

# ENGINEERING TEST REPORT



## SafePlug Outlet Control Board Model No.: 3063

**FCC ID: S9C-3063**

*Applicant:*

**OFI, Inc. (subsidiary of 2D2C Inc.)**  
100 Hanson Avenue  
Kitchener, Ontario  
Canada N2C 2E2

*In Accordance With*

**Federal Communications Commission (FCC)**  
**Part 15, Subpart C**  
**Unlicensed Low Power Transmitter Operating in the Band 13.110-14.010 MHz**

**UltraTech's File No.: OFI-010F15C225**

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

Date: June 16, 2010



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Tested by: Hung Trinh, EMC/RFI Technician

Issued Date: June 16, 2010

Test Dates: June 03-08, 2010

- 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.*

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Korea KCC-RRL

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## EXHIBIT 1. INTRODUCTION

### 1.1. SCOPE

|                                      |  |
|--------------------------------------|--|
| <b>Reference:</b>                    | FCC Part 15, Subpart C, Sec. 15.225 - Operation within the band 13.110 – 14.010 MHz.   |
| <b>Title:</b>                        | Title 47, Code of Federal Regulations (CFR), Part 15, Subpart C  |
| <b>Purpose of Test:</b>              | To gain FCC Certification Authorization for Section 15.225 - Operation within the Band 13.110 - 14.010 MHz.  |
| <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 environment  |

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

None.

### 1.3. NORMATIVE REFERENCES

| Publication                | Year                         | Title   |
|----------------------------|------------------------------|---|
| FCC 47 CFR 15              | 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 |
| CISPR 22<br>EN 55022       | 2008-09, Edition 6.0<br>2006 | Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement  |
| CISPR 16-1-1<br>+A1<br>+A2 | 2006<br>2006<br>2007         | Specification for radio disturbance and immunity measuring apparatus and methods.<br>Part 1-1: Measuring Apparatus  |
| CISPR 16-1-2<br>+A1<br>+A2 | 2003<br>2004<br>2006         | Specification for radio disturbance and immunity measuring apparatus and methods.<br>Part 1-2: Conducted disturbances   |

## EXHIBIT 2. PERFORMANCE ASSESSMENT

### 2.1. CLIENT INFORMATION

| APPLICANT              |  |
|------------------------|--|
| <b>Name:</b>           | OFI, Inc. (subsidiary of 2D2C Inc.)  |
| <b>Address:</b>        | 100 Hanson Avenue<br>Kitchener, Ontario<br>Canada N2C 2E2  |
| <b>Contact Person:</b> | Nick Jones<br>Phone #: 519-884-3100<br>Fax #: 519-884-9800<br>Email Address: njones@safeplug.com |

| MANUFACTURER           |  |
|------------------------|--|
| <b>Name:</b>           | OFI, Inc. (subsidiary of 2D2C Inc.)  |
| <b>Address:</b>        | 100 Hanson Avenue<br>Kitchener, Ontario<br>Canada N2C 2E2  |
| <b>Contact Person:</b> | Nick Jones<br>Phone #: 519-884-3100<br>Fax #: 519-884-9800<br>Email Address: njones@safeplug.com |

### 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>                    | OFI, Inc. (subsidiary of 2D2C Inc.)  |
| <b>Product Name:</b>                  | SafePlug Outlet Control Board  |
| <b>Model Name or Number:</b>          | 3063   |
| <b>Serial Number:</b>                 | Test sample  |
| <b>Type of Equipment:</b>             | Low Power Communication Device Transmitter   |
| <b>Input Power Supply Type:</b>       | 5 Vdc regulated $\pm 5\%$  |
| <b>Primary User Functions of EUT:</b> | Periodically polls for presence of contactless memory at each receptacle (7.5 Hz at each receptacle) |

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### ULTRATECH GROUP OF LABS

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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 #: OFI-010F15C225

June 16, 2010

## 2.3. EUT'S TECHNICAL SPECIFICATIONS

| Transmitter                            |   |
|--|---|
| <b>Equipment Type:</b>                 | Fixed based / mobile                              |
| <b>Intended Operating Environment:</b> | Residential, commercial, industrial or business   |
| <b>Power Supply Requirement:</b>       | 5 Vdc regulated $\pm 5\%$                         |
| <b>Field Strength:</b>                 | 31.1 dB $\mu$ V/m at 10 m                         |
| <b>Operating Frequency Range:</b>      | 13.56 MHz   |
| <b>RF Output Impedance:</b>            | 50 $\Omega$                                       |
| <b>20 dB Bandwidth:</b>                | 5.46 kHz  |
| <b>Modulation Type:</b>                | ASK   |
| <b>Oscillator Frequencies:</b>         | 13.56 MHz   |
| <b>Antenna Connector Type:</b>         | Integral etched circuit board trace magnetic loop |

## 2.4. LIST OF EUT'S PORTS

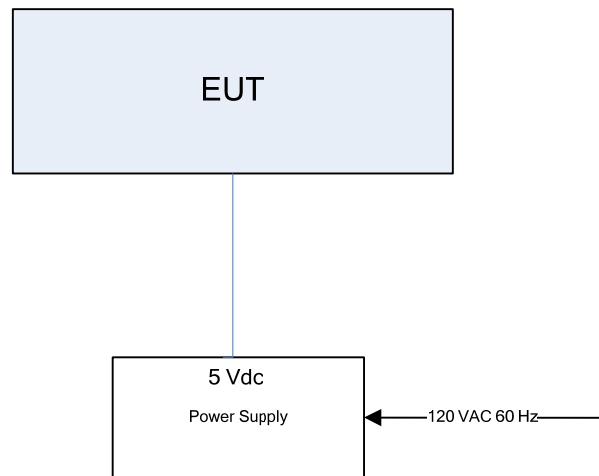
| Port Number | EUT's Port Description | Number of Identical Ports  | Connector Type | Cable Type (Shielded/Non-shielded) |
|-------------|------------------------|----------------------------|----------------|------------------------------------|
| 1           | 0-5 V analog input     | 3                          | Solder pin     | Direct board to board / no cable   |
| 2           | 12 V relay drive       | 2                          | Solder pin     | Direct board to board / no cable   |
| 3           | 12 V power in          | 1                          | Solder pin     | Direct board to board / no cable   |
| 4           | 5 V power in           | 1                          | Solder pin     | Direct board to board / no cable   |
| 5           | Firmware download port | For manufacturing use only |                |                                    |
| 6           | Firmware download port | For manufacturing use only |                |                                    |

## 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:            | 5 Vdc regulated power supply |
| Brand Name:             | N/A                          |
| Model Name or Number:   | 171184                       |
| Serial Number:          | N/A                          |
| Cable Length & Type:    | > 3 m, Non-shielded          |

## 2.6. GENERAL TEST SETUP BLOCK DIAGRAM



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

### 3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

|                     |         |
|---------------------|---------|
| Temperature:        | 21°C    |
| Humidity:           | 51%     |
| Pressure:           | 102 kPa |
| Power input source: | 5 Vdc   |

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

|                                  |  |
|----------------------------------|--|
| <b>Operating Modes:</b>          | The EUT was configured for continuous transmission for the duration of testing.                                      |
| <b>Special Test Software:</b>    | N/A  |
| <b>Special Hardware Used:</b>    | N/A  |
| <b>Transmitter Test Antenna:</b> | The EUT was tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment. |

|  |                           |
|--|---------------------------|
| <b>Transmitter Test Signals:</b>                   |                           |
| <b>Frequency:</b>                                  | 13.56 MHz                 |
| <b>Transmitter Wanted Output Test Signals:</b>     |                           |
| ▪ RF Power Output (measured maximum output power): | 31.1 dB $\mu$ V/m at 10 m |
| ▪ Normal Test Modulation:                          | ASK                       |
| ▪ Modulating signal source:                        | Internal                  |

## 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 Regulations | Test Requirements   | Compliance (Yes/No) |
|-----------------|---|---------------------|
| 15.203 & 15.204 | The transmitter shall use a transmitting antenna that is an integral part of the device | Yes                 |
| 15.215          | 20 dB & 99% Bandwidth   | Yes                 |
| 15.225(a) – (d) | Field Strength of Emissions Inside and Outside the Permitted Band 13.110 - 14.010 MHz   | Yes                 |
| 15.225(e)       | Frequency Stability   | Yes                 |
| 15.107 & 15.207 | Class B - Power Line Conducted Emissions  | Yes                 |

\*\* The power line conducted emission and Digital Apparatus test results are documented in the OFI-010FCC15C247 report.

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

N/A

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File #: OFI-010F15C225

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

### 5.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.4 and ULTR-P001-2004.

### 5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document LAB 34 with a confidence level of 95%. Please refer to Exhibit 6 for Measurement Uncertainties.

### 5.3. MEASUREMENT EQUIPMENT USED

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

### 5.4. COMPLIANCE WITH FCC PART 15 – GENERAL TECHNICAL REQUIREMENTS

| FCC Section | FCC Rules   |  |
|-------------|---|--|
| 15.203      | <p>Described how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.</p> <p>The exception is in those cases where EUT must be professionally installed. In order to demonstrate that professional installation is required, the following 3 points must be addressed:</p> <ul style="list-style-type: none"><li>• The application (or intended use) of the EUT</li><li>• The installation requirements of the EUT</li><li>• The method by which the EUT will be marketed</li></ul> | Integral PCB antenna                                     |
| 15.204      | <p>Provided the information for every antenna proposed for use with the EUT:</p> <ul style="list-style-type: none"><li>(a) type (e.g. Yagi, patch, grid, dish, etc...),</li><li>(b) manufacturer and model number</li><li>(c) gain with reference to an isotropic radiator</li></ul>  | Only furnished integral antenna will be used in the EUT. |

## 5.5. OCCUPIED BANDWIDTH

### 5.5.1. Limits

The 20 dB bandwidth of the emission shall be contained within the band 13.110–14.010 MHz.

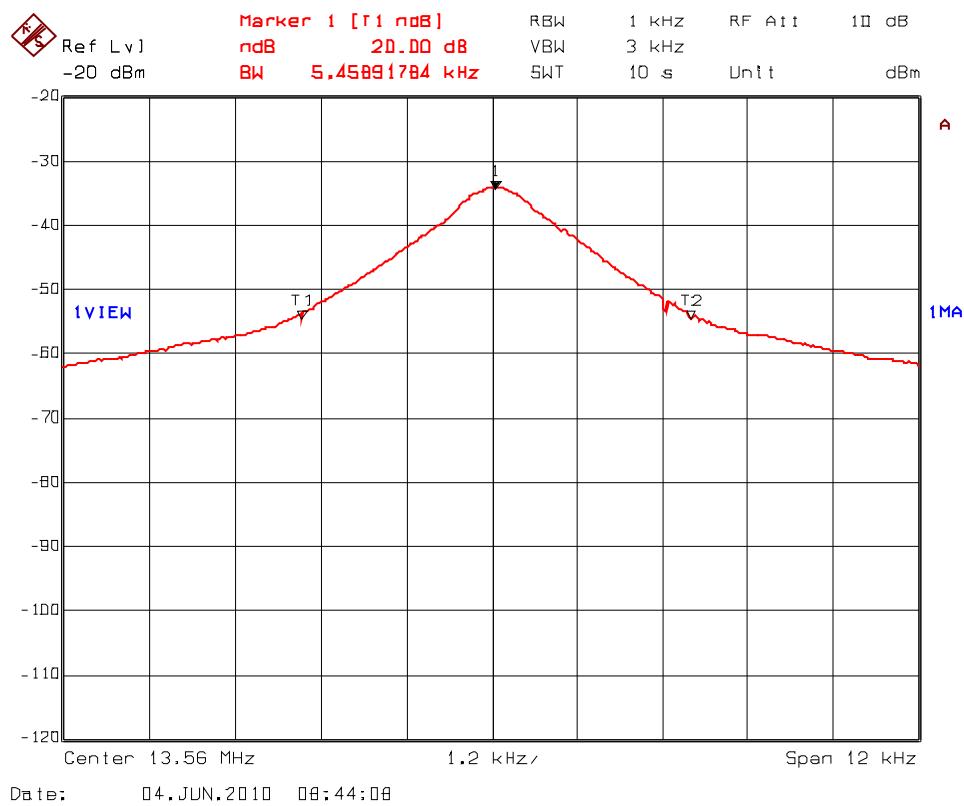
### 5.5.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

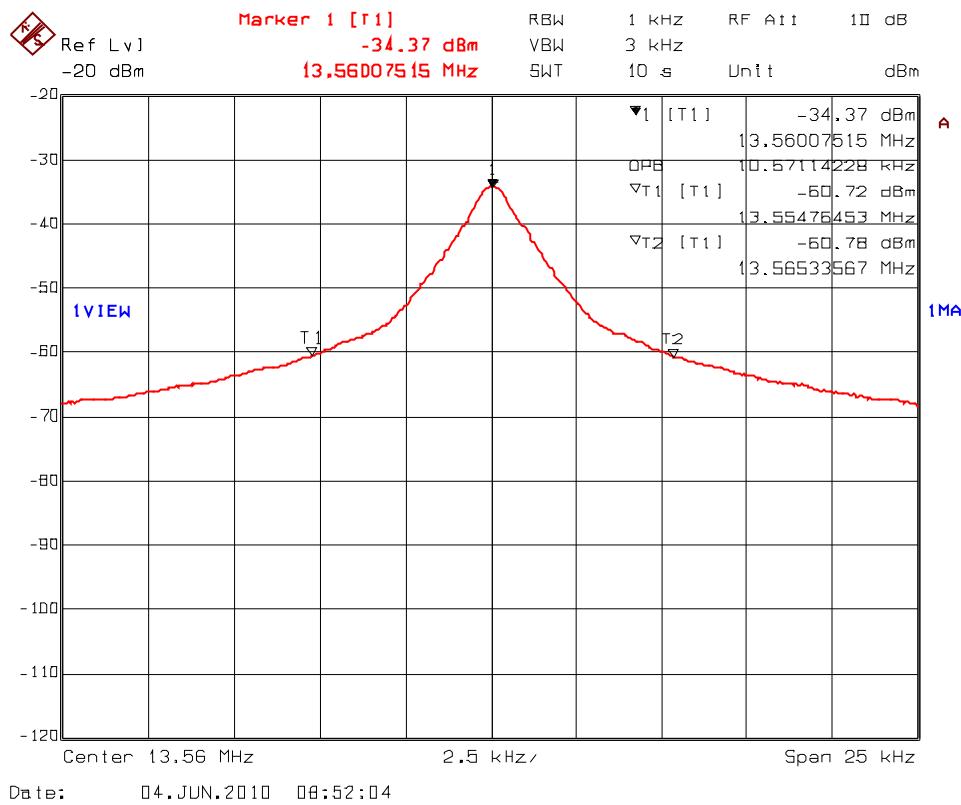
### 5.5.3. Test Data

| Test Frequency (MHz) | Occupied Bandwidth (kHz) |         |
|----------------------|--------------------------|---------|
|                      | 20 dB BW                 | 99 % BW |
| 13.56                | 5.46                     | 10.57   |

Plot #1: 20 dB Bandwidth - Test Frequency: 13.56 MHz



Plot #2: 99% Occupied Bandwidth - Test Frequency: 13.56 MHz



## 5.6. FIELD STRENGTH OF EMISSIONS INSIDE & OUTSIDE THE PERMITTED BAND 13.110-14.010 MHz [47 CFR 15.225 (a) to (d)]

### 5.6.1. Limits

- (a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
- (b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- (c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110 – 14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

### 47 CFR 15.209(a) – Radiated Emission Limits; general requirements

| Frequency (MHz) | Field Strength Limits (microvolts/m) | Distance (Meters) |
|-----------------|--------------------------------------|-------------------|
| 0.009 - 0.490   | 2,400 / F (KHz)                      | 300               |
| 0.490 - 1.705   | 24,000 / F (KHz)                     | 30                |
| 1.705 - 30.0    | 30                                   | 30                |
| 30 – 88         | 100                                  | 3                 |
| 88 – 216        | 150                                  | 3                 |
| 216 – 960       | 200                                  | 3                 |
| Above 960       | 500                                  | 3                 |

### 5.6.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and high-pass filter are used for this measurement.

- For measurements from 9 KHz to 150 KHz, set RBW = 200 Hz, VBW  $\geq$  RBW, SWEEP=AUTO.
- For measurements from 150 KHz to 30 MHz, set RBW = 10 KHz, VBW  $\geq$  RBW, SWEEP=AUTO.
- For measurements from 30 MHz to 1 GHz, set RBW = 100 KHz, VBW  $\geq$  RBW, SWEEP=AUTO.
- For measurement above 1 GHz, set RBW = 1 MHz, VBW = 1 MHz, SWEEP=AUTO.

If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

### 5.6.3. Test Data

#### Remarks:

- For frequencies below 30 MHz, radiated spurious emissions measurements were performed at 10 m distance. The results at 10 meters can be extrapolated to 30 meters using a factor of 40 dB/decade.
- For frequencies at or above 30 MHz, the results measured at 3 m distance shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade.
- The 13.56 MHz radio and the 2.4 GHz radio were set to transmit continuously during radiated emission tests.

#### 5.6.3.1. Field Strength of Emissions Inside the Permitted Band

| Frequency (MHz) | Measured Field Strength @ 10 m (dB $\mu$ V/m) | Detector Used (Peak/QP) | Antenna Plane (H/V) | Field Strength Extrapolated Value @ 30m (dB $\mu$ V/m) | § 15.225 Field Strength Limits @ 30m | Margin (dB) |
|-----------------|---|-------------------------|---------------------|--|--------------------------------------|-------------|
| 13.56           | 31.1  | Peak                    | V                   | 12.0   | 84.0                                 | -72.0       |
| 13.56           | 25.6  | Peak                    | H                   | 6.5  | 84.0                                 | -77.5       |

#### 5.6.3.2. Field Strength of Emissions Outside the Permitted Band

| FREQUENCY (MHz) | RF PEAK LEVEL (dB $\mu$ V/m) | RF AVG LEVEL (dB $\mu$ V/m) | ANTENNA PLANE (H/V) | LIMIT 15.209 (dB $\mu$ V/m) | LIMIT MARGIN (dB) | PASS/FAIL | Distance (m) |
|-----------------|------------------------------|-----------------------------|---------------------|-----------------------------|-------------------|-----------|--------------|
| 35.60           | 31.48                        | 31.48                       | V                   | 40.00                       | -8.52             | PASS      | 3            |
| 35.60           | 31.48                        | 31.48                       | H                   | 40.00                       | -8.52             | PASS      | 3            |
| 40.68           | 33.98                        | 33.98                       | V                   | 40.00                       | -6.02             | PASS      | 3            |
| 40.68           | 16.83                        | 16.83                       | H                   | 40.00                       | -23.17            | PASS      | 3            |
| 54.24           | 11.91                        | 11.91                       | V                   | 40.00                       | -28.09            | PASS      | 3            |
| 57.13           | 21.85                        | 21.85                       | V                   | 40.00                       | -18.15            | PASS      | 3            |
| 57.13           | 13.54                        | 13.54                       | H                   | 40.00                       | -26.46            | PASS      | 3            |
| 81.36           | 18.41                        | 18.41                       | V                   | 40.00                       | -21.59            | PASS      | 3            |
| 81.36           | 13.45                        | 13.45                       | H                   | 40.00                       | -26.55            | PASS      | 3            |
| 94.92           | 26.47                        | 26.47                       | V                   | 43.50                       | -17.03            | PASS      | 3            |
| 94.92           | 20.44                        | 20.44                       | H                   | 43.50                       | -23.06            | PASS      | 3            |
| 108.48          | 22.25                        | 22.25                       | V                   | 43.50                       | -21.25            | PASS      | 3            |
| 108.48          | 12.23                        | 12.23                       | H                   | 43.50                       | -31.27            | PASS      | 3            |
| 122.04          | 21.62                        | 21.62                       | V                   | 43.50                       | -21.88            | PASS      | 3            |
| 122.04          | 14.86                        | 14.86                       | H                   | 43.50                       | -28.64            | PASS      | 3            |
| 135.60          | 22.03                        | 22.03                       | V                   | 43.50                       | -21.47            | PASS      | 3            |
| 135.60          | 16.01                        | 16.01                       | H                   | 43.50                       | -27.49            | PASS      | 3            |
| 141.50          | 26.56                        | 26.56                       | V                   | 43.50                       | -16.94            | PASS      | 3            |

Continued ...

| FREQUENCY<br>(MHz) | RF<br>PEAK LEVEL<br>(dBuV/m) | RF<br>AVG LEVEL<br>(dBuV/m) | ANTENNA<br>PLANE<br>(H/V) | LIMIT<br>15.209<br>(dBuV/m) | LIMIT<br>MARGIN<br>(dB) | PASS/<br>FAIL | Distance<br>(m) |
|--------------------|------------------------------|-----------------------------|---------------------------|-----------------------------|-------------------------|---------------|-----------------|
| 149.50             | 25.46                        | 25.46                       | V                         | 43.50                       | -18.04                  | PASS          | 3               |
| 149.50             | 19.55                        | 19.55                       | H                         | 43.50                       | -23.95                  | PASS          | 3               |
| 176.50             | 20.65                        | 20.65                       | V                         | 43.50                       | -22.85                  | PASS          | 3               |
| 176.50             | 15.84                        | 15.84                       | H                         | 43.50                       | -27.66                  | PASS          | 3               |
| 217.30             | 24.62                        | 24.62                       | V                         | 46.00                       | -21.38                  | PASS          | 3               |
| 217.30             | 21.46                        | 21.46                       | H                         | 46.00                       | -24.54                  | PASS          | 3               |
| 230.80             | 22.04                        | 22.04                       | V                         | 46.00                       | -23.96                  | PASS          | 3               |
| 230.80             | 24.87                        | 24.87                       | H                         | 46.00                       | -21.13                  | PASS          | 3               |
| 276.80             | 22.50                        | 22.50                       | V                         | 46.00                       | -23.50                  | PASS          | 3               |
| 312.00             | 22.20                        | 22.20                       | V                         | 46.00                       | -23.80                  | PASS          | 3               |
| 312.00             | 31.33                        | 31.33                       | H                         | 46.00                       | -14.67                  | PASS          | 3               |
| 339.30             | 25.18                        | 25.18                       | V                         | 46.00                       | -20.82                  | PASS          | 3               |
| 339.30             | 26.37                        | 26.37                       | H                         | 46.00                       | -19.63                  | PASS          | 3               |
| 352.80             | 27.51                        | 27.51                       | V                         | 46.00                       | -18.49                  | PASS          | 3               |
| 352.80             | 27.96                        | 27.96                       | H                         | 46.00                       | -18.04                  | PASS          | 3               |
| 366.30             | 27.45                        | 27.45                       | V                         | 46.00                       | -18.55                  | PASS          | 3               |
| 366.30             | 29.12                        | 29.12                       | H                         | 46.00                       | -16.88                  | PASS          | 3               |
| 379.80             | 31.46                        | 31.46                       | V                         | 46.00                       | -14.54                  | PASS          | 3               |
| 379.80             | 27.59                        | 27.59                       | H                         | 46.00                       | -18.41                  | PASS          | 3               |
| 393.50             | 24.99                        | 24.99                       | V                         | 46.00                       | -21.01                  | PASS          | 3               |
| 393.50             | 23.01                        | 23.01                       | H                         | 46.00                       | -22.99                  | PASS          | 3               |
| 406.80             | 28.28                        | 28.28                       | V                         | 46.00                       | -17.72                  | PASS          | 3               |
| 406.80             | 25.44                        | 25.44                       | H                         | 46.00                       | -20.56                  | PASS          | 3               |
| 434.00             | 27.18                        | 27.18                       | V                         | 46.00                       | -18.82                  | PASS          | 3               |
| 434.00             | 21.72                        | 21.72                       | H                         | 46.00                       | -24.28                  | PASS          | 3               |
| 447.80             | 24.87                        | 24.87                       | V                         | 46.00                       | -21.13                  | PASS          | 3               |
| 583.30             | 29.99                        | 29.99                       | V                         | 46.00                       | -16.01                  | PASS          | 3               |
| 583.30             | 24.64                        | 24.64                       | H                         | 46.00                       | -21.36                  | PASS          | 3               |
| 1466.88            | 45.37                        | 45.37                       | V                         | 54.00                       | -8.63                   | PASS          | 3               |
| 1466.88            | 42.29                        | 42.29                       | H                         | 54.00                       | -11.71                  | PASS          | 3               |
| 1955.99            | 52.03                        | 29.05                       | V                         | 54.00                       | -24.95                  | PASS          | 3               |
| 1955.99            | 49.63                        | 28.03                       | H                         | 54.00                       | -25.97                  | PASS          | 3               |

- The spurious radiated emissions were scanned from 30 – 12.5 GHz at 3 m distance
- All spurious emissions that are in excess of 30 dB below the specified limit shall be recorded.

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File #: OFI-010F15C225

June 16, 2010

## 5.7. FREQUENCY STABILITY [47 CFR 15.225(e)]

### 5.7.1. Limits

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### 5.7.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004.

### 5.7.3. Test Data

|                                    |                                    |
|------------------------------------|------------------------------------|
| Frequency Band:                    | 13.56 MHz                          |
| Center Frequency:                  | 13.56 MHz                          |
| Frequency Tolerance Limit:         | $\pm 0.01\% (\pm 1356 \text{ Hz})$ |
| Max. Frequency Tolerance Measured: | +156 Hz                            |
| Input Voltage Rating:              | 5 Vdc                              |

| Ambient Temperature (°C) | Frequency Drift (Hz)              |  |  |
|--------------------------|-----------------------------------|--|--|
|                          | Supply Voltage (Nominal)<br>5 Vdc | Supply Voltage (85 % of Nominal)<br>4.52 Vdc | Supply Voltage (115% of Nominal)<br>5.75 Vdc |
| -40                      | -12                               | --   | --   |
| -30                      | 48                                | --   | --   |
| -20                      | 156                               | --   | --   |
| -10                      | 120                               | --   | --   |
| 0                        | 108                               | --   | --   |
| +10                      | 84                                | --   | --   |
| +20                      | 0                                 | -24  | -12  |
| +30                      | -12                               | --   | --   |
| +40                      | -72                               | --   | --   |
| +50                      | -96                               | --   | --   |
| +65                      | -132                              | --   | --   |

## 5.8. POWERLINE CONDUCTED EMISSIONS [47 CFR 15.107(a) & 15.207]

### 5.8.1. Limits

The equipment shall meet the limits of the following table:

| Test Frequency Range (MHz) | Class B Limits (dB $\mu$ V) |           | Measuring Bandwidth  |
|----------------------------|-----------------------------|-----------|--|
|                            | Quasi-Peak                  | Average   |  |
| 0.15 to 0.5                | 66 to 56*                   | 56 to 46* | RBW = 9 kHz<br>VBW $\geq$ 9 kHz for QP<br>VBW = 1 Hz for Average |
| 0.5 to 5                   | 56                          | 46        | RBW = 9 kHz<br>VBW $\geq$ 9 kHz for QP<br>VBW = 1 Hz for Average |
| 5 to 30                    | 60                          | 50        | RBW = 9 kHz<br>VBW $\geq$ 9 kHz for QP<br>VBW = 1 Hz for Average |

\* Decreasing linearly with logarithm of frequency

### 5.8.2. Method of Measurements

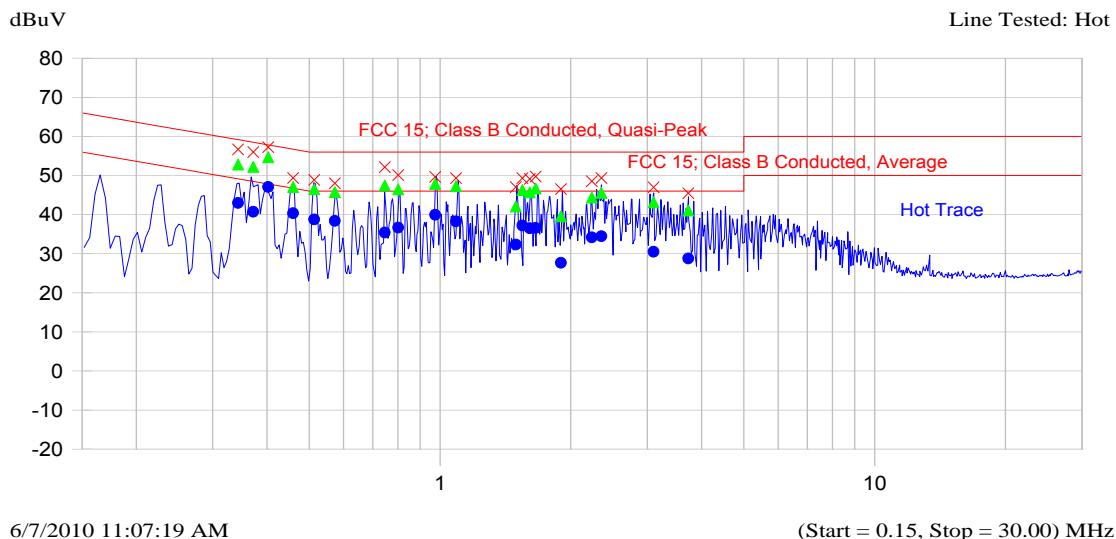
Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

### 5.8.3. Test Data

#### Plot # 3: Power Line Conducted Emission – Line tested: Hot

Test Configuration 1: EUT was on RF receiving mode, Line Voltage: 5 Vdc  
 (tests were performed using off-shelf external AC/DC adaptor)

#### Current Graph



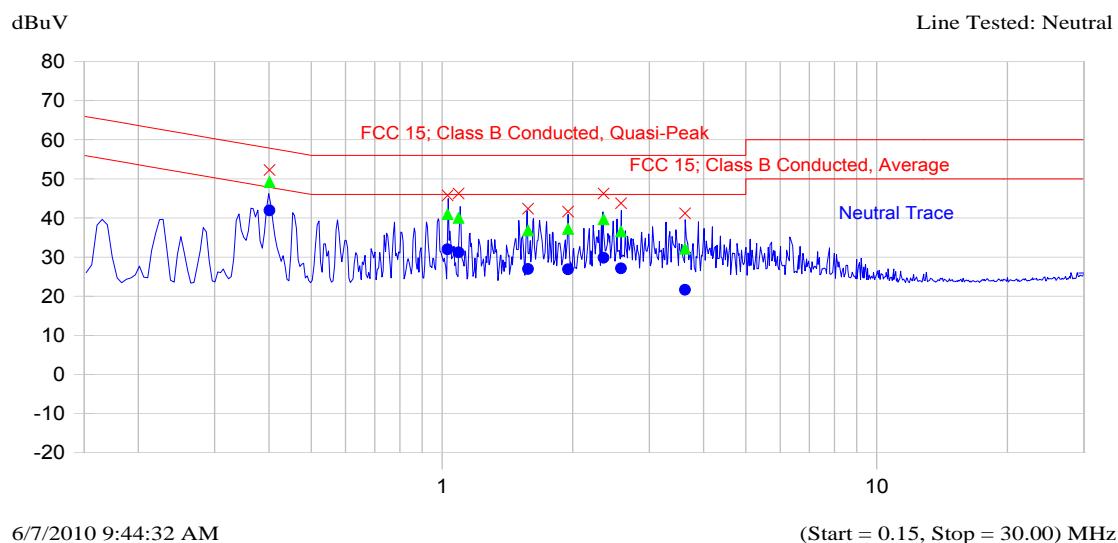
#### Current List

| Frequency<br>MHz | Peak<br>dBuV | QP<br>dBuV | Delta QP-QP Limit<br>dB | Avg<br>dBuV | Delta Avg-Avg Limit<br>dB | Trace Name |
|------------------|--------------|------------|-------------------------|-------------|---------------------------|------------|
| 0.343            | 56.6         | 52.8       | -7.6                    | 42.9        | -7.5                      | Hot Trace  |
| 0.372            | 56.0         | 52.2       | -7.4                    | 40.7        | -8.9                      | Hot Trace  |
| 0.402            | 57.2         | 54.7       | -4.1                    | 47.1        | -1.7                      | Hot Trace  |
| 0.459            | 49.3         | 47.1       | -10.1                   | 40.3        | -6.8                      | Hot Trace  |
| 0.513            | 48.9         | 46.5       | -9.5                    | 38.7        | -7.3                      | Hot Trace  |
| 0.573            | 48.0         | 45.7       | -10.3                   | 38.4        | -7.6                      | Hot Trace  |
| 0.746            | 52.1         | 47.4       | -8.6                    | 35.4        | -10.6                     | Hot Trace  |
| 0.801            | 50.1         | 46.5       | -9.5                    | 36.7        | -9.3                      | Hot Trace  |
| 0.974            | 49.6         | 47.8       | -8.2                    | 39.9        | -6.1                      | Hot Trace  |
| 1.089            | 49.3         | 47.2       | -8.8                    | 38.2        | -7.8                      | Hot Trace  |
| 1.495            | 47.0         | 42.0       | -14.0                   | 32.3        | -13.7                     | Hot Trace  |
| 1.547            | 49.3         | 46.3       | -9.7                    | 37.2        | -8.8                      | Hot Trace  |
| 1.608            | 49.1         | 45.7       | -10.3                   | 36.5        | -9.5                      | Hot Trace  |
| 1.660            | 49.7         | 46.6       | -9.4                    | 36.6        | -9.4                      | Hot Trace  |
| 1.899            | 46.5         | 39.6       | -16.4                   | 27.7        | -18.3                     | Hot Trace  |
| 2.234            | 48.5         | 44.3       | -11.7                   | 34.2        | -11.8                     | Hot Trace  |
| 2.352            | 49.4         | 45.5       | -10.5                   | 34.4        | -11.6                     | Hot Trace  |
| 3.097            | 47.0         | 43.1       | -12.9                   | 30.5        | -15.5                     | Hot Trace  |
| 3.725            | 45.4         | 41.1       | -14.9                   | 28.8        | -17.2                     | Hot Trace  |

Plot # 4: Power Line Conducted Emission – Line tested: Neutral

Test Configuration 1: EUT was on RF receiving mode, Line Voltage: 5 Vdc  
(tests were performed using off-shelf external AC/DC adaptor)

Current Graph



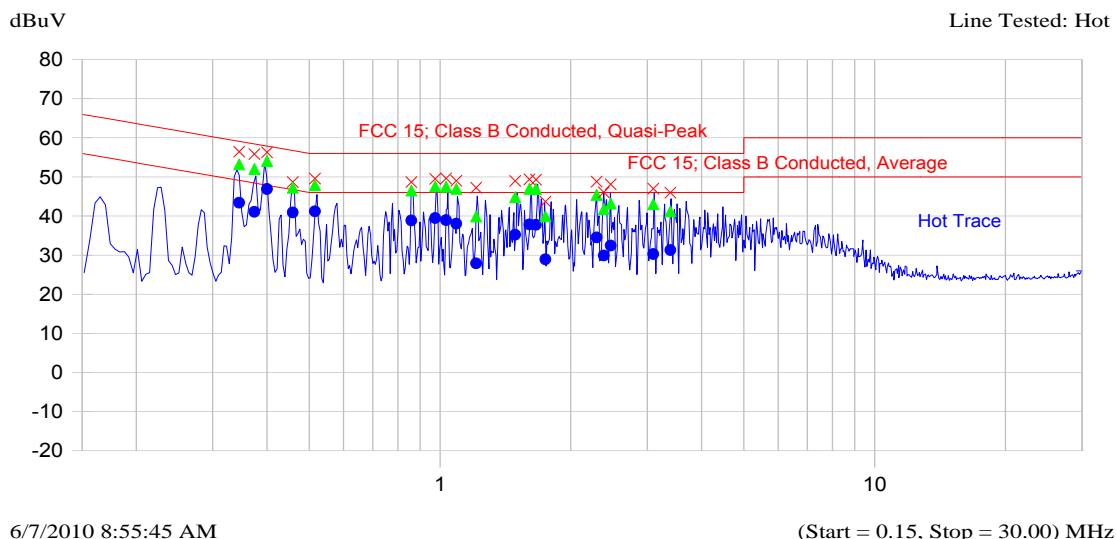
Current List

| Frequency<br>MHz | Peak<br>dBuV | QP<br>dBuV | Delta<br>QP-QP Limit<br>dB | Avg<br>dBuV | Delta<br>Avg-Avg Limit<br>dB | Trace Name    |
|------------------|--------------|------------|----------------------------|-------------|------------------------------|---------------|
| 0.401            | 52.2         | 49.2       | -9.6                       | 41.9        | -6.8                         | Neutral Trace |
| 1.029            | 45.8         | 41.0       | -15.0                      | 32.0        | -14.0                        | Neutral Trace |
| 1.092            | 46.2         | 40.0       | -16.0                      | 31.2        | -14.8                        | Neutral Trace |
| 1.577            | 42.4         | 36.8       | -19.2                      | 26.9        | -19.1                        | Neutral Trace |
| 1.950            | 41.6         | 37.2       | -18.8                      | 26.9        | -19.1                        | Neutral Trace |
| 2.352            | 46.3         | 39.7       | -16.3                      | 29.8        | -16.2                        | Neutral Trace |
| 2.582            | 43.7         | 36.5       | -19.5                      | 27.1        | -18.9                        | Neutral Trace |
| 3.621            | 41.2         | 32.1       | -23.9                      | 21.6        | -24.4                        | Neutral Trace |

Plot # 5: Power Line Conducted Emission – Line tested: Hot

Test Configuration 2: EUT was on RF transmitting mode, Line Voltage: 5 Vdc  
(tests were performed using off-shelf external AC/DC adaptor)

Current Graph

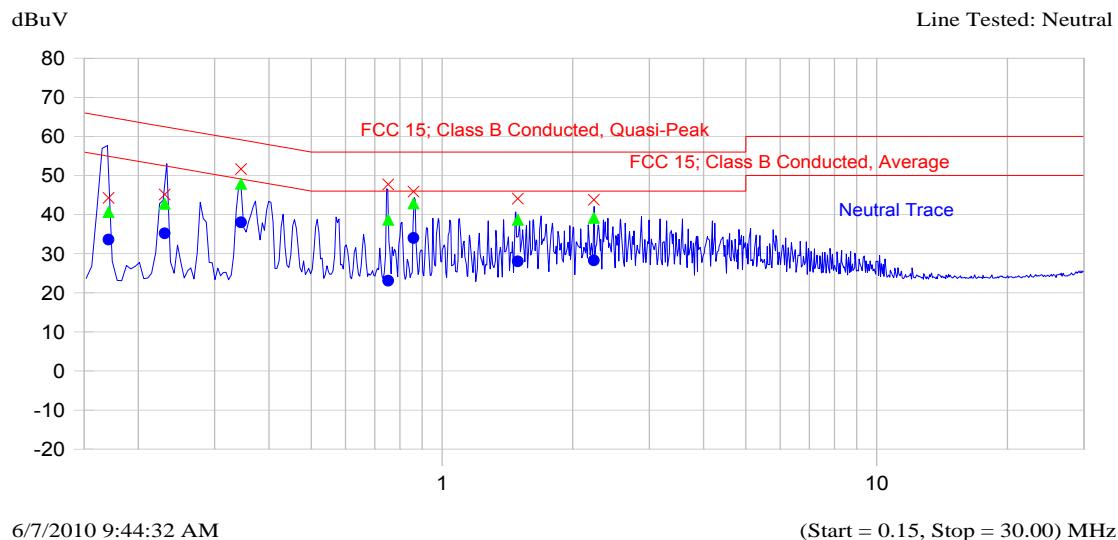


Current List

| Frequency<br>MHz | Peak<br>dBuV | QP<br>dBuV | Delta QP-QP Limit<br>dB | Avg<br>dBuV | Delta Avg-Avg Limit<br>dB | Trace Name |
|------------------|--------------|------------|-------------------------|-------------|---------------------------|------------|
| 0.345            | 56.4         | 53.2       | -7.2                    | 43.4        | -6.9                      | Hot Trace  |
| 0.374            | 55.8         | 52.0       | -7.5                    | 41.1        | -8.5                      | Hot Trace  |
| 0.400            | 56.3         | 54.1       | -4.7                    | 46.9        | -1.9                      | Hot Trace  |
| 0.458            | 48.6         | 47.2       | -9.9                    | 40.9        | -6.3                      | Hot Trace  |
| 0.515            | 49.6         | 47.9       | -8.1                    | 41.2        | -4.8                      | Hot Trace  |
| 0.859            | 48.6         | 46.5       | -9.5                    | 38.8        | -7.2                      | Hot Trace  |
| 0.974            | 49.5         | 47.5       | -8.5                    | 39.5        | -6.5                      | Hot Trace  |
| 1.032            | 49.6         | 47.5       | -8.5                    | 38.9        | -7.1                      | Hot Trace  |
| 1.089            | 49.0         | 46.9       | -9.1                    | 38.0        | -8.0                      | Hot Trace  |

Plot # 6: Power Line Conducted Emission – Line tested: Neutral  
Test Configuration 2: EUT was on RF transmitting mode, Line Voltage: 5 Vdc  
(tests were performed using off-shelf external AC/DC adaptor)

### Current Graph



### Current List

| Frequency<br>MHz | Peak<br>dBuV | QP<br>dBuV | Delta QP-QP Limit<br>dB | Avg<br>dBuV | Delta Avg-Avg Limit<br>dB | Trace Name    |
|------------------|--------------|------------|-------------------------|-------------|---------------------------|---------------|
| 0.171            | 44.3         | 40.6       | -24.8                   | 33.6        | -21.8                     | Neutral Trace |
| 0.230            | 45.1         | 42.8       | -20.9                   | 35.2        | -18.4                     | Neutral Trace |
| 0.345            | 51.6         | 47.9       | -12.5                   | 38.0        | -12.4                     | Neutral Trace |
| 0.751            | 47.7         | 38.7       | -17.3                   | 23.0        | -23.0                     | Neutral Trace |
| 0.860            | 45.9         | 42.8       | -13.2                   | 34.0        | -12.0                     | Neutral Trace |
| 1.494            | 44.1         | 38.7       | -17.3                   | 28.0        | -18.0                     | Neutral Trace |
| 2.234            | 43.8         | 39.2       | -16.8                   | 28.3        | -17.7                     | Neutral Trace |

## EXHIBIT 6. TEST EQUIPMENT LIST

| Test Instruments   | Manufacturer    | Model No. | Serial No. | Operating Range                         |
|--|-----------------|-----------|------------|---|
| EMI Receiver System/<br>Spectrum Analyzer with<br>built-in Amplifier | Hewlett Packard | HP 8546A  | 3520A00248 | 9KHz-5.6GHz,<br>50 Ohms                 |
| Transient Limiter  | Hewlett Packard | 11947A    | 310701998  | 9 kHz – 200 MHz<br>10 dB attenuation    |
| L.I.S.N.   | EMCO            | 3825/2    | 89071531   | 9 kHz – 200 MHz<br>50 Ohms / 50 $\mu$ H |
| 12'x16'x12' RF Shielded<br>Chamber                                   | RF Shielding    | ...       | ..         | ...                                     |
| EMI-Test Receiver  | Rohde & Schwarz | ESU40     | 100037     | 20 Hz- 40 GHz Build<br>in amplifier     |
| Spectrum Analyzer  | Rohde & Schwarz | FSEK30    | 100077     | 20 Hz- 40 GHz                           |
| Loop Antenna   | Emco            | 6502      | 2611       | 10 kHz – 30 MHz                         |
| Biconilog Antenna  | Emco            | 3142      | 10005      | 26 – 3000 MHz                           |
| Biconilog Antenna  | Emco            | 3142B     | 1575       | 26 – 2000 MHz                           |
| Log Periodic   | Emco            | 93148     | 1101       | 0.2 – 2 GHz                             |
| Log Periodic   | Emco            | 3148      | 23845      | 0.2 – 2 GHz                             |
| Horn Antenna   | Emco            | 3115      | 6570       | 1 – 18 GHz                              |
| Horn Antenna   | Emco            | 3115      | 5955       | 1 – 18 GHz                              |
| RF Amplifier   | Com-Power       | PA-103A   | 161243     | 10 MHz – 1000 MHz                       |
| RF Amplifier   | Hewlett Packard | 84498     | 3008A00769 | 1 – 26.5 GHz                            |
| Temperature & Humidity<br>Chamber                                    | Tenney          | T5        | 9723B      | -40°C - +80°C range                     |

## EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and LAB 34.

### 7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

| CONTRIBUTION<br>(Line Conducted)   | PROBABILITY<br>DISTRIBUTION | UNCERTAINTY (dB) |             |
|--|-----------------------------|------------------|-------------|
|  |                             | 9-150 kHz        | 0.15-30 MHz |
| EMI Receiver specification   | Rectangular                 | $\pm 1.5$        | $\pm 1.5$   |
| LISN coupling specification  | Rectangular                 | $\pm 1.5$        | $\pm 1.5$   |
| Cable and Input Transient Limiter calibration  | Normal (k=2)                | $\pm 0.3$        | $\pm 0.5$   |
| Mismatch: Receiver VRC $\Gamma_1 = 0.03$<br>LISN VRC $\Gamma_R = 0.8(9 \text{ kHz}) 0.2 (30 \text{ MHz})$<br>Uncertainty limits $20\text{Log}(1+\Gamma_1\Gamma_R)$ | U-Shaped                    | $\pm 0.2$        | $\pm 0.3$   |
| System repeatability   | Std. deviation              | $\pm 0.2$        | $\pm 0.05$  |
| Repeatability of EUT   | --                          | --               | --          |
| Combined standard uncertainty  | Normal                      | $\pm 1.25$       | $\pm 1.30$  |
| Expanded uncertainty U   | Normal (k=2)                | $\pm 2.50$       | $\pm 2.60$  |

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30 \text{ dB}$$

$$U = 2u_c(y) = \pm 2.6 \text{ dB}$$

## 7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

| CONTRIBUTION<br>(Radiated Emissions)   | PROBABILITY<br>DISTRIBUTION | UNCERTAINTY ( $\pm$ dB) |               |
|--|-----------------------------|-------------------------|---------------|
|  |                             | 3 m                     | 10 m          |
| Antenna Factor Calibration   | Normal (k=2)                | $\pm 1.0$               | $\pm 1.0$     |
| Cable Loss Calibration   | Normal (k=2)                | $\pm 0.3$               | $\pm 0.5$     |
| EMI Receiver specification   | Rectangular                 | $\pm 1.5$               | $\pm 1.5$     |
| Antenna Directivity  | Rectangular                 | $\pm 0.5$               | $\pm 0.5$     |
| Antenna factor variation with height   | Rectangular                 | $\pm 2.0$               | $\pm 0.5$     |
| Antenna phase center variation   | Rectangular                 | 0.0                     | $\pm 0.2$     |
| Antenna factor frequency interpolation   | Rectangular                 | $\pm 0.25$              | $\pm 0.25$    |
| Measurement distance variation   | Rectangular                 | $\pm 0.6$               | $\pm 0.4$     |
| Site imperfections   | Rectangular                 | $\pm 2.0$               | $\pm 2.0$     |
| Mismatch: Receiver VRC $\Gamma_1 = 0.2$<br>Antenna VRC $\Gamma_R = 0.67(Bi)$ 0.3 (Lp)<br>Uncertainty limits $20\log(1+\Gamma_1\Gamma_R)$ | U-Shaped                    | $+1.1$<br><br>$-1.25$   | $\pm 0.5$     |
| System repeatability   | Std. Deviation              | $\pm 0.5$               | $\pm 0.5$     |
| 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:

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