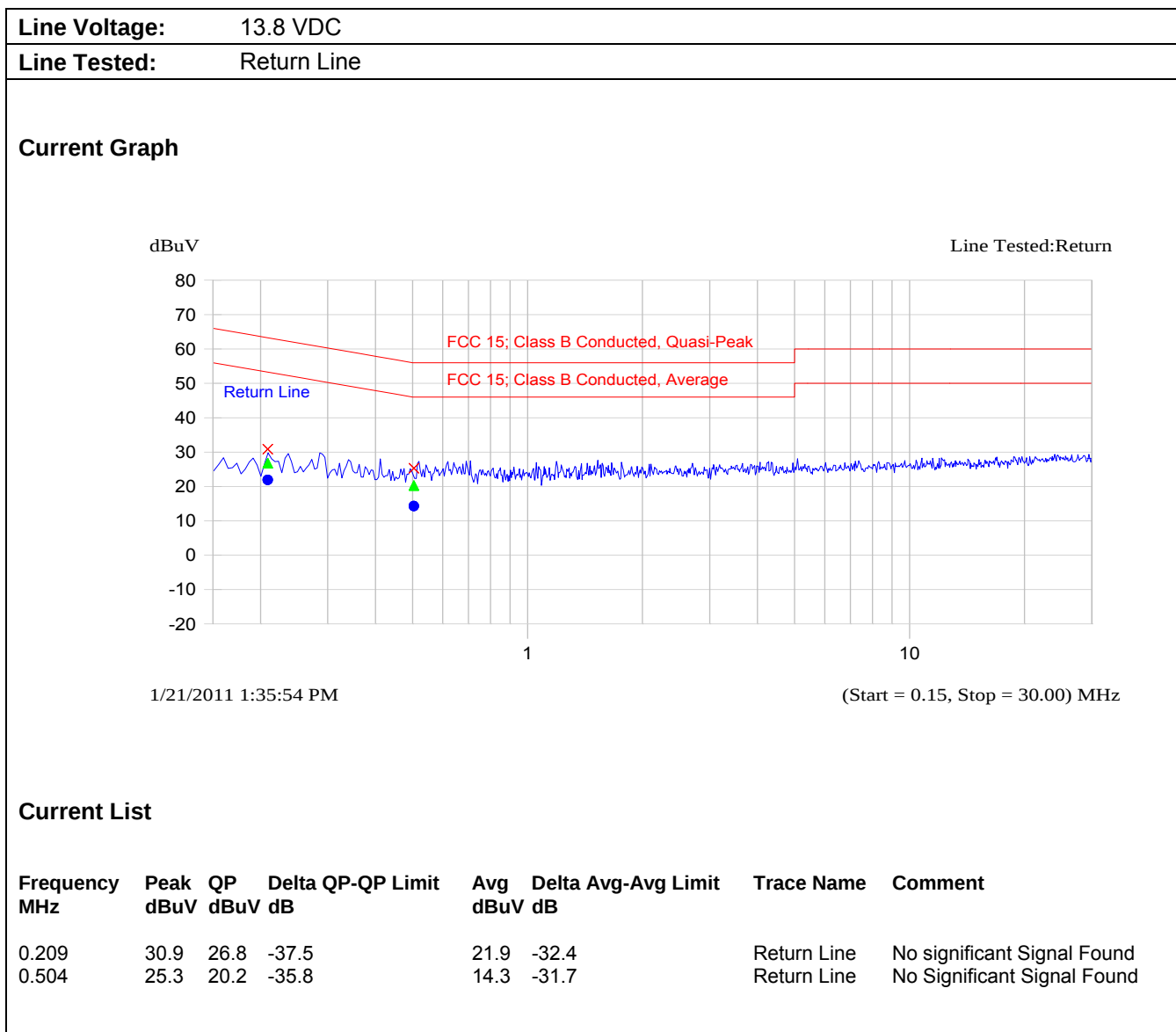
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

#### 5.4.4. Test Data

**Plot 5.4.4.1. Power Line Conducted Emissions, Positive Line**



**Plot 5.4.4.2. Power Line Conducted Emissions, Return Line**



## 5.5. RECEIVER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS [§15.111(a)]

### 5.5.1. Limits

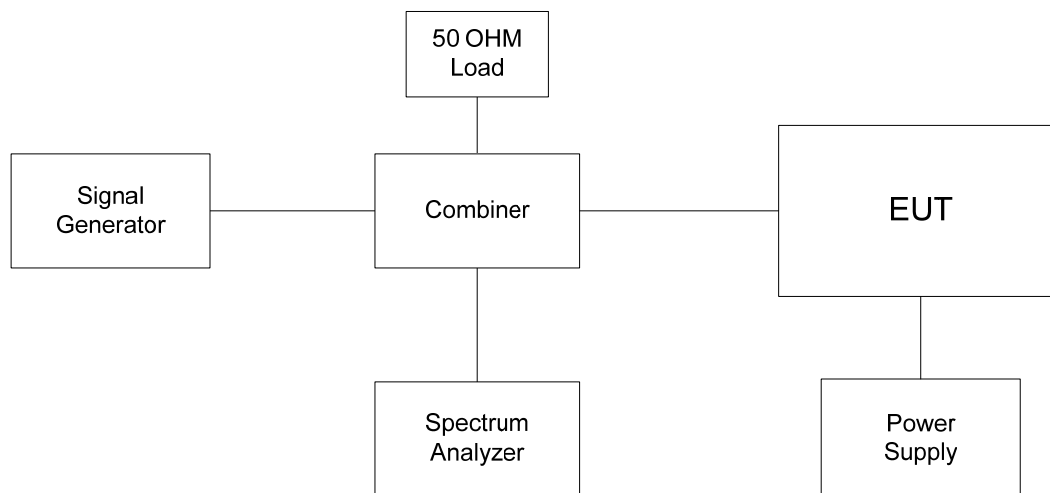
Receivers that operate (tune) in the frequency range 30 to 960 MHz and CB receivers that provides terminals for the connection of an external antenna may be tested to demonstrate compliance with the provisions of @ 15.109 with the antenna terminals shielded and terminated with a resistive termination equal to the impedance specified for the antenna, provided these receivers also comply with the following:- With the receiver antenna terminal connected to a resistive termination equal to the impedance specified or employed for the antenna, the power at the antenna terminal at frequency within the range from 30 MHz to 5<sup>th</sup> harmonic of the highest frequency shall not exceed 2.0 nanowatts (or -57 dBm @ 50 Ohm).

### 5.5.2. Method of Measurements

Refer to Ultratech Test Procedures ULTR-P001-200 & ANSI C63.4 for method of measurements.

The spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which the emission limit is specified, up to 5<sup>th</sup> harmonic of the highest frequency

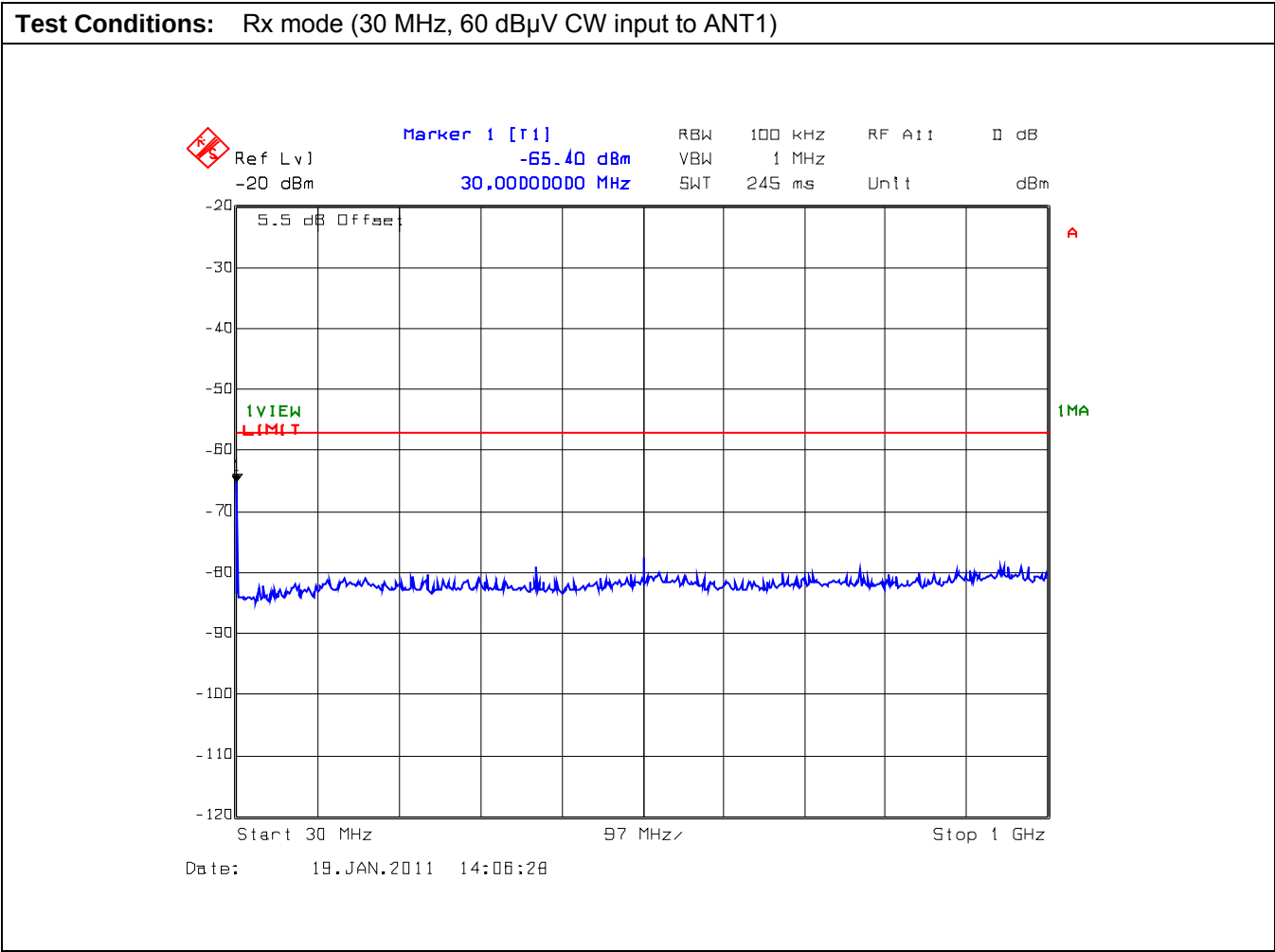
### 5.5.3. Test Arrangement



5.5.4. Test Data

5.5.4.1. 0.03 – 60 MHz Band

Plot 5.5.4.1.1. Conducted Receiver Spurious Emissions, ANT1, 30 MHz - 1 GHz



ULTRATECH GROUP OF LABS

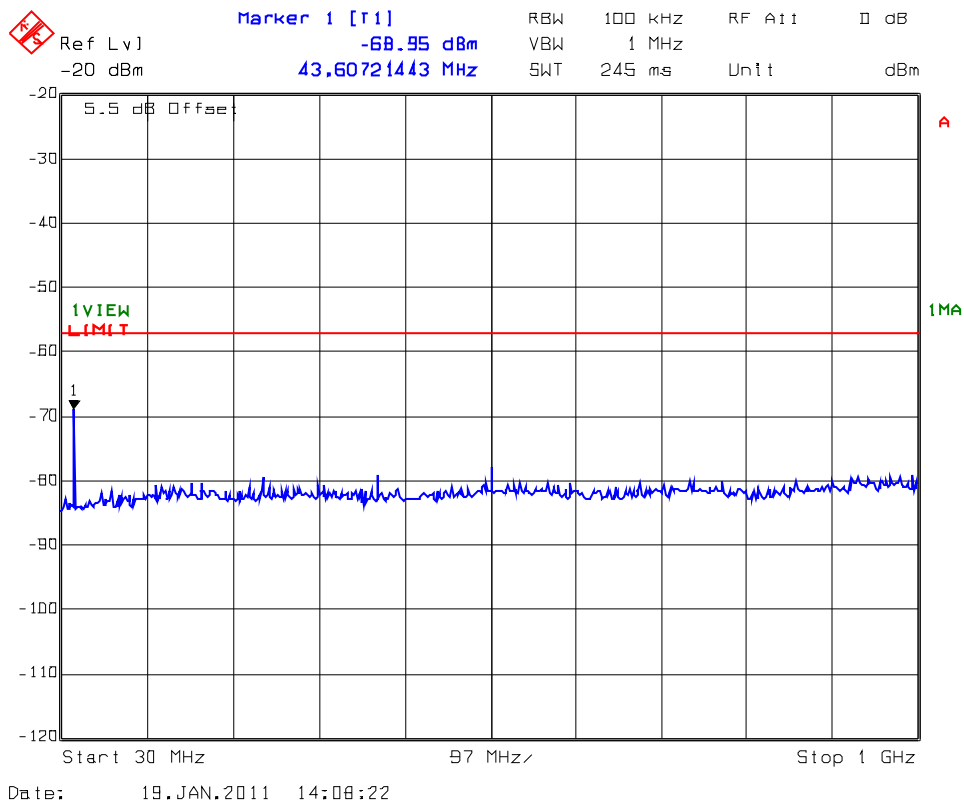
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: ICOM-266F15B121

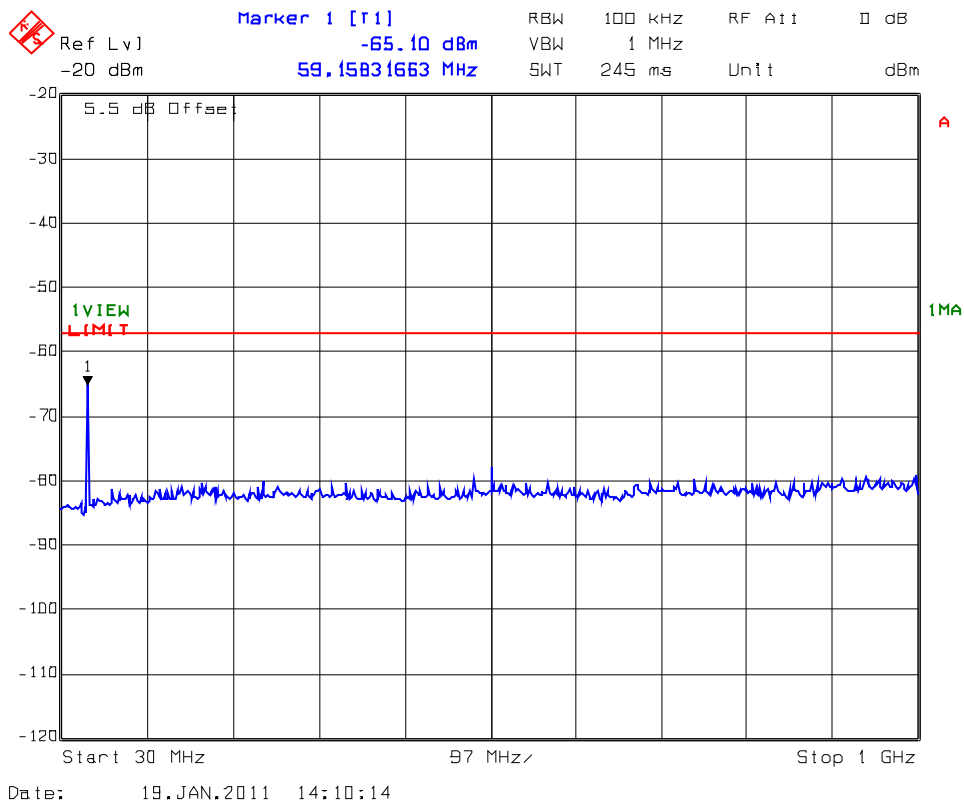
January 24, 2011

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

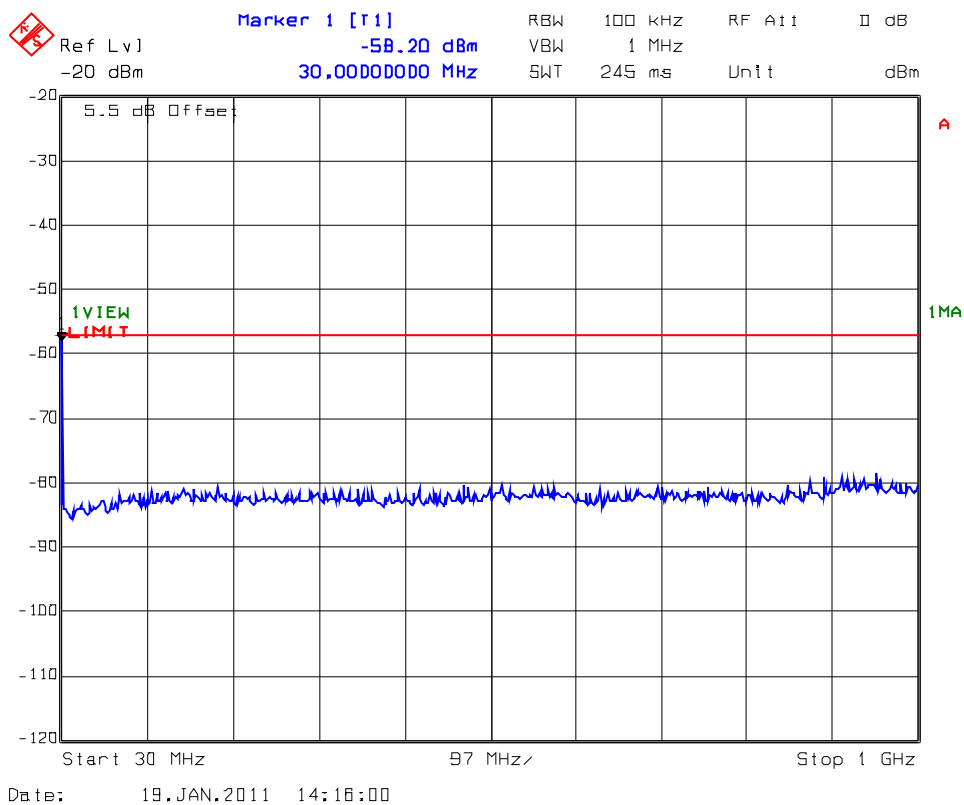
**Test Conditions:** Rx mode (45.0 MHz, 60 dBμV CW input to ANT1)



**Test Conditions:** Rx mode (60.0 MHz, 60 dBμV CW input to ANT1)

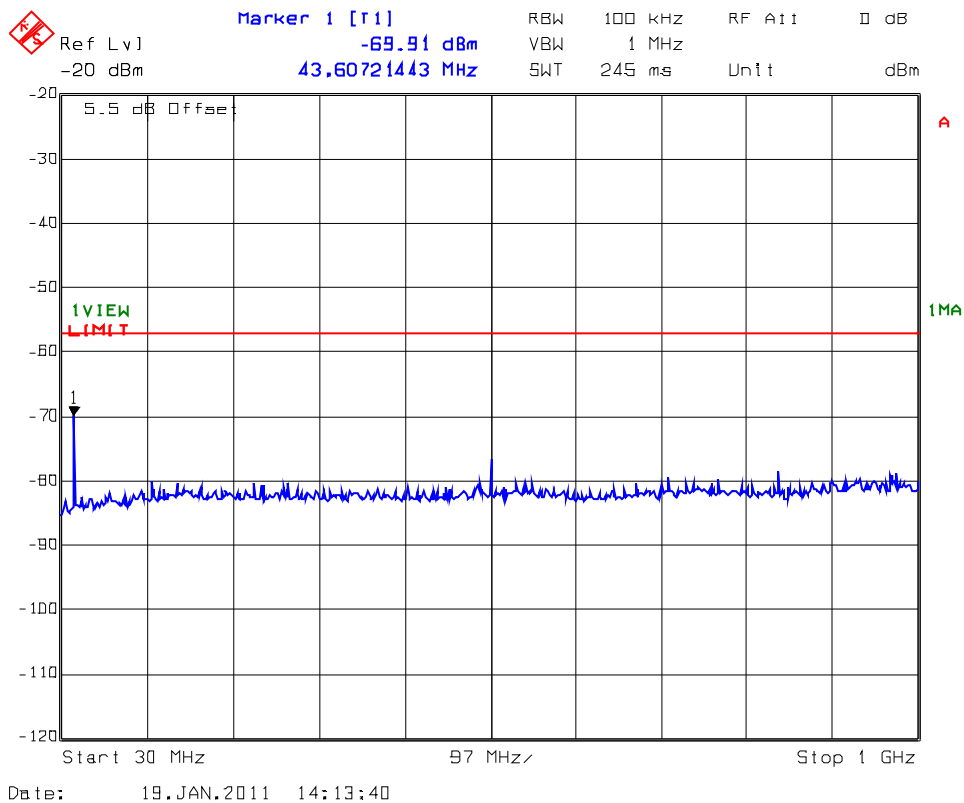


**Test Conditions:** Rx mode (30 MHz, 60 dBμV CW input to ANT2)

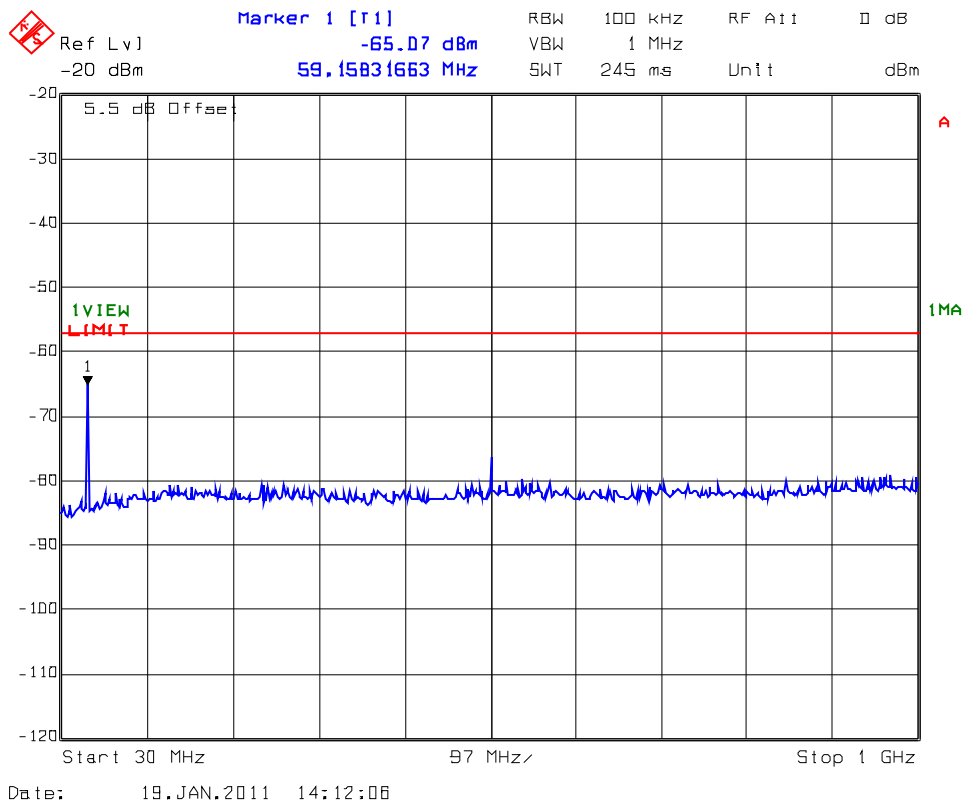


#### Plot 5.5.4.1.5. Conducted Receiver Spurious Emissions, ANT2, 30 MHz - 1 GHz

**Test Conditions:** Rx mode (45.0 MHz, 60 dBμV CW input to ANT2)

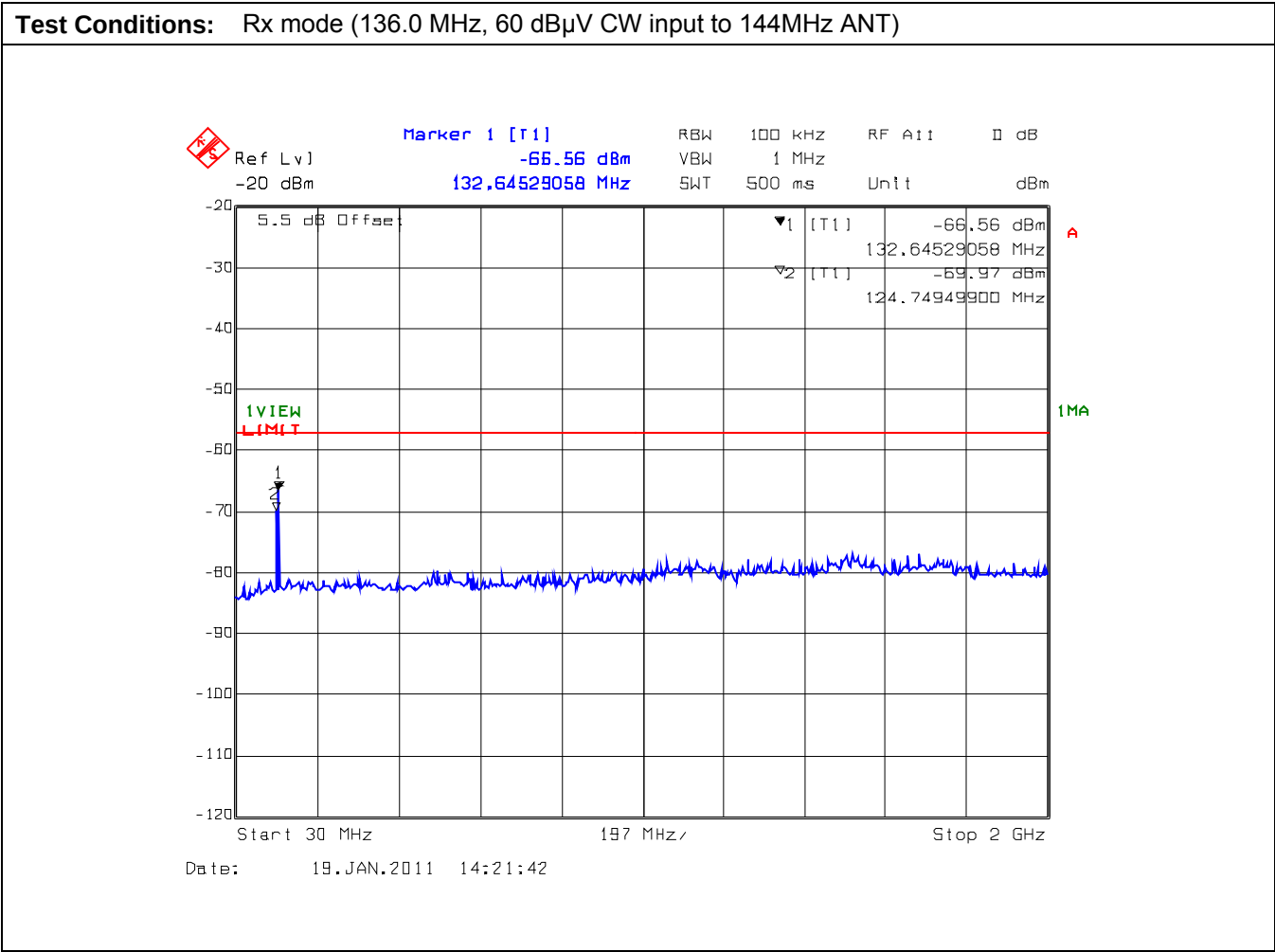


**Test Conditions:** Rx mode (60.0 MHz, 60 dBμV CW input to ANT2)

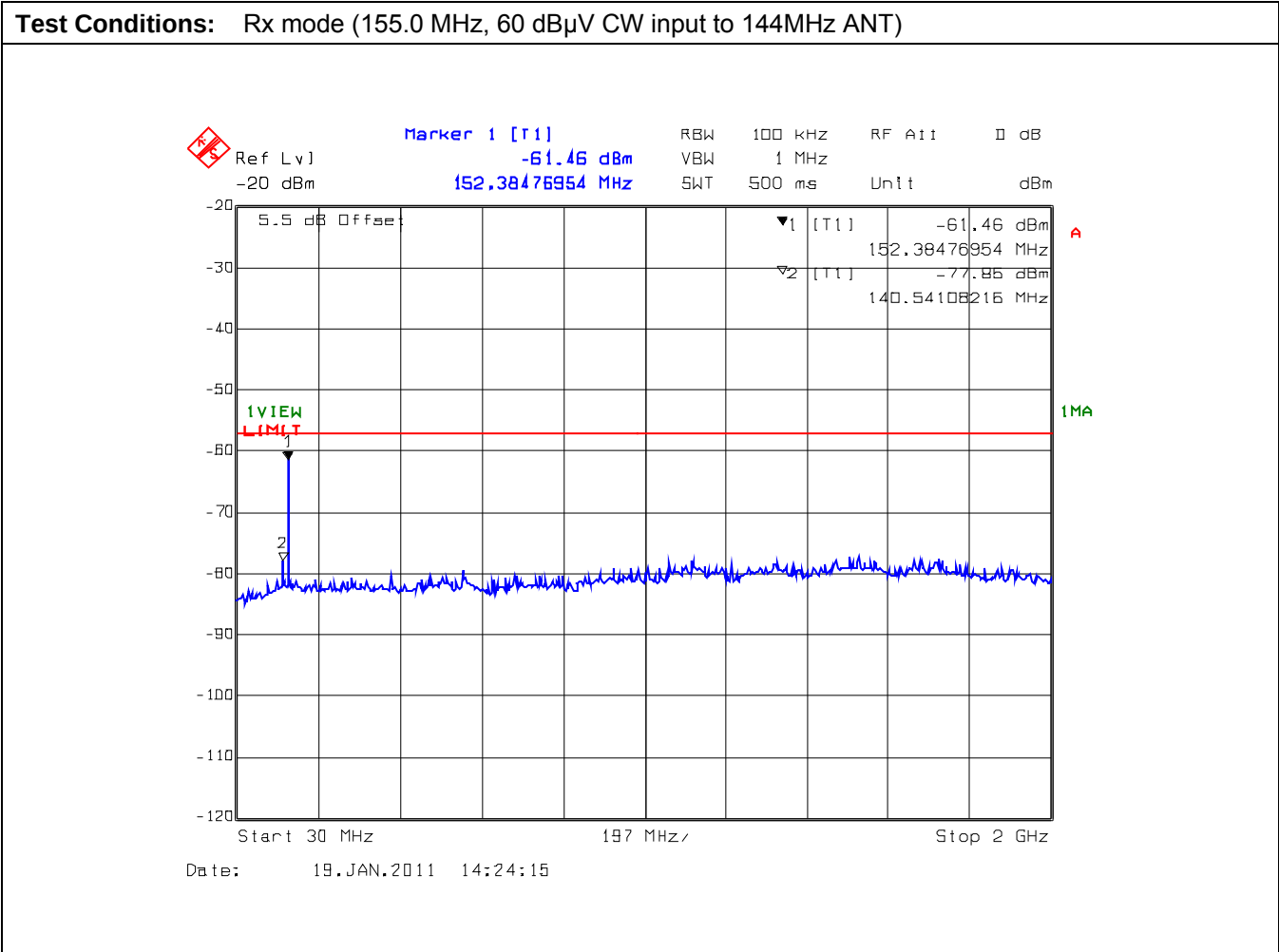


5.5.4.2. 136 – 174 MHz Band

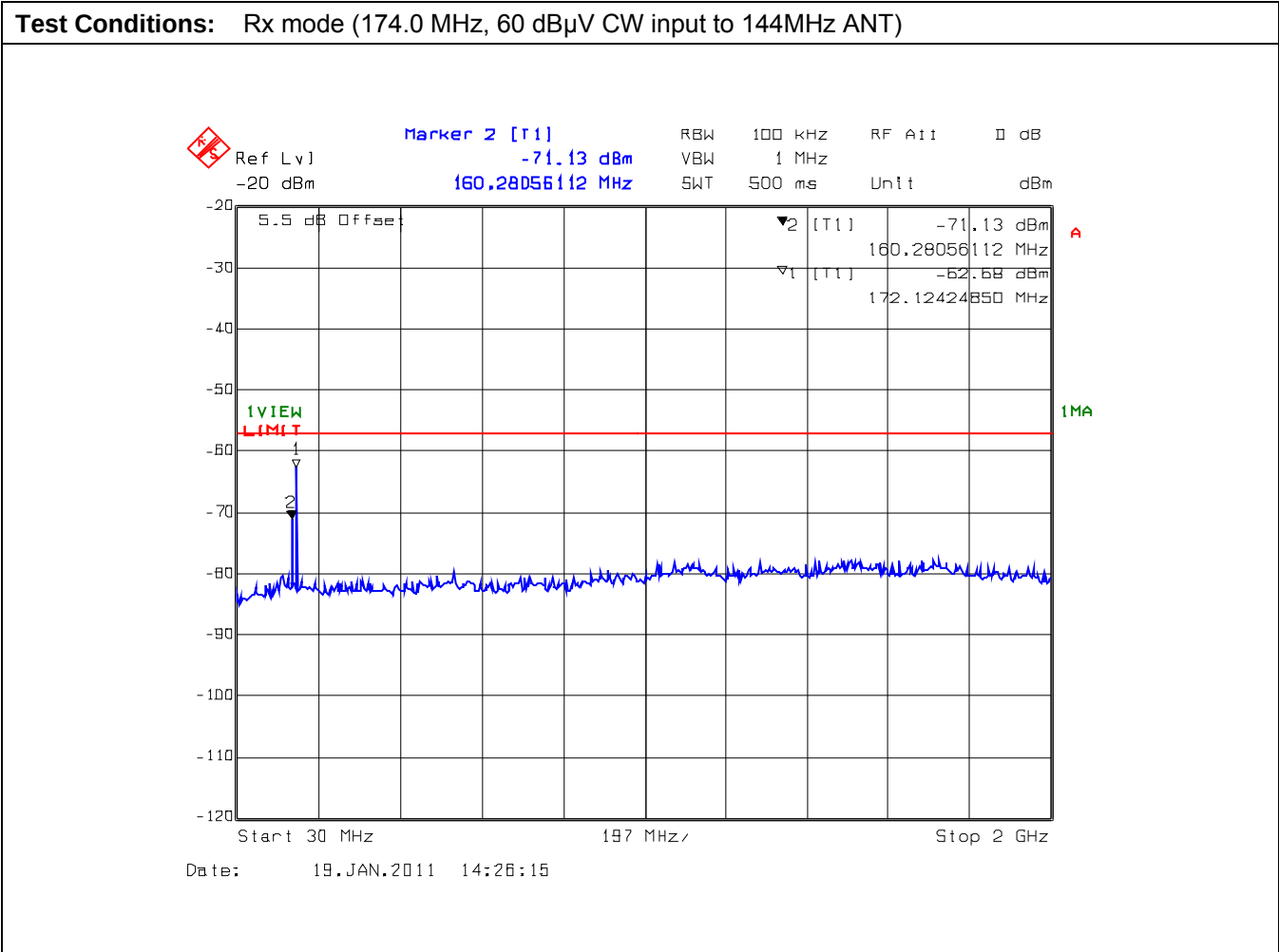
Plot 5.5.4.2.1. Conducted Receiver Spurious Emissions, 144MHz ANT, 30 MHz - 2 GHz



Plot 5.5.4.2.2. Conducted Receiver Spurious Emissions, 144MHz ANT, 30 MHz - 2 GHz

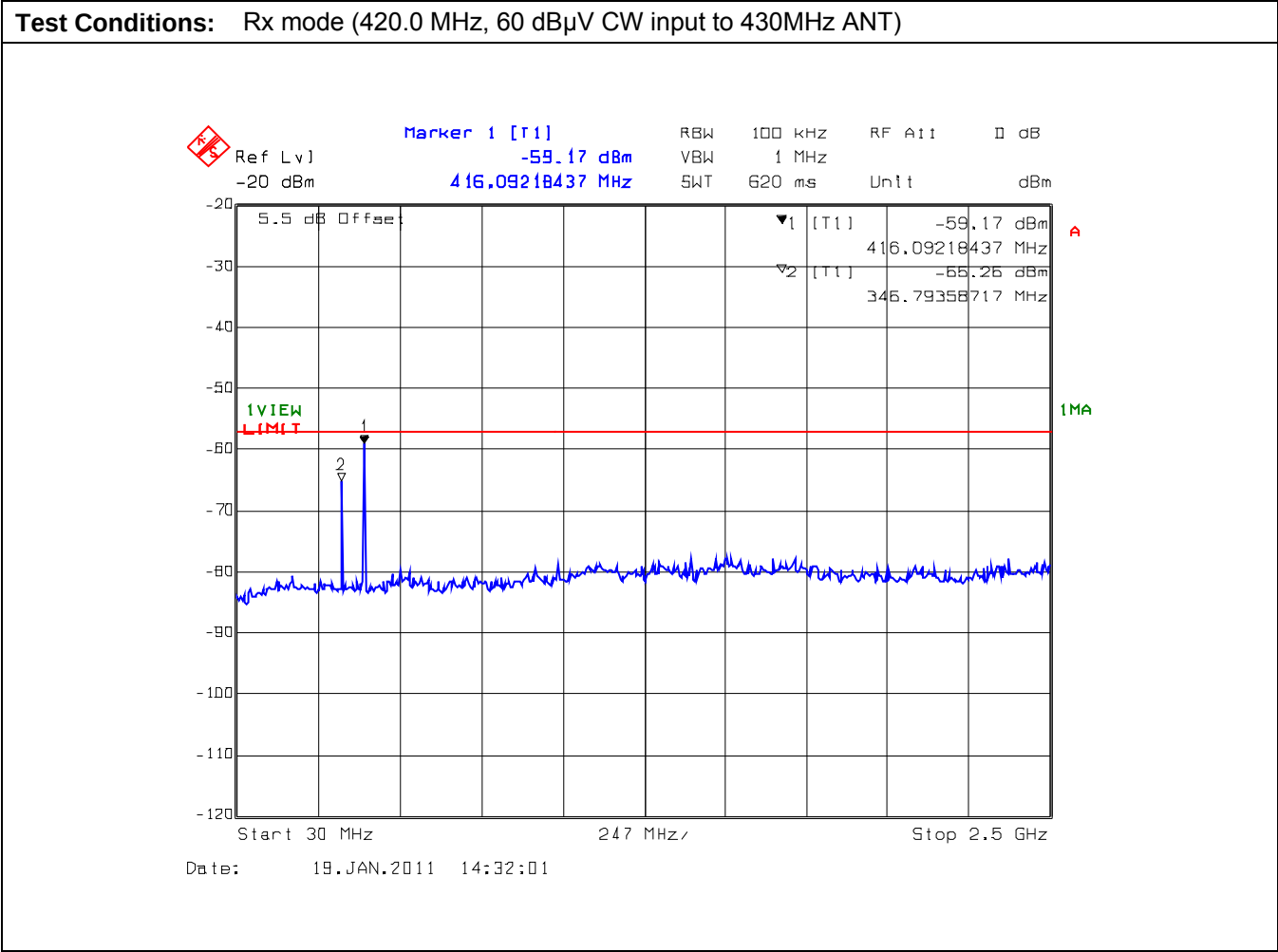


Plot 5.5.4.2.3. Conducted Receiver Spurious Emissions, 144MHz ANT, 30 MHz - 2 GHz



5.5.4.3. 420 – 480 MHz Band

Plot 5.5.4.3.1. Conducted Receiver Spurious Emissions, 430MHz ANT, 30 MHz – 2.5 GHz



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>

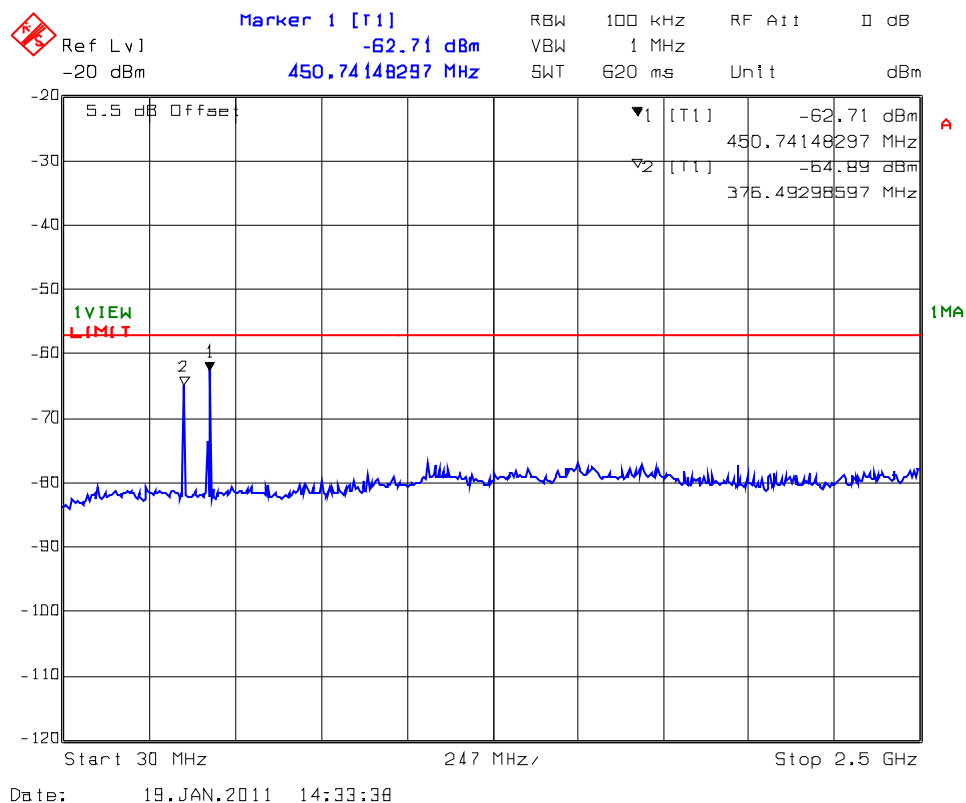
File #: ICOM-266F15B121

January 24, 2011

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

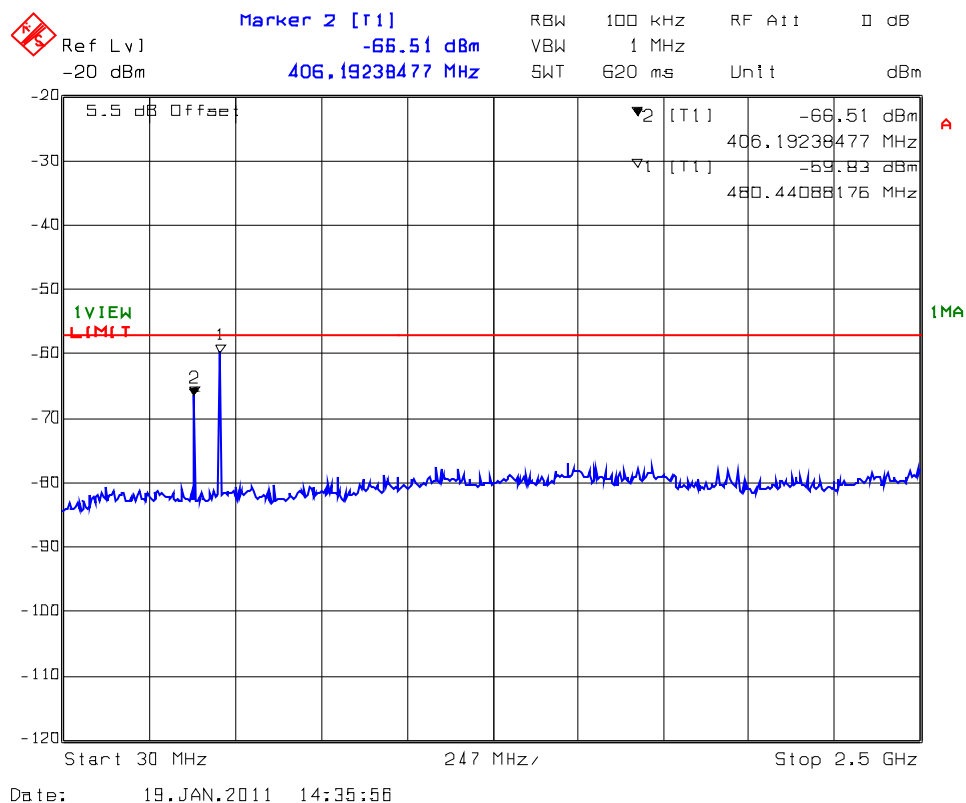
**Plot 5.5.4.3.2. Conducted Receiver Spurious Emissions, 430MHz ANT, 30 MHz - 2.5 GHz**

**Test Conditions:** Rx mode (450.0 MHz, 60 dBμV CW input to 430MHz ANT)



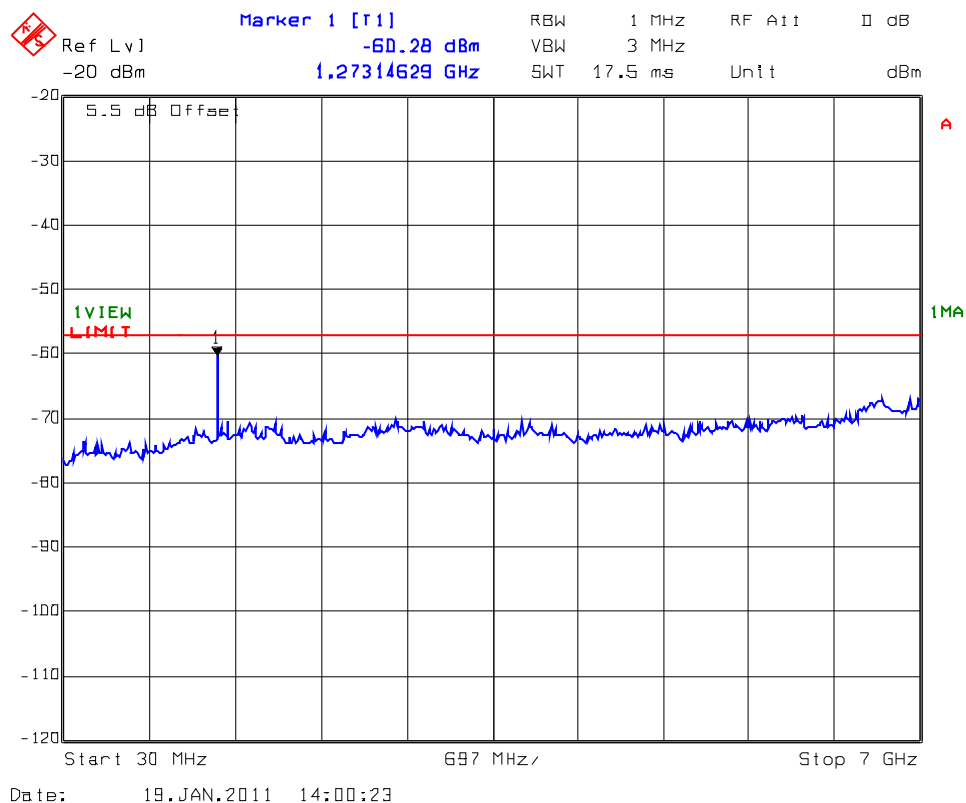
**Plot 5.5.4.3.3. Conducted Receiver Spurious Emissions, 430MHz ANT, 30 MHz - 2.5 GHz**

**Test Conditions:** Rx mode (480.0 MHz, 60 dBμV CW input to 430MHz ANT)

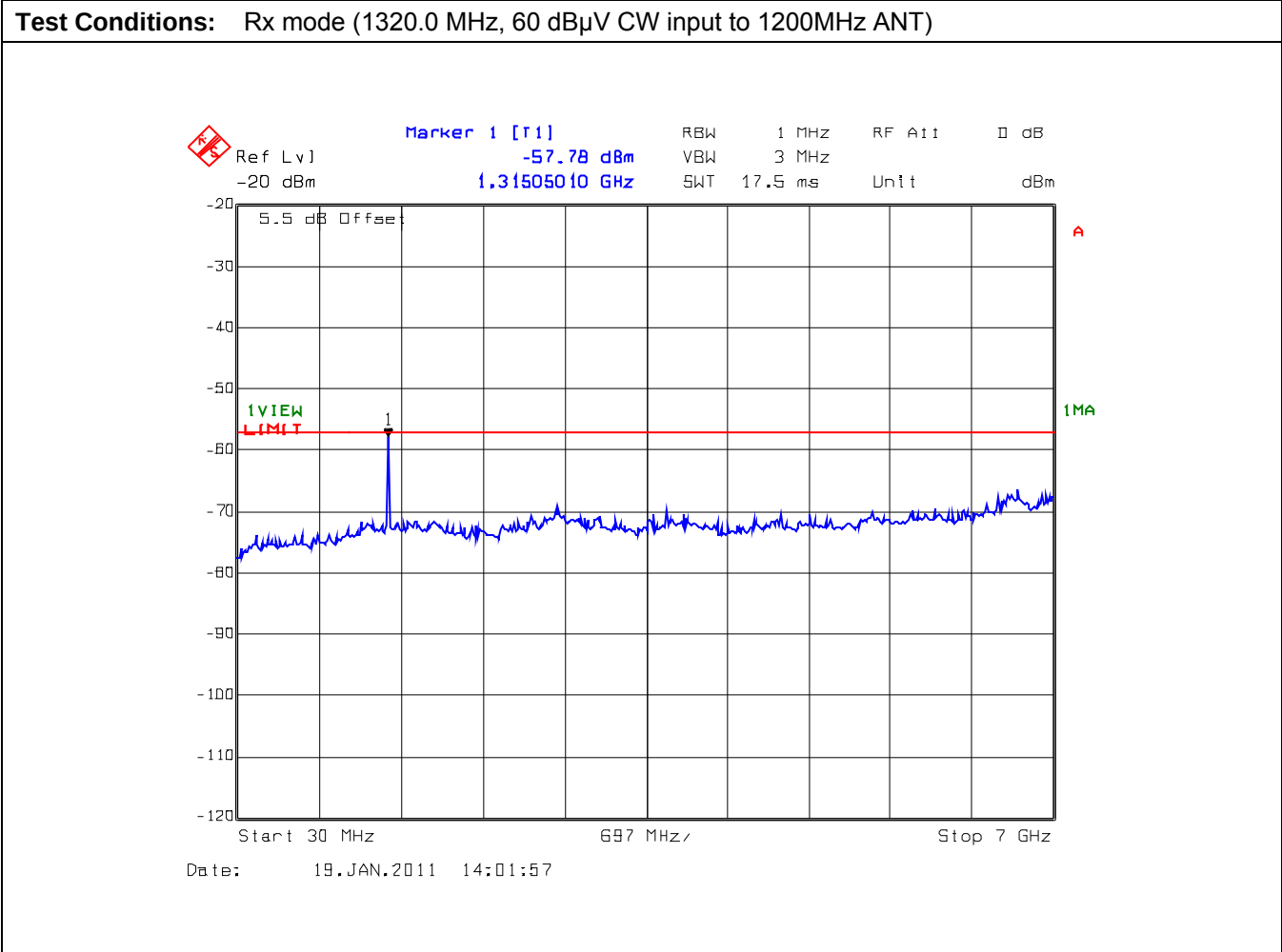




**Test Conditions:** Rx mode (1280.0 MHz, 60 dBμV CW input to 1200MHz ANT)



Plot 5.5.4.4.3. Conducted Receiver Spurious Emissions, 1200MHz ANT, 30 MHz - 7 GHz



**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 #: ICOM-266F15B121

January 24, 2011

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

## 5.6. SPURIOUS/HARMONIC RADIATED EMISSIONS FROM RECEIVER AND CLASS B UNINTENTIONAL RADIATORS (DIGITAL DEVICES) [§ 15.109(a)]

### 5.6.1. Limits

The equipment shall meet the limits of the following table:

| Test Frequency Range (MHz) | Class B Limits @ 3 m<br>(dB $\mu$ V/m) |
|----------------------------|----------------------------------------|
| 30 – 88                    | 40.0                                   |
| 88 – 216                   | 43.5                                   |
| 216 – 960                  | 46.0                                   |
| Above 960                  | 54.0                                   |

### 5.6.2. Method of Measurements

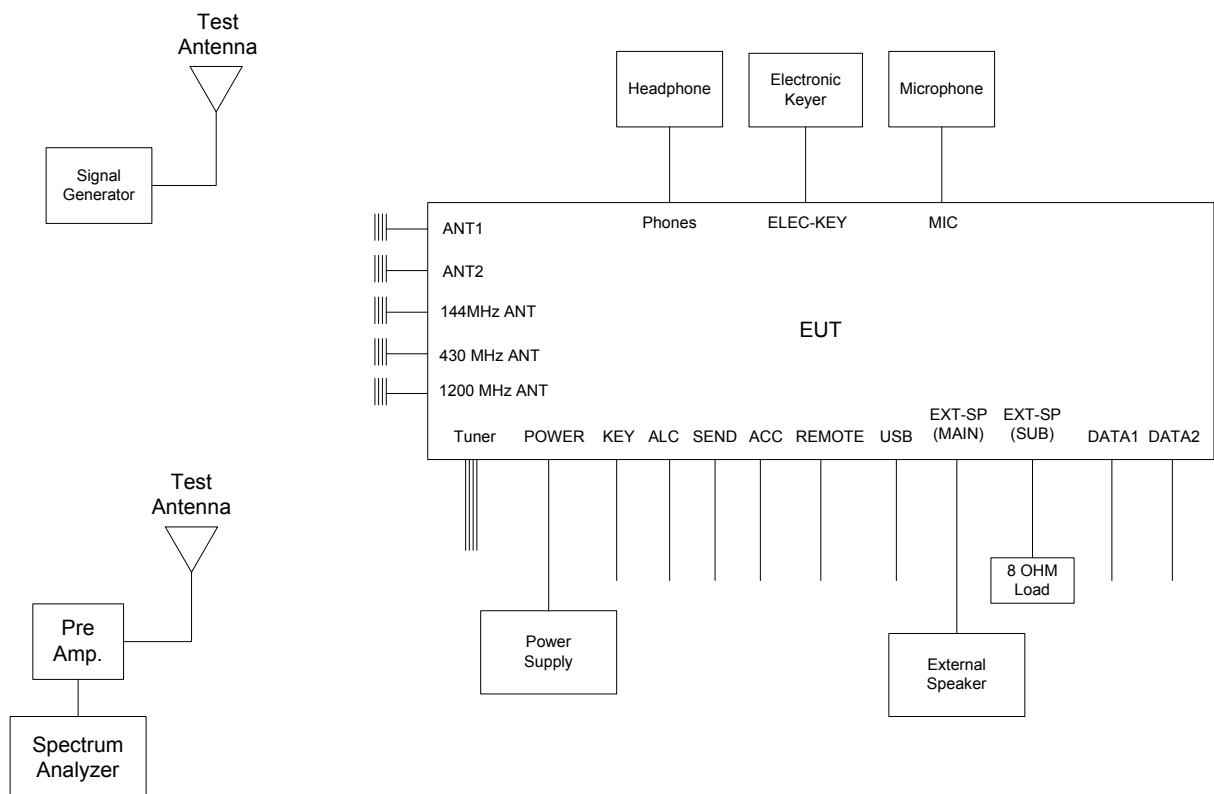
Refer to Ultratech Test Procedures ULTR-P001-200 & ANSI C63.4 for method of measurements.

The spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

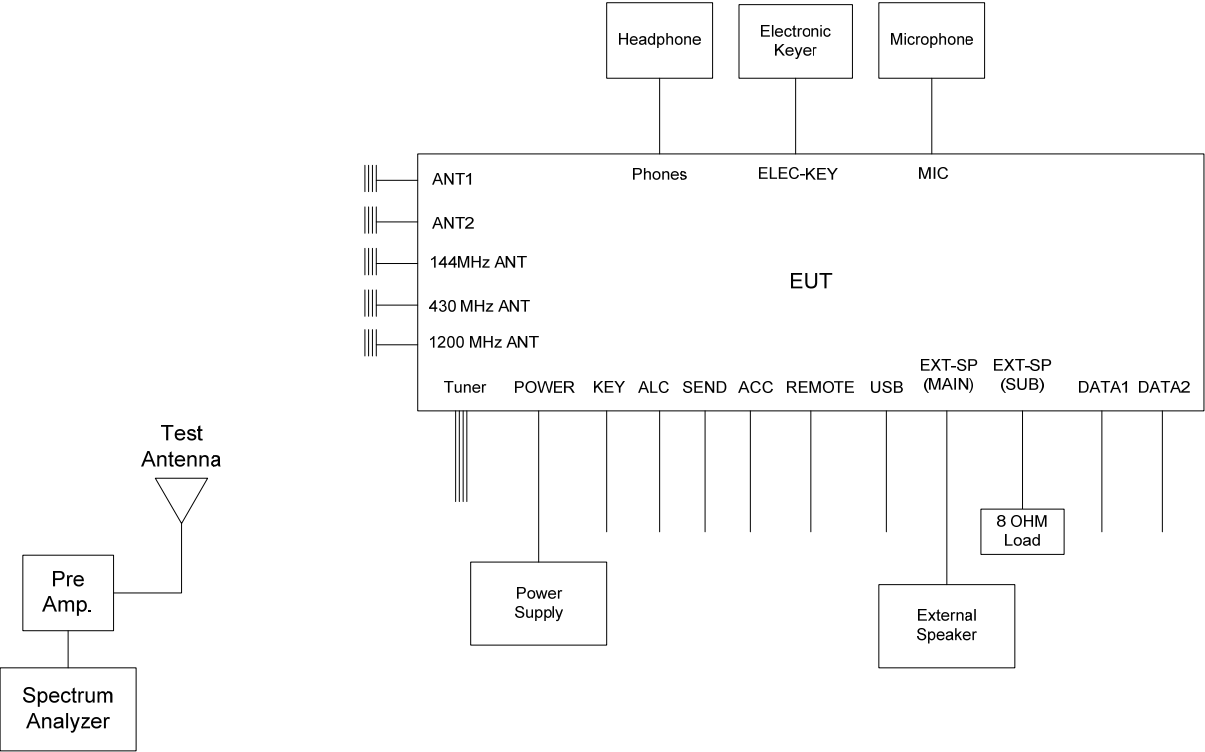
| Highest frequency generated or used in the device<br>or on which the device operates or tunes (MHz) | Upper frequency of measurement range<br>(MHz)                                      |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Below 1.705                                                                                         | 30                                                                                 |
| 1.705 - 108                                                                                         | 1000                                                                               |
| 108 – 500                                                                                           | 2000                                                                               |
| 500 -1000                                                                                           | 5000                                                                               |
| Above 1000                                                                                          | 5 <sup>th</sup> harmonic of the highest frequency or 40 GHz,<br>whichever is lower |

### 5.6.3. Test Arrangement

#### Receiver Mode



Digital Device



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 #: ICOM-266F15B121

January 24, 2011

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

#### 5.6.4. Test Data

##### Remarks:

- The measuring receiver shall be tuned over the frequency range 30 MHz to 5<sup>th</sup> harmonic of the highest frequency.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.

##### 5.6.4.1. 0.03 – 60 MHz Band

##### 5.6.4.1.1. Radiated Receiver Spurious Emissions Near Lowest Frequency (30 MHz)

| Frequency (MHz) | RF Level (dBμV/m) | Detector Used (Peak/QP) | Antenna Plane (H/V) | Limit (dBμV/m) | Margin (dB) |
|-----------------|-------------------|-------------------------|---------------------|----------------|-------------|
| 188.91          | 35.08             | Peak                    | H                   | 43.5           | -8.4        |

##### 5.6.4.1.2. Radiated Receiver Spurious Emissions Near Middle Frequency (45 MHz)

| Frequency (MHz)                                                       | RF Level (dBμV/m) | Detector Used (Peak/QP) | Antenna Plane (H/V) | Limit (dBμV/m) | Margin (dB) |
|-----------------------------------------------------------------------|-------------------|-------------------------|---------------------|----------------|-------------|
| All spurious emissions are more than 20 dB below the specified limit. |                   |                         |                     |                |             |

##### 5.6.4.1.3. Radiated Receiver Spurious Emissions Near Highest Frequency (60 MHz)

| Frequency (MHz)                                                       | RF Level (dBμV/m) | Detector Used (Peak/QP) | Antenna Plane (H/V) | Limit (dBμV/m) | Margin (dB) |
|-----------------------------------------------------------------------|-------------------|-------------------------|---------------------|----------------|-------------|
| All spurious emissions are more than 20 dB below the specified limit. |                   |                         |                     |                |             |

#### 5.6.4.2. 136 – 174 MHz Band

##### 5.6.4.2.1. Radiated Receiver Spurious Emissions Near Lowest Frequency (136 MHz)

| Frequency<br>(MHz)                                                    | RF Level<br>(dB $\mu$ V/m) | Detector<br>Used<br>(Peak/QP) | Antenna<br>Plane<br>(H/V) | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-----------------------------------------------------------------------|----------------------------|-------------------------------|---------------------------|-------------------------|----------------|
| All spurious emissions are more than 20 dB below the specified limit. |                            |                               |                           |                         |                |

##### 5.6.4.2.2. Radiated Receiver Spurious Emissions Near Middle Frequency (155 MHz)

| Frequency<br>(MHz)                                                    | RF Level<br>(dB $\mu$ V/m) | Detector<br>Used<br>(Peak/QP) | Antenna<br>Plane<br>(H/V) | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-----------------------------------------------------------------------|----------------------------|-------------------------------|---------------------------|-------------------------|----------------|
| All spurious emissions are more than 20 dB below the specified limit. |                            |                               |                           |                         |                |

##### 5.6.4.2.3. Radiated Receiver Spurious Emissions Near Highest Frequency (174 MHz)

| Frequency<br>(MHz)                                                    | RF Level<br>(dB $\mu$ V/m) | Detector<br>Used<br>(Peak/QP) | Antenna<br>Plane<br>(H/V) | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|-----------------------------------------------------------------------|----------------------------|-------------------------------|---------------------------|-------------------------|----------------|
| All spurious emissions are more than 20 dB below the specified limit. |                            |                               |                           |                         |                |

#### 5.6.4.3. 420 – 480 MHz Band

##### 5.6.4.3.1. Radiated Receiver Spurious Emissions Near Lowest Frequency (420 MHz)

| Frequency (MHz) | RF Level (dBμV/m) | Detector Used (Peak/QP) | Antenna Plane (H/V) | Limit (dBμV/m) | Margin (dB) |
|-----------------|-------------------|-------------------------|---------------------|----------------|-------------|
| 697.50          | 28.18             | Peak                    | V                   | 46.0           | -17.8       |
| 697.50          | 26.71             | Peak                    | H                   | 46.0           | -19.3       |

##### 5.6.4.3.2. Radiated Receiver Spurious Emissions Near Middle Frequency (450 MHz)

| Frequency (MHz) | RF Level (dBμV/m) | Detector Used (Peak/QP) | Antenna Plane (H/V) | Limit (dBμV/m) | Margin (dB) |
|-----------------|-------------------|-------------------------|---------------------|----------------|-------------|
| 757.50          | 31.35             | Peak                    | V                   | 46.0           | -14.7       |
| 757.50          | 29.75             | Peak                    | H                   | 46.0           | -16.3       |

##### 5.6.4.3.3. Radiated Receiver Spurious Emissions Near Highest Frequency (480 MHz)

| Frequency (MHz) | RF Level (dBμV/m) | Detector Used (Peak/QP) | Antenna Plane (H/V) | Limit (dBμV/m) | Margin (dB) |
|-----------------|-------------------|-------------------------|---------------------|----------------|-------------|
| 408.75          | 30.06             | Peak                    | V                   | 46.0           | -15.9       |
| 408.75          | 30.47             | Peak                    | H                   | 46.0           | -15.5       |
| 817.50          | 31.89             | Peak                    | V                   | 46.0           | -14.1       |
| 817.50          | 30.10             | Peak                    | H                   | 46.0           | -15.9       |

#### 5.6.4.4. 1240 – 1320 MHz Band

##### 5.6.4.4.1. Radiated Receiver Spurious Emissions Near Lowest Frequency (30 MHz)

| Frequency (MHz)                                                       | RF Level (dB $\mu$ V/m) | Detector Used (Peak/QP) | Antenna Plane (H/V) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------------------------------------------------------------|-------------------------|-------------------------|---------------------|----------------------|-------------|
| All spurious emissions are more than 20 dB below the specified limit. |                         |                         |                     |                      |             |

##### 5.6.4.4.2. Radiated Receiver Spurious Emissions Near Middle Frequency (30 MHz)

| Frequency (MHz) | RF Level (dB $\mu$ V/m) | Detector Used (Peak/QP) | Antenna Plane (H/V) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|-------------------------|-------------------------|---------------------|----------------------|-------------|
| 1036.05         | 42.71                   | Peak                    | V                   | 54.0                 | -11.3       |
| 1036.05         | 44.95                   | Peak                    | H                   | 54.0                 | -9.1        |

##### 5.6.4.4.3. Radiated Receiver Spurious Emissions Near Highest Frequency (60 MHz)

| Frequency (MHz) | RF Level (dB $\mu$ V/m) | Detector Used (Peak/QP) | Antenna Plane (H/V) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|-------------------------|-------------------------|---------------------|----------------------|-------------|
| 1076.05         | 41.42                   | Peak                    | V                   | 54.0                 | -12.6       |

#### 5.6.4.5. Radiated Emissions From Class B Digital Devices

| Remark: The emissions were scanned from 30 MHz to 6 GHz at 3 m distance. |                   |                         |                     |                |             |                    |
|--------------------------------------------------------------------------|-------------------|-------------------------|---------------------|----------------|-------------|--------------------|
| Frequency (MHz)                                                          | RF Level (dBµV/m) | Detector Used (Peak/QP) | Antenna Plane (H/V) | Limit (dBµV/m) | Margin (dB) | Result (Pass/Fail) |
| 129.0                                                                    | 25.55             | Peak                    | H                   | 43.5           | -18.0       | Pass               |
| 133.8                                                                    | 25.01             | Peak                    | H                   | 43.5           | -18.5       | Pass               |
| 137.8                                                                    | 27.60             | Peak                    | H                   | 43.5           | -15.9       | Pass               |
| 188.9                                                                    | 26.19             | Peak                    | V                   | 43.5           | -17.3       | Pass               |
| 188.9                                                                    | 33.23             | Peak                    | H                   | 43.5           | -10.3       | Pass               |
| 199.6                                                                    | 32.08             | Peak                    | H                   | 43.5           | -11.4       | Pass               |
| 201.6                                                                    | 31.92             | Peak                    | H                   | 43.5           | -11.6       | Pass               |
| 203.6                                                                    | 23.73             | Peak                    | V                   | 43.5           | -19.8       | Pass               |
| 203.6                                                                    | 32.12             | Peak                    | H                   | 43.5           | -11.4       | Pass               |
| 207.5                                                                    | 32.42             | Peak                    | H                   | 43.5           | -11.1       | Pass               |
| 211.8                                                                    | 31.98             | Peak                    | H                   | 43.5           | -11.5       | Pass               |
| 258.2                                                                    | 34.79             | Peak                    | H                   | 46.0           | -11.2       | Pass               |
| 1290.0                                                                   | 41.53             | Peak                    | V                   | 54.0           | -12.5       | Pass               |
| 1290.0                                                                   | 40.94             | Peak                    | H                   | 54.0           | -13.1       | Pass               |
| 1304.0                                                                   | 42.00             | Peak                    | V                   | 54.0           | -12.0       | Pass               |
| 1304.0                                                                   | 39.91             | Peak                    | H                   | 54.0           | -14.1       | Pass               |
| 1318.0                                                                   | 44.51             | Peak                    | V                   | 54.0           | -9.5        | Pass               |
| 1318.0                                                                   | 42.88             | Peak                    | H                   | 54.0           | -11.1       | Pass               |
| 1333.0                                                                   | 46.39             | Peak                    | V                   | 54.0           | -7.6        | Pass               |
| 1333.0                                                                   | 43.49             | Peak                    | H                   | 54.0           | -10.5       | Pass               |
| 1347.0                                                                   | 43.76             | Peak                    | V                   | 54.0           | -10.2       | Pass               |
| 1347.0                                                                   | 40.76             | Peak                    | H                   | 54.0           | -13.2       | Pass               |
| 1419.0                                                                   | 40.95             | Peak                    | V                   | 54.0           | -13.1       | Pass               |
| 1419.0                                                                   | 40.52             | Peak                    | H                   | 54.0           | -13.5       | Pass               |
| 1554.0                                                                   | 45.83             | Peak                    | V                   | 54.0           | -8.2        | Pass               |
| 1554.0                                                                   | 43.13             | Peak                    | H                   | 54.0           | -10.9       | Pass               |

#### 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 #: ICOM-266F15B121

January 24, 2011

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

## 5.7. REQUIREMENTS FOR SCANNING RECEIVERS [§ 15.121]

### 5.7.1. FCC Rules

- a. Except as provided in paragraph (c) of this section, scanning receivers and frequency converters designed or marketed for use with scanning receivers, shall:
  - (1) Be incapable of operating (tuning), or readily being altered by the user to operate, within the frequency bands allocated to the Cellular Radiotelephone Service in part 22 of this chapter (cellular telephone bands). Scanning receivers capable of "readily being altered by the user" include, but are not limited to, those for which the ability to receive transmissions in the cellular telephone bands can be added by clipping the leads of, or installing, a simple component such as a diode, resistor or jumper wire; replacing a plug-in semiconductor chip; or programming a semiconductor chip using special access codes or an external device, such as a personal computer. Scanning receivers, and frequency converters designed for use with scanning receivers, also shall be incapable of converting digital cellular communication transmissions to analog voice audio.
  - (2) Be designed so that the tuning, control and filtering circuitry is inaccessible. The design must be such that any attempts to modify the equipment to receive transmissions from the Cellular Radiotelephone Service likely will render the receiver inoperable.
- b. Except as provided in paragraph (c) of this section, scanning receivers shall reject any signals from the Cellular Radiotelephone Service frequency bands that are 38 dB or lower based upon a 12 dB SINAD measurement, which is considered the threshold where a signal can be clearly discerned from any interference that may be present.
- c. Scanning receivers and frequency converters designed or marketed for use with scanning receivers, are not subject to the requirements of paragraphs (a) and (b) of this section provided that they are manufactured exclusively for, and marketed exclusively to, entities described in 18 U.S.C. 2512(2), or are marketed exclusively as test equipment pursuant to Sec. 15.3(dd)
- d. Modification of a scanning receiver to receive transmissions from Cellular Radiotelephone Service frequency bands will be considered to constitute manufacture of such equipment. This includes any individual, individuals, entity or organization that modifies one or more scanners. Any modification to a scanning receiver to receive transmissions from the Cellular Radiotelephone Service frequency bands voids the certification of the scanning receiver, regardless of the date of manufacture of the original unit. In addition, the provisions of Sec. 15.23 shall not be interpreted as permitting modification of a scanning receiver to receive cellular radiotelephone service transmissions.
- e. Scanning receivers and frequency converters designed for use with scanning receivers shall not be assembled from kits or marketed in kit form unless they comply with the requirements in paragraph (a) through (c) of this section.

- f. Scanning receivers shall have a label permanently affixed to the product, and this label shall be readily visible to the purchaser at the time of purchase. The label shall read as follows: WARNING: MODIFICATION OF THIS DEVICE TO RECEIVE CELLULAR RADIOTELEPHONE SERVICE SIGNALS IS PROHIBITED UNDER FCC RULES AND FEDERAL LAW.
- (1) ``Permanently affixed" means that the label is etched, engraved, stamped, silkscreened, indelible printed or otherwise permanently marked on a permanently attached part of the equipment or on a nameplate of metal, plastic or other material fastened to the equipment by welding, riveting, or permanent adhesive. The label shall be designed to last the expected lifetime of the equipment in the environment in which the equipment may be operated and must not be readily detachable. The label shall not be a stick-on, paper label.
  - (2) When the device is so small that it is not practicable to place the warning label on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user and shall also be placed on the container in which the device is marketed. However, the FCC identifier must be displayed on the device.

### 5.7.2. Declaration for Compliance with FCC §15.121

- Comply with FCC 121(a)(1) – This Scanning Receiver is incapable of operating (tuning), or readily being altered by the user to operate, within the frequency bands allocated to the Cellular Radiotelephone Service in part 22 of this chapter (cellular telephone bands).

Please refer to ICOM attestation letter conforming compliance with this requirement.

- Comply with FCC 121(a)(2) – This Scanning Receiver is designed so that the tuning, control and filtering circuitry is inaccessible. The design is such that any attempts to modify the equipment to receive transmissions from the Cellular Radiotelephone Service likely will render the receiver inoperable.

Please refer to ICOM attestation letter conforming compliance with this requirement.

- Comply with FCC 121(b) – Please refer to the following Section of this Test Report for Scanning Receivers Cellular Band Rejection test.
- Comply with FCC 121(c) – Not applicable.
- Comply with FCC 121(d) – The Users Manual of this Scanning Receiver is provided with the Warning statement as below.

**CAUTION: Changes or modifications to this device, not expressly approved by ICOM Inc., could void your authority to operate this device under FCC regulations.**

- Comply with FCC 121(e) – This Scanning Receiver is not assembled from kits or marketed in kit form.
- Comply with FCC 121(f) – Scanning receivers shall have a label permanently affixed to the product, and this label shall be readily visible to the purchaser at the time of purchase. The label reads as follows: **WARNING: MODIFICATION OF THIS DEVICE TO RECEIVE CELLULAR RADIOTELEPHONE SERVICE SIGNALS IS PROHIBITED UNDER FCC RULES AND FEDERAL LAW.**

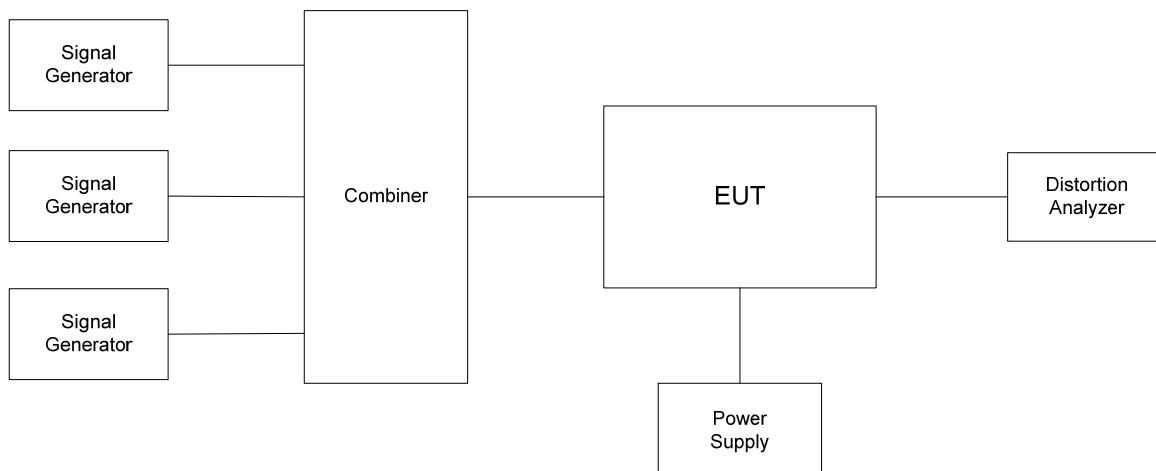
## 5.8. SCANNING RECEIVERS CELLULAR BAND REJECTION [§ 15.121(b)]

### 5.8.1. Limits

Except as provided in paragraph (c) of this section, scanning receivers shall reject any signals from the Cellular Radiotelephone Service frequency bands that are 38dB or lower based upon a 12dB SINAD measurement, which is considered the threshold where a signal can be clearly discerned from any interference that may be present.

### 5.8.2. Method of Measurements

- (1) Connected the EUT as shown in the following block diagram
- (2) Apply a standard RF signal to the receiver input port
- (3) Adjust the audio output signal of the receiver to it's rated value with the distortion less than 10%
- (4) Adjust the RF Signal Generator Output Power to produce 12 dB SINAD without the audio output power dropping by more than 3 dB
- (5) Repeat step (4) at lowest, middle and highest channel frequencies across all cellular base station band to establish a reference sensitivity level. The reference sensitivity taken was the lowest or worse-case sensitivity for all of the bands.
- (6) Adjust the RF Signal Generator output to a level of +60 dB above the reference sensitivity obtained in step (5)
- (7) Set the Receiver squelch threshold (the signal required to open the squelch) no greater than +20 dB above the reference sensitivity level.
- (8) Put the receiver in a scanning mode and allow it to scan across it's complete receive range
- (9) If the receiver unsquelched or stopped on any frequency, the display frequency is recorded. The signal generator output level was then adjusted until 12 dB SINAD from the receiver was produced. The signal generator level associated with this response was also noted.
- (10) Repeat this procedure for 3 frequencies in the cellular base station transmit band.
- (11) The difference between the signal generator output for any response recorded and reference sensitivity is the rejection ratio



### 5.8.3. Test Data

Remark: Cellular Transmitter Test frequencies are 824.04, 836.40, 848.97, 869.04, 880.62 and 893.97 MHz.

#### 5.8.3.1. AM Mode [HF (ANT1 and ANT2), VHF (144MHz ANT), UHF (430MHz ANT)]

| EUT's Scanning Frequency Band (MHz)                                                                                                 | Cellular Transmitter Test Frequencies (MHz) | RF Input Signal Level @ Cellular Frequencies for 12 dB SINAD (dBm) | Reference Sensitivity (dBm) | Rejection Ratio (dB) | Maximum Rejection Ratio Limit (dB) |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------|-----------------------------|----------------------|------------------------------------|
| No signal found in scanning across complete receiver range [HF (ANT1 and ANT2), VHF (144MHz ANT), UHF (430MHz ANT)], -35 dBm input. |                                             |                                                                    |                             |                      |                                    |

#### 5.8.3.2. FM Mode [HF (ANT1 and ANT2), VHF (144MHz ANT), UHF (430MHz ANT), UHF (1200MHz ANT)]

| EUT's Scanning Frequency Band (MHz)                                                                                                                    | Cellular Transmitter Test Frequencies (MHz) | RF Input Signal Level @ Cellular Frequencies for 12 dB SINAD (dBm) | Reference Sensitivity (dBm) | Rejection Ratio (dB) | Maximum Rejection Ratio Limit (dB) |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------|-----------------------------|----------------------|------------------------------------|
| No signal found in scanning across complete receiver range [HF (ANT1 and ANT2), VHF (144MHz ANT), UHF (430MHz ANT), UHF (1200MHz ANT)], -35 dBm input. |                                             |                                                                    |                             |                      |                                    |

#### 5.8.3.3. DV Mode [HF (ANT1 and ANT2), VHF (144MHz ANT), UHF (430MHz ANT), UHF (1200MHz ANT)]

| EUT's Scanning Frequency Band (MHz)                                                                                                                    | Cellular Transmitter Test Frequencies (MHz) | RF Input Signal Level @ Cellular Frequencies for 12 dB SINAD (dBm) | Reference Sensitivity (dBm) | Rejection Ratio (dB) | Maximum Rejection Ratio Limit (dB) |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------|-----------------------------|----------------------|------------------------------------|
| No signal found in scanning across complete receiver range [HF (ANT1 and ANT2), VHF (144MHz ANT), UHF (430MHz ANT), UHF (1200MHz ANT)], -35 dBm input. |                                             |                                                                    |                             |                      |                                    |

#### 5.8.3.4. CW Mode [HF (ANT1 and ANT2), VHF (144MHz ANT), UHF (430MHz ANT)]

| EUT's Scanning Frequency Band (MHz)                                                                                                 | Cellular Transmitter Test Frequencies (MHz) | RF Input Signal Level @ Cellular Frequencies for 12 dB SINAD (dBm) | Reference Sensitivity (dBm) | Rejection Ratio (dB) | Maximum Rejection Ratio Limit (dB) |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------|-----------------------------|----------------------|------------------------------------|
| No signal found in scanning across complete receiver range [HF (ANT1 and ANT2), VHF (144MHz ANT), UHF (430MHz ANT)], -35 dBm input. |                                             |                                                                    |                             |                      |                                    |

#### 5.8.3.5. SSB Mode [HF (ANT1 and ANT2), VHF (144MHz ANT), UHF (430MHz ANT)]

| EUT's Scanning Frequency Band (MHz)                                                                                                 | Cellular Transmitter Test Frequencies (MHz) | RF Input Signal Level @ Cellular Frequencies for 12 dB SINAD (dBm) | Reference Sensitivity (dBm) | Rejection Ratio (dB) | Maximum Rejection Ratio Limit (dB) |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------|-----------------------------|----------------------|------------------------------------|
| No signal found in scanning across complete receiver range [HF (ANT1 and ANT2), VHF (144MHz ANT), UHF (430MHz ANT)], -35 dBm input. |                                             |                                                                    |                             |                      |                                    |

5.8.3.6. RTTY Mode [HF (ANT1 and ANT2), VHF (144MHz ANT), UHF (430MHz ANT)]

| EUT's Scanning Frequency Band (MHz)                                                                                                 | Cellular Transmitter Test Frequencies (MHz) | RF Input Signal Level @ Cellular Frequencies for 12 dB SINAD (dBm) | Reference Sensitivity (dBm) | Rejection Ratio (dB) | Maximum Rejection Ratio Limit (dB) |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------|-----------------------------|----------------------|------------------------------------|
| No signal found in scanning across complete receiver range [HF (ANT1 and ANT2), VHF (144MHz ANT), UHF (430MHz ANT)], -35 dBm input. |                                             |                                                                    |                             |                      |                                    |

## EXHIBIT 6. TEST EQUIPMENTS LIST

| Test Instruments                  | Manufacturer        | Model No.                 | Serial No. | Frequency Range                  | Cal. Due Date |
|-----------------------------------|---------------------|---------------------------|------------|----------------------------------|---------------|
| Semi-Anechoic Chamber             | TDK                 | FCC: 91038<br>IC: 2049A-3 | --         | --                               | 01 May 2011   |
| Spectrum Analyzer                 | Agilent             | E7401A                    | US40240432 | 9 kHz – 1.5 GHz                  | 10 Jan 2012   |
| Attenuator                        | Pasternack          | PE7010-20                 | ---        | DC - 2 GHz<br>20dB attenuation   | 18 Jan 2012   |
| L.I.S.N.                          | EMCO                | 3825/2                    | 8907-1531  | 10 kHz – 100 MHz                 | 30 May 2011   |
| L.I.S.N.                          | EMCO                | 3810/2                    | 2209       | 9 kHz – 30 MHz                   | 25 Aug 2011   |
| EMI Receiver                      | Rohde & Schwarz     | ESU40                     | 100037     | 20 Hz - 40 GHz                   | 09 Mar 2011   |
| Pre Amplifier                     | AH System           | PAM-0118                  | 225        | 20 MHz - 18 GHz                  | 08 Mar 2011   |
| Biconilog Antenna                 | EMCO                | 3142C                     | 00026873   | 26 - 3000 MHz                    | 18 Apr 2011   |
| Horn Antenna                      | EMCO                | 3115                      | 9701-5061  | 1GHz - 18 GHz                    | 28 Nov 2011   |
| Semi-Anechoic Chamber             | TDK                 | FCC: 91038<br>IC: 2049A-3 | --         | --                               | 01 May 2011   |
| Spectrum Analyzer                 | Rohde & Schwarz     | FSEK                      | 834157/005 | 9 kHz - 40 GHz                   | 26 Jul 2011   |
| Combiner                          | Mini Circuit        | ZFSC-3-4                  | 15542      | 1 MHz - 1 GHz                    |               |
| RF Synthesized Signal Generator   | HP                  | 8648C                     | 3343U00391 | 100 kHz - 3200 MHz<br>AM/ FM/ PM | 16 Dec 2011   |
| Power supply                      | Tenma               | 72-7295                   | 490300297  | 1-40V DC 5A                      | Cal. on use   |
| RF Communication Test Set         | Hewlett Packard     | 8920B                     | US39064699 | 30 MHz - 1 GHz                   | 27 Oct 2012   |
| Log Periodic dipole Array antenna | ETS                 | 3148                      | 23845      | 200-2000 MHz                     | 15 Nov 2011   |
| Horn antenna                      | ETS-LINDGREN        | 3117                      | 119425     | 1-18 GHz                         | 18 Jan 2011   |
| Preamplifier                      | Com Power           | PA-103A                   | 161243     | 10-1000 MHz                      | 22 Jun 2011   |
| Preamplifier                      | Hewlett Packard     | 8449B                     | 3008A00769 | 1-18 GHz                         | 18 Jan 2011   |
| RF Signal Generator               | Marconi Instruments | 2024                      | 112255/164 | 9 kHz – 2.4 GHz                  | 23 Jul 2011   |
| Radiocommunication Test Set       | Rohde & Schwarz     | CMS54                     | 839096/007 | 0.4-1000 MHz                     | 25 Nov 2011   |

### 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 #: ICOM-266F15B121

January 24, 2011

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. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

|       | Line Conducted Emission Measurement Uncertainty<br>(150 kHz – 30 MHz):           | Measured   | Limit     |
|-------|----------------------------------------------------------------------------------|------------|-----------|
| $u_c$ | Combined <u>standard</u> uncertainty:<br>$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$ | $\pm 1.57$ | $\pm 1.8$ |
| $U$   | Expanded uncertainty $U$ :<br>$U = 2u_c(y)$                                      | $\pm 3.14$ | $\pm 3.6$ |

### 7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

|       | Radiated Emission Measurement Uncertainty @ 3m, Horizontal<br>(30-1000 MHz):     | Measured   | Limit     |
|-------|----------------------------------------------------------------------------------|------------|-----------|
| $u_c$ | Combined <u>standard</u> uncertainty:<br>$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$ | $\pm 2.15$ | $\pm 2.6$ |
| $U$   | Expanded uncertainty $U$ :<br>$U = 2u_c(y)$                                      | $\pm 4.30$ | $\pm 5.2$ |

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

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