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# Report On

EMC Evaluation of  
OnRamp Wireless  
GE KV2C Meter equipped with On-Ramp Wireless TRN-2014  
communication module Model TRN-2014

FCC Part 15 Subpart B  
ICES-003 Issue 5

**Report No. SC1300586A**

**June 27 2013**



America

TÜV SÜD America Inc., 10040 Mesa Rim Road, San Diego, CA 92121  
Tel: (858) 678-1400. Website: [www.TUVamerica.com](http://www.TUVamerica.com)

**REPORT ON** EMC Evaluation of the  
OnRamp Wireless  
TRN-2014 GE KV2C Meter equipped with On-Ramp Wireless TRN-2014  
communication module

**TEST REPORT NUMBER** SC1300586A

**TEST REPORT DATE** June 27 2013

**PREPARED FOR** OnRamp Wireless  
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**Name** Authorized Signatory

**DATED** June 27, 2013



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### Revision History

| SC1300586A<br>OnRamp Wireless<br>GE KV2C Meter equipped with On-Ramp Wireless TRN-2014 communication module |                 |              |        |                |                 |
|---|-----------------|--------------|--------|----------------|-----------------|
| DATE  | OLD REVISION    | NEW REVISION | REASON | PAGES AFFECTED | APPROVED BY     |
| 06/27/13  | Initial Release |              |        |                | Juan M Gonzalez |
|   |                 |              |        |                |                 |
|   |                 |              |        |                |                 |
|   |                 |              |        |                |                 |

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## **SECTION 1**

### **REPORT SUMMARY**

EMC Evaluation of the  
OnRamp Wireless

GE KV2C Meter equipped with On-Ramp Wireless TRN-2014 communication module



## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the OnRamp Wireless GE KV2C Meter equipped with On-Ramp Wireless TRN-2014 communication module to the requirements of FCC Part 15 Subpart B and Industry Canada ICES-003.

|                 |  |
|-----------------|--|
| Objective       | To perform EMC Evaluation to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out. |
| Manufacturer    | OnRamp Wireless  |
| Model Number(s) | TRN-2014   |

Meter Forms included in this test report

| Meter Form    | Class        | Rating      |
|---------------|--------------|-------------|
| KV2C Form 1S  | CL200        | 120-480 VAC |
| KV2C Form 2S  | CL200, CL320 | 120-480 VAC |
| KV2C Form 3S  | CL20         | 120-480 VAC |
| KV2C Form 4S  | CL20         | 120-480 VAC |
| KV2C Form 9S  | CL20         | 120-480 VAC |
| KV2C Form 12S | CL200, CL320 | 120-480 VAC |
| KV2C Form 16S | CL200, CL320 | 120-480 VAC |
| KV2C Form 36S | CL20         | 120-480 VAC |
| KV2C Form 45S | CL20         | 120-480 VAC |

|                                     |  |
|-------------------------------------|--|
| Serial Number(s)                    | x000022A5(Radiated Measurements)   |
| Number of Samples Tested            | 1  |
| Highest Frequency Generated or Used | 2475.63 MHz  |
| Test Specification/Issue/Date       | <ul style="list-style-type: none"> <li>FCC Part 15 Subpart B (October 1, 2011)</li> <li>Spectrum Management and Telecommunications Interference-Causing Equipment Standard ICES-003 Information Technology Equipment (ITE) — Limits and methods of measurement (Issue 5 August 2012).</li> </ul> |
| Start of Test                       | June 26, 2013  |
| Finish of Test                      | June 27, 2013  |
| Name of Engineer(s)                 | Juan Manuel Gonzalez   |
| Related Document(s)                 |  |



## 1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart B is shown below. Test results from these tests are deemed satisfactory evidence of compliance with Industry Canada Interference-Causing Equipment Standard ICES-003.

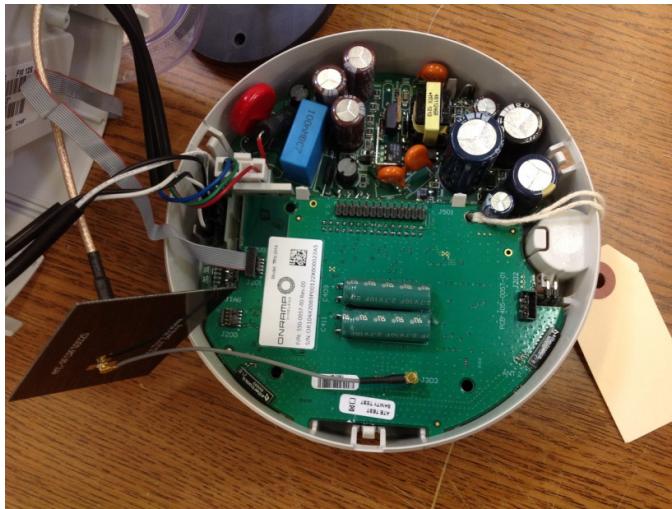
| Part 15 | Test Description         | Result    | Comments/Base Standard |
|---------|--------------------------|-----------|------------------------|
| §15.107 | Conducted Limits         | Compliant | Class B requirement    |
| §15.109 | Radiated Emission Limits | Compliant | Class B requirement    |

## 1.3 PRODUCT INFORMATION

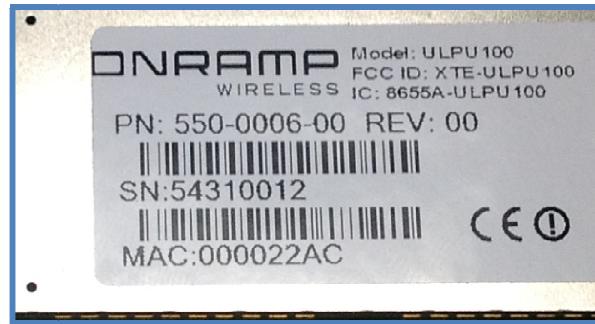
### 1.3.1 EUT General Description

The Equipment Under Test (EUT) was a GE KV2C Meter equipped with On-Ramp Wireless TRN-2014 communication module as shown in the photograph below.

The communication module of the EUT is a wireless module primarily used for smart grid and remote monitoring applications. The communication module's transceiver is already approved under FCC ID XTE-ULPU100 and IC 8655A-ULPU100, it is being reassessed due to addition of integration into the GE KV2C electric meter with an external antenna.



**Equipment Under Test**



**Equipment Under Test**

On-Ramp Wireless TRN-2014 communication module



## 1.4 EUT TEST CONFIGURATION

### 1.4.1 Test Configuration Description

| Test Configuration | Description  |
|--------------------|--|
| Default            | Typical normal install configuration and operation (unintentional radiator configuration – EUT in receive mode). EUT powered by 240V-60Hz Isolated Transformer |

### 1.4.2 EUT Exercise Software

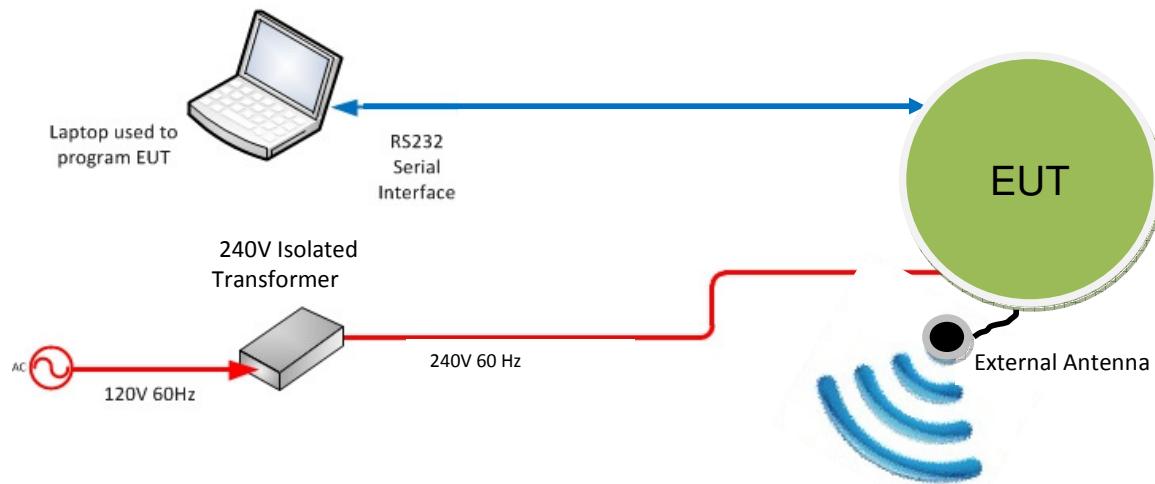
Client provided “CertTools\_0.4.1.exe” was used to configure the EUT communication module. The tool runs on a Windows platform and uses a serial port to communicate with the EUT debug port. Because the EUT ground is isolated and can float at high voltage potential, an USB-to-USB isolator is used between the test Laptop and the EUT.

The tool provide for means of selecting the channel, the transmission gain and selecting Rx, Tx or Idle modes. On Tx mode, the communication module transmits a modulated waveform to the selected antenna. The mode selected is maintained after the tool is disconnected from the EUT.

### 1.4.3 Support Equipment and I/O cables

| Manufacturer | Equipment/Cable           | Description  |
|--------------|---------------------------|--|
| Dell         | Test Laptop               | Windows based laptop (Model E6520)                                     |
| FTDI         | USB to Serial cable       | USB to serial converter  |
| -            | Isolator                  | USB to USB Isolator  |
| Philmore     | 240V Isolated Transformer | Model ST-100 (120VAC->240VAC)  |
| ORW          | Adapter cable             | Ribbon adapter cable   |
| HP           | Power Supply              | DC Power Supply used to verify the Peak Output Power from the TRN-2014 |

**1.4.4 Simplified Test Configuration Diagram**





### 1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

### 1.6 MODIFICATION RECORD

| Description of Modification                     | Modification Fitted By | Date Modification Fitted |
|---|------------------------|--------------------------|
| Serial Number: x000022A5(Radiated Measurements) |                        |                          |
|   |                        |                          |

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

### 1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.4-2009, 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.

For radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.4-2009. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

### 1.8 TEST FACILITY

#### 1.8.1 FCC – Registration No.: US5296

TÜV SÜD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.498 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US5296.

#### 1.8.2 Industry Canada (IC) Registration No.: 3067A

The 10m Semi-anechoic chamber of TÜV SÜD America Inc. (San Diego), has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No. 3067A.



## SECTION 2

### TEST DETAILS

EMC Evaluation of the  
OnRamp Wireless

GE KV2C Meter equipped with On-Ramp Wireless TRN-2014 communication module

## 2.1 CONDUCTED LIMITS

### 2.1.1 Specification Reference

Part 15 Subpart B §15.107(a)

### 2.1.2 Standard Applicable

Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges

| Frequency of emission (MHz) | Conducted limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15–0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5–5                       | 56                           | 46        |
| 5–30                        | 60                           | 50        |

\*Decreases with the logarithm of the frequency.

### 2.1.3 Equipment Under Test and Modification State

Serial No: x000022A5(Radiated Measurements) /Default Test Configuration

### 2.1.4 Date of Test/Initial of test personnel who performed the test

June 26, 2013/JMG

### 2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.1.6 Environmental Conditions

|                     |          |
|---------------------|----------|
| Ambient Temperature | 23.0°C   |
| Relative Humidity   | 50.6%    |
| ATM Pressure        | 99.5 kPa |

### 2.1.7 Additional Observations

Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.1.8 for sample computation.

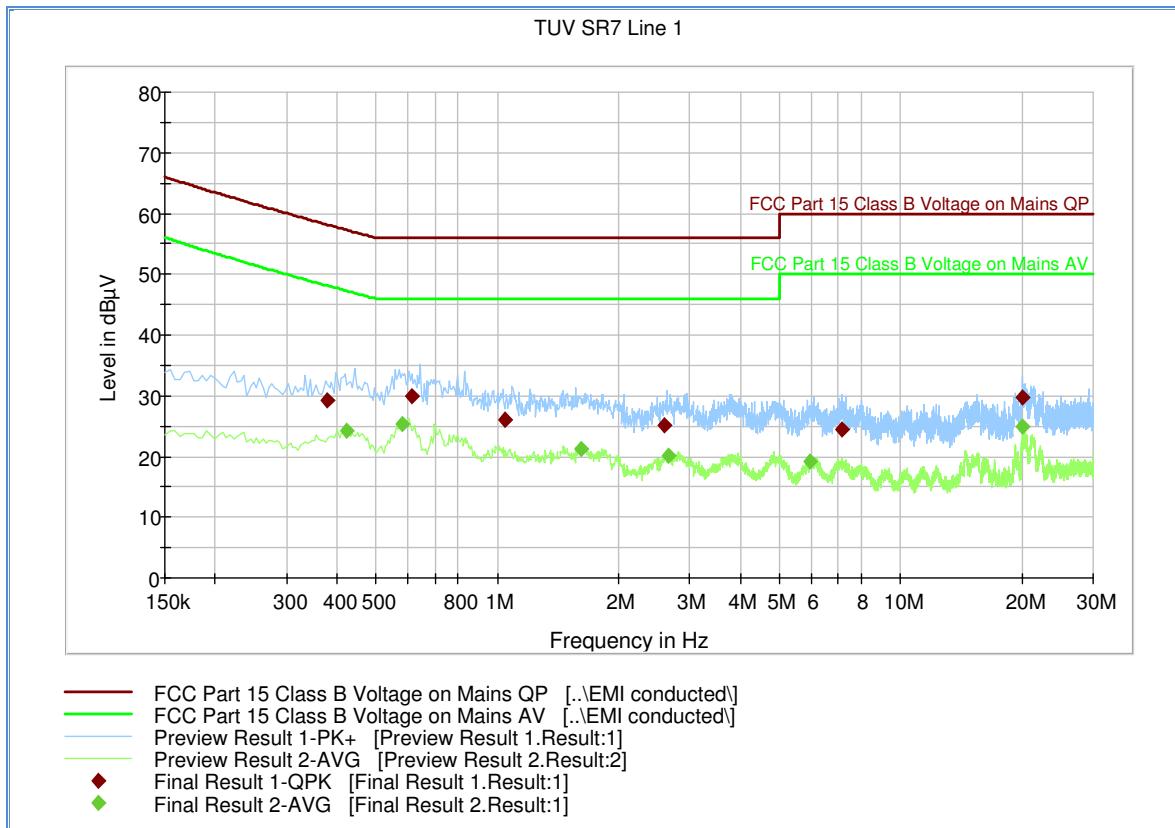
### 2.1.8 Sample Computation (Conducted Emission – Quasi Peak)

|  |                                |      |      |
|--|--------------------------------|------|------|
| Measuring equipment raw measurement (db $\mu$ V) @ 150kHz  |                                |      | 5.5  |
| Correction Factor (dB)                                     | Asset# 8607 (20 dB attenuator) | 19.9 | 20.7 |
|  | Asset# 1177 (cable)            | 0.15 |      |
|  | Asset# 1176 (cable)            | 0.35 |      |
|  | Asset# 7568 (LISN)             | 0.30 |      |
| Reported QuasiPeak Final Measurement (db $\mu$ V) @ 150kHz |                                |      | 26.2 |

### 2.1.9 Test Results

Compliant. See attached plots and tables.

## 2.1.10 Line 1 (Phase A)



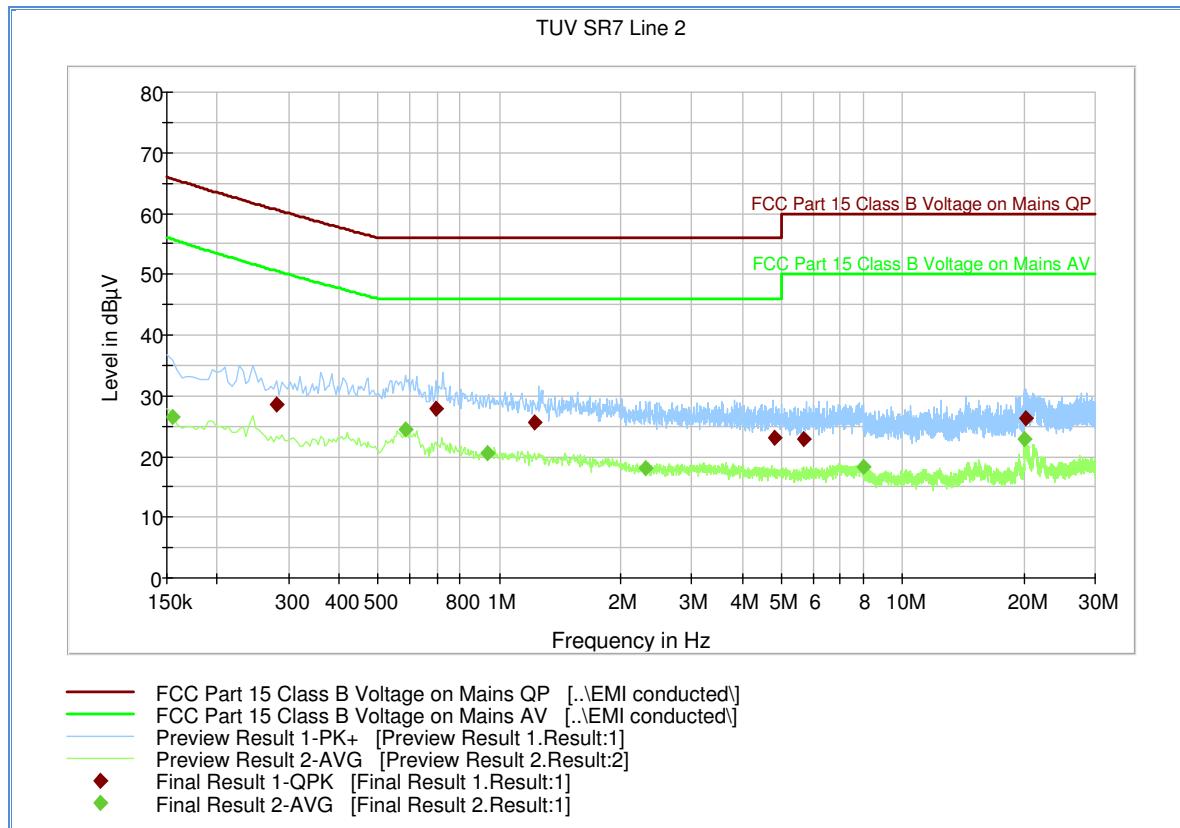
## Quasi Peak

| Frequency (MHz) | QuasiPeak (dB $\mu$ V) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin - QPK (dB) | Limit - QPK (dB $\mu$ V) |
|-----------------|------------------------|-----------------|-----------------|--------|------|------------|-------------------|--------------------------|
| 0.379500        | 29.2                   | 1000.0          | 9.000           | Off    | L1   | 20.2       | 29.0              | 58.1                     |
| 0.613500        | 30.1                   | 1000.0          | 9.000           | Off    | L1   | 20.2       | 26.0              | 56.0                     |
| 1.041000        | 26.1                   | 1000.0          | 9.000           | Off    | L1   | 20.2       | 29.9              | 56.0                     |
| 2.598000        | 25.2                   | 1000.0          | 9.000           | Off    | L1   | 20.3       | 30.8              | 56.0                     |
| 7.143000        | 24.4                   | 1000.0          | 9.000           | Off    | L1   | 20.4       | 35.6              | 60.0                     |
| 19.999500       | 29.7                   | 1000.0          | 9.000           | Off    | L1   | 21.0       | 30.4              | 60.0                     |

## Average

| Frequency (MHz) | Average (dB $\mu$ V) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin - Ave (dB) | Limit - Ave (dB $\mu$ V) |
|-----------------|----------------------|-----------------|-----------------|--------|------|------------|-------------------|--------------------------|
| 0.424500        | 24.3                 | 1000.0          | 9.000           | Off    | L1   | 20.2       | 22.9              | 47.2                     |
| 0.582000        | 25.4                 | 1000.0          | 9.000           | Off    | L1   | 20.2       | 20.6              | 46.0                     |
| 1.617000        | 21.3                 | 1000.0          | 9.000           | Off    | L1   | 20.3       | 24.7              | 46.0                     |
| 2.652000        | 20.1                 | 1000.0          | 9.000           | Off    | L1   | 20.3       | 25.9              | 46.0                     |
| 5.977500        | 19.1                 | 1000.0          | 9.000           | Off    | L1   | 20.4       | 30.9              | 50.0                     |
| 19.999500       | 24.8                 | 1000.0          | 9.000           | Off    | L1   | 21.0       | 25.2              | 50.0                     |

## 2.1.11 Line 2 (Phase B)



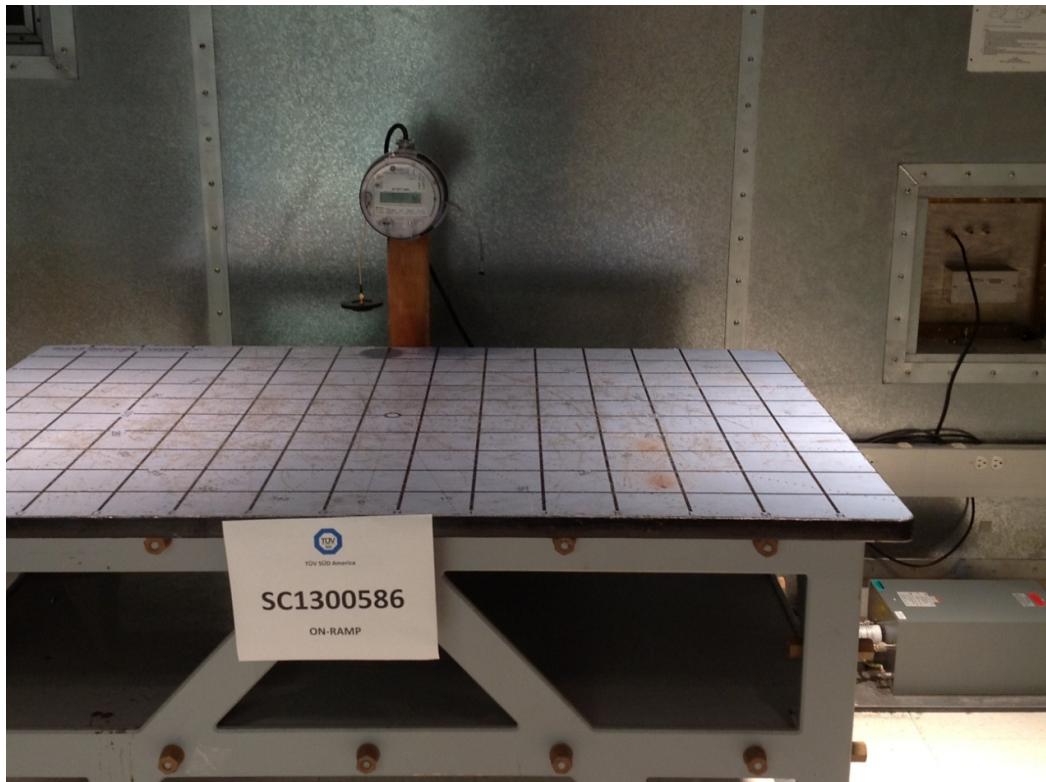
## Quasi Peak

| Frequency (MHz) | QuasiPeak (dB $\mu$ V) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin - QPK (dB) | Limit - QPK (dB $\mu$ V) |
|-----------------|------------------------|-----------------|-----------------|--------|------|------------|-------------------|--------------------------|
| 0.280500        | 28.6                   | 1000.0          | 9.000           | Off    | N    | 21.1       | 32.0              | 60.6                     |
| 0.699000        | 27.9                   | 1000.0          | 9.000           | Off    | N    | 21.1       | 28.1              | 56.0                     |
| 1.221000        | 25.6                   | 1000.0          | 9.000           | Off    | N    | 21.1       | 30.4              | 56.0                     |
| 4.812000        | 23.0                   | 1000.0          | 9.000           | Off    | N    | 21.2       | 33.0              | 56.0                     |
| 5.707500        | 22.9                   | 1000.0          | 9.000           | Off    | N    | 21.2       | 37.1              | 60.0                     |
| 20.238000       | 26.4                   | 1000.0          | 9.000           | Off    | N    | 21.7       | 33.6              | 60.0                     |

## Average

| Frequency (MHz) | Average (dB $\mu$ V) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin - Ave (dB) | Limit - Ave (dB $\mu$ V) |
|-----------------|----------------------|-----------------|-----------------|--------|------|------------|-------------------|--------------------------|
| 0.154500        | 26.6                 | 1000.0          | 9.000           | Off    | N    | 21.2       | 29.2              | 55.7                     |
| 0.586500        | 24.4                 | 1000.0          | 9.000           | Off    | N    | 21.1       | 21.6              | 46.0                     |
| 0.937500        | 20.5                 | 1000.0          | 9.000           | Off    | N    | 21.1       | 25.5              | 46.0                     |
| 2.310000        | 18.0                 | 1000.0          | 9.000           | Off    | N    | 21.1       | 28.0              | 46.0                     |
| 7.975500        | 18.3                 | 1000.0          | 9.000           | Off    | N    | 21.2       | 31.7              | 50.0                     |
| 19.999500       | 22.9                 | 1000.0          | 9.000           | Off    | N    | 21.7       | 27.1              | 50.0                     |

**2.1.12 Test Setup Photo (Front)**



**2.1.13 Test Setup Photo (Back)**





## 2.2 RADIATED EMISSION LIMITS

### 2.2.1 Specification Reference

Part 15 Subpart B §15.109(a)

### 2.2.2 Standard Applicable

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency of emission (MHz) | Field Strength (microvolts/meter) |
|-----------------------------|-----------------------------------|
| 30-88                       | 100                               |
| 88-216                      | 150                               |
| 216-960                     | 200                               |
| Above 960                   | 500                               |

### 2.2.3 Equipment Under Test and Modification State

Serial No: x000022A5(Radiated Measurements) /Default Test Configuration

### 2.2.4 Date of Test/Initial of test personnel who performed the test

June 26, 2013/JMG

### 2.2.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.2.6 Environmental Conditions

|                     |          |
|---------------------|----------|
| Ambient Temperature | 23.0°C   |
| Relative Humidity   | 50.6%    |
| ATM Pressure        | 99.5 kPa |

### 2.2.7 Additional Observations

- The spectrum was searched from 30MHz to 18GHz and verified to Class B limits.
- There are no emissions observed above 1GHz, all points presented are noise floor measurements.
- Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.2.8 for sample computation.

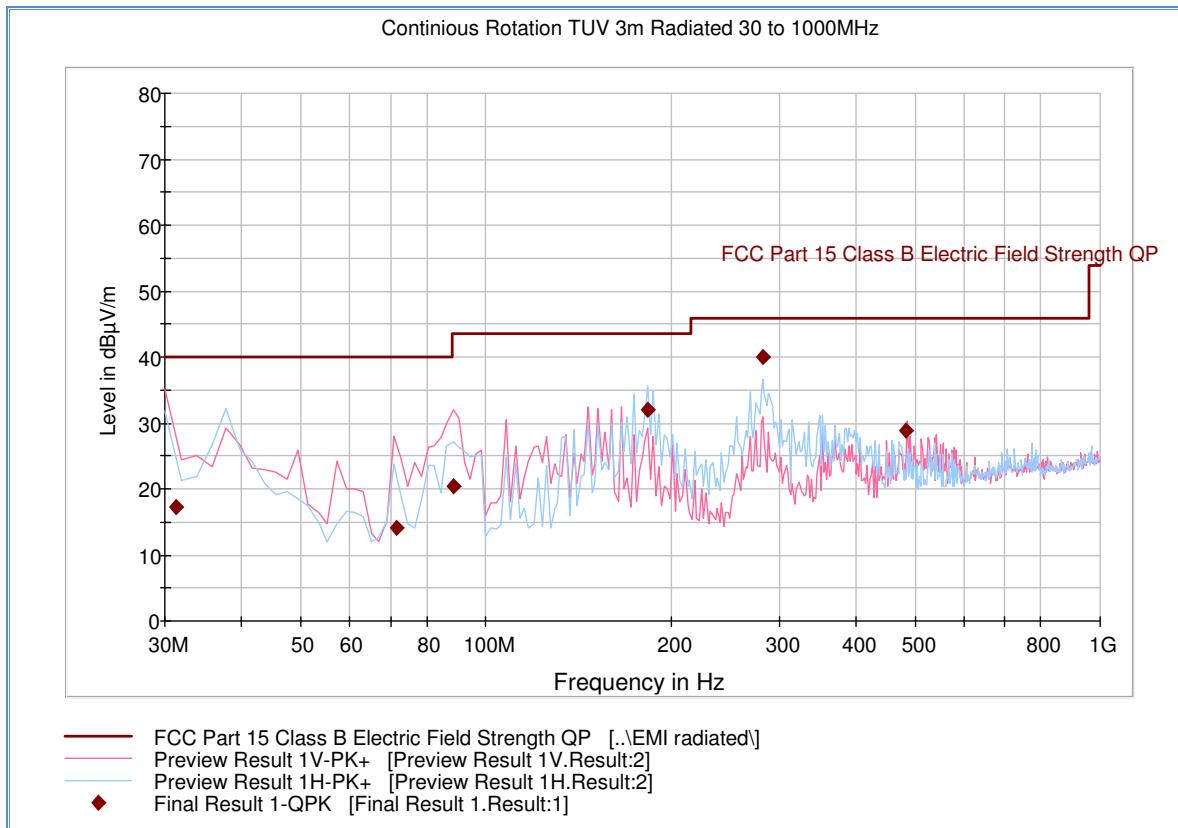
### 2.2.8 Sample Computation (Radiated Emission)

| Measuring equipment raw measurement (db $\mu$ V) @ 30 MHz |   |       | 24.4        |
|---|---|-------|-------------|
| Correction Factor (dB)                                    | Asset# 1066 (cable)   | 0.3   | -12.6       |
|   | Asset# 1172 (cable)   | 0.3   |             |
|   | Asset# 1016 (preamplifier)  | -30.7 |             |
|   | Asset# 1175(cable)  | 0.3   |             |
|   | Asset# 1002 (antenna)   | 17.2  |             |
|   | <b>Reported QuasiPeak Final Measurement (db<math>\mu</math>V/m) @ 30MHz</b> |       | <b>11.8</b> |

### 2.2.9 Test Results

See attached plots.

### 2.2.9.1 Below 1GHz Radiated Emission Test



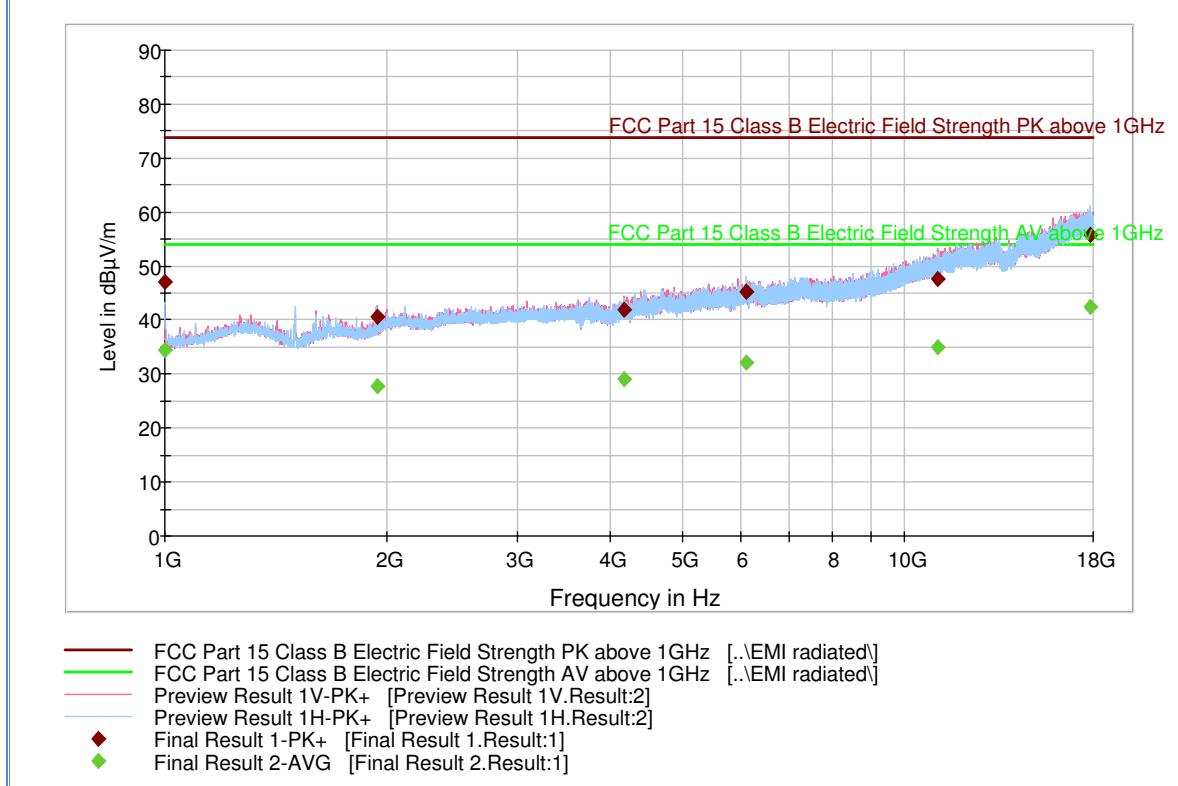
#### Quasi-Peak Data

| Frequency (MHz) | QuasiPeak (dBμV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|--------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 31.320000       | 17.2               | 1000.0          | 120.000         | 150.0       | V            | 309.0         | -11.6      | 22.8        | 40.0           |
| 71.501643       | 14.1               | 1000.0          | 120.000         | 105.0       | V            | 230.0         | -21.7      | 25.9        | 40.0           |
| 88.492745       | 20.4               | 1000.0          | 120.000         | 400.0       | V            | 11.0          | -20.3      | 23.1        | 43.5           |
| 183.727134      | 32.0               | 1000.0          | 120.000         | 150.0       | H            | 15.0          | -15.9      | 11.5        | 43.5           |
| 282.265411      | 40.0               | 1000.0          | 120.000         | 100.0       | H            | 82.0          | -12.3      | 6.0         | 46.0           |
| 483.869739      | 28.8               | 1000.0          | 120.000         | 105.0       | V            | 96.0          | -5.7       | 17.2        | 46.0           |

#### Test Notes:

### 2.2.9.2 Above 1GHz Radiated Emission Test

Continuous Rotation TUV 3m Radiated 1000 to 18000MHz



#### Peak Data

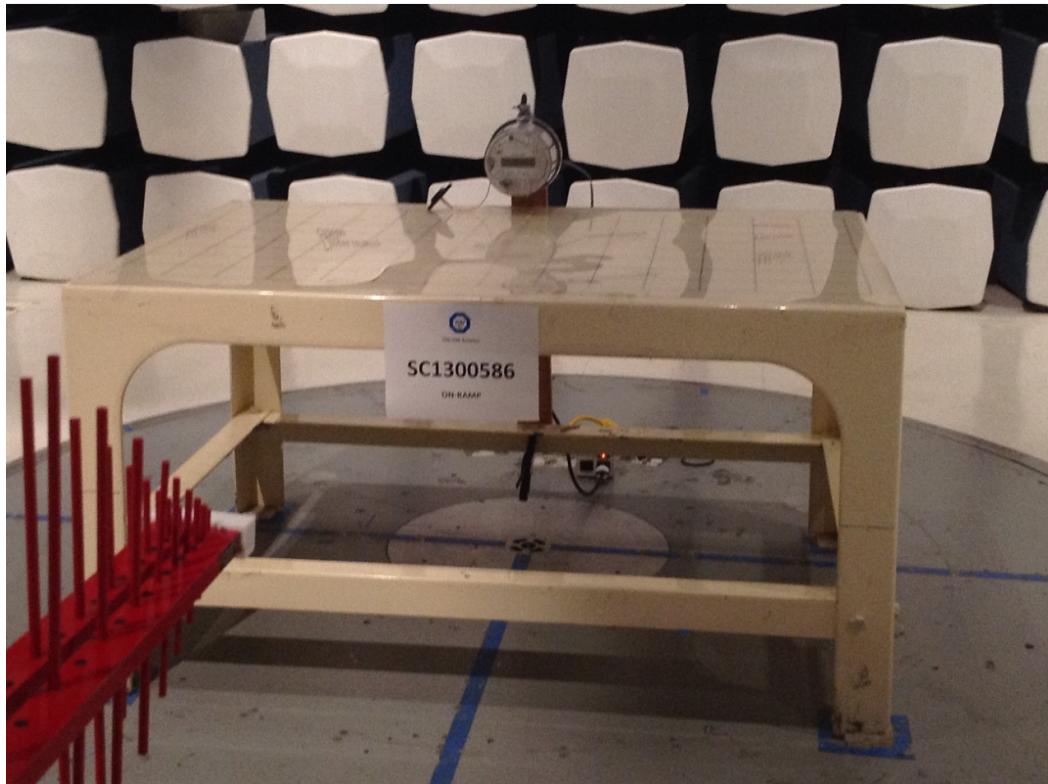
| Frequency (MHz) | Max Peak (dB $\mu$ V/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dB $\mu$ V/m) |
|-----------------|-------------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------------|
| 1000.000000     | 47.0                    | 1000.0          | 1000.000        | 248.3       | H            | 10.0          | -6.3       | 26.9        | 73.9                 |
| 1938.053333     | 40.7                    | 1000.0          | 1000.000        | 333.1       | V            | 212.0         | -2.0       | 33.2        | 73.9                 |
| 4187.160000     | 41.9                    | 1000.0          | 1000.000        | 302.6       | V            | 232.0         | 3.8        | 32.0        | 73.9                 |
| 6118.560000     | 45.3                    | 1000.0          | 1000.000        | 300.6       | H            | 57.0          | 8.1        | 28.6        | 73.9                 |
| 11091.46000     | 47.5                    | 1000.0          | 1000.000        | 402.6       | V            | 20.0          | 14.6       | 26.4        | 73.9                 |
| 17880.21333     | 55.9                    | 1000.0          | 1000.000        | 157.5       | H            | 53.0          | 22.4       | 18.0        | 73.9                 |

#### Average Data

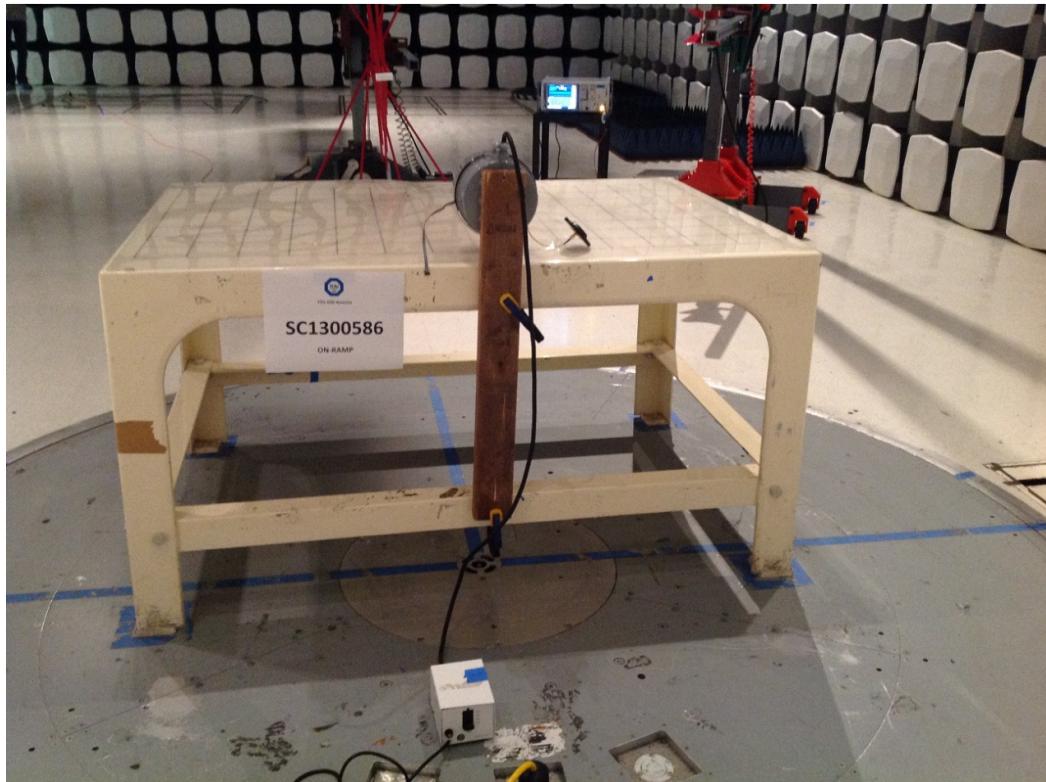
| Frequency (MHz) | Average (dB $\mu$ V/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dB $\mu$ V/m) |
|-----------------|------------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------------|
| 1000.000000     | 34.5                   | 1000.0          | 1000.000        | 248.3       | H            | 10.0          | -6.3       | 19.4        | 53.9                 |
| 1938.053333     | 27.7                   | 1000.0          | 1000.000        | 333.1       | V            | 212.0         | -2.0       | 26.2        | 53.9                 |
| 4187.160000     | 29.0                   | 1000.0          | 1000.000        | 302.6       | V            | 232.0         | 3.8        | 24.9        | 53.9                 |
| 6118.560000     | 32.2                   | 1000.0          | 1000.000        | 300.6       | H            | 57.0          | 8.1        | 21.7        | 53.9                 |
| 11091.46000     | 35.0                   | 1000.0          | 1000.000        | 402.6       | V            | 20.0          | 14.6       | 18.9        | 53.9                 |
| 17880.21333     | 42.5                   | 1000.0          | 1000.000        | 157.5       | H            | 53.0          | 22.4       | 11.4        | 53.9                 |

#### Test Notes:

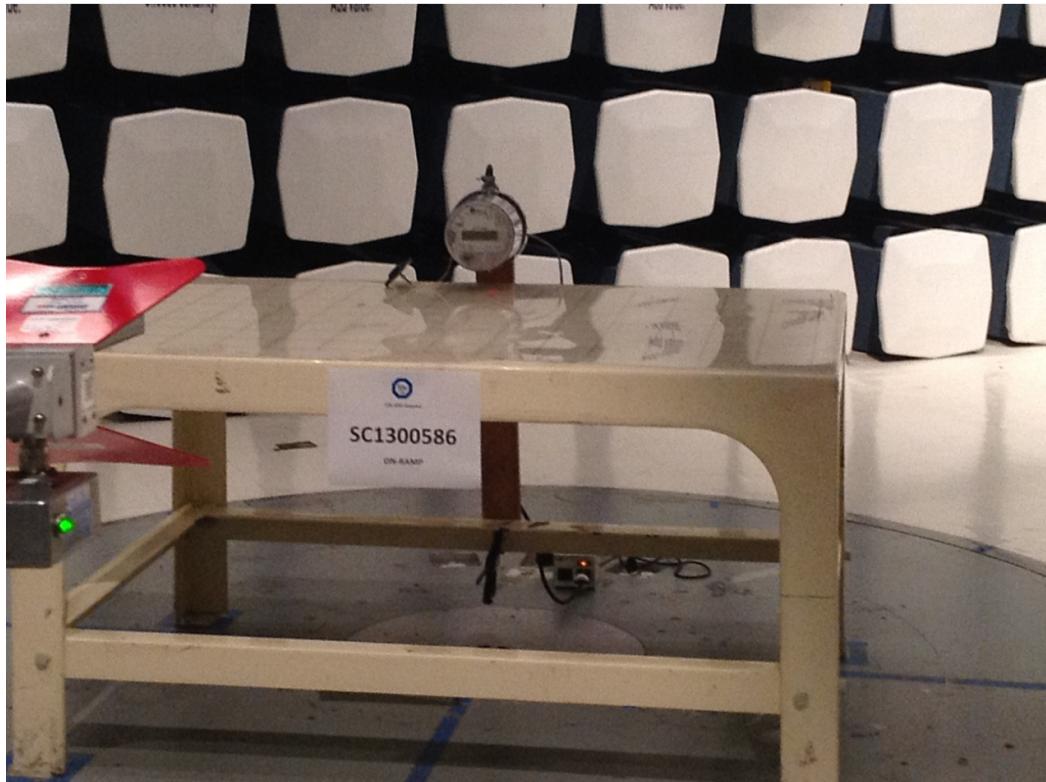
**2.2.10 Test Setup Photo (Below 1GHz Front)**



**2.2.11 Test Setup Photo (Below 1GHz Back)**



**2.2.12 Test Setup Photo (Above 1GHz Front)**



**2.2.13 Test Setup Photo (Above 1GHz Back)**





### **SECTION 3**

#### **TEST EQUIPMENT USED**

### 3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

| ID Number<br>(SDGE/SDRB)       | Test Equipment                              | Type                | Serial Number | Manufacturer               | Cal Date | Cal Due Date |
|--------------------------------|---|---------------------|---------------|----------------------------|----------|--------------|
| Conducted Emissions Test Setup |   |                     |               |                            |          |              |
| 1049                           | EMI Test Receiver                           | ESU                 | 100133        | Rhode & Schwarz            | 06/13/12 | 07/13/13     |
| 7567                           | LISN  | FCC-LISN-50-25-2-10 | 120304        | Fischer Custom Comm.       | 01/11/13 | 06/11/14     |
| 8607                           | 20dB Attenuator                             | CAT-20              | N/A           | MCL HAT-20                 | 08/21/12 | 08/21/13     |
| 8609                           | 20dB Attenuator                             | CAT-20              | N/A           | MCL HAT-20                 | 08/21/12 | 08/21/13     |
| Radiated Test Setup            |   |                     |               |                            |          |              |
| 1002                           | Bilog Antenna                               | 3142C               | 000058717     | EMCO                       | 01/21/13 | 01/21/14     |
| 7575                           | Double-ridged waveguide horn antenna        | 3117                | 00155511      | EMCO                       | 03/25/13 | 03/25/14     |
| 8628                           | Pre-amplifier                               | QLI 01182835-JO     | 8986002       | QuinStar Technologies Inc. | 09/21/12 | 09/21/13     |
| 8543                           | High-frequency cable                        | Micropore 19057793  | N/A           | United Microwave Products  | 09/21/12 | 09/21/13     |
| 1040                           | EMI Test Receiver                           | ESIB40              | 100292        | Rhode & Schwarz            | 08/10/12 | 08/10/13     |
| 1049                           | EMI Test Receiver                           | ESU                 | 100133        | Rhode & Schwarz            | 06/13/12 | 07/13/13     |
| 1016                           | Pre-amplifier                               | PAM-0202            | 187           | PAM                        | 09/24/12 | 09/24/13     |
| Miscellaneous                  |   |                     |               |                            |          |              |
| 7560                           | Barometer/Temperature /Humidity Transmitter | iBTHX-W             | 1240476       | Omega                      | 08/12/12 | 08/12/13     |
| 6452                           | Multimeter                                  | 3478A               | 2911A52177    | Hewlett Packard            | 07/16/12 | 07/16/13     |
|                                | Test Software                               | EMC32               | V8.52         | Rhode & Schwarz            | N/A      |              |

### 3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

#### 3.2.1 Radiated Emission Measurements (Below 1GHz)

| Contribution |                            | Probability Distribution Type | Probability Distribution $x_i$ | Standard Uncertainty $u(x_i)$   | $[u(x_i)]^2$ |
|--------------|----------------------------|-------------------------------|--------------------------------|---------------------------------|--------------|
| 1            | Receiver/Spectrum Analyzer | Rectangular                   | 0.45                           | 0.26                            | 0.07         |
| 2            | Cables                     | Rectangular                   | 0.50                           | 0.29                            | 0.08         |
| 3            | Preamp                     | Rectangular                   | 0.50                           | 0.29                            | 0.08         |
| 4            | Antenna                    | Rectangular                   | 0.75                           | 0.43                            | 0.19         |
| 5            | Site                       | Rectangular                   | 3.89                           | 2.25                            | 5.04         |
| 6            | EUT Setup                  | Rectangular                   | 1.00                           | 0.58                            | 0.33         |
|              |                            |                               |                                | Combined Uncertainty ( $u_c$ ): | 2.41         |
|              |                            |                               |                                | Coverage Factor ( $k$ ):        | 2            |
|              |                            |                               |                                | Expanded Uncertainty:           | 4.82         |

#### 3.2.2 Radiated Emission Measurements (Above 1GHz)

| Contribution |                            | Probability Distribution Type | Probability Distribution $x_i$ | Standard Uncertainty $u(x_i)$   | $[u(x_i)]^2$ |
|--------------|----------------------------|-------------------------------|--------------------------------|---------------------------------|--------------|
| 1            | Receiver/Spectrum Analyzer | Rectangular                   | 0.57                           | 0.33                            | 0.11         |
| 2            | Cables                     | Rectangular                   | 0.70                           | 0.40                            | 0.16         |
| 3            | Preamp                     | Rectangular                   | 0.50                           | 0.29                            | 0.08         |
| 4            | Antenna                    | Rectangular                   | 0.37                           | 0.21                            | 0.05         |
| 5            | Site                       | Rectangular                   | 3.89                           | 2.25                            | 5.04         |
| 6            | EUT Setup                  | Rectangular                   | 1.00                           | 0.58                            | 0.33         |
|              |                            |                               |                                | Combined Uncertainty ( $u_c$ ): | 2.40         |
|              |                            |                               |                                | Coverage Factor ( $k$ ):        | 2            |
|              |                            |                               |                                | Expanded Uncertainty:           | 4.81         |

### 3.2.3 AC Mains Conducted Emissions Measurement

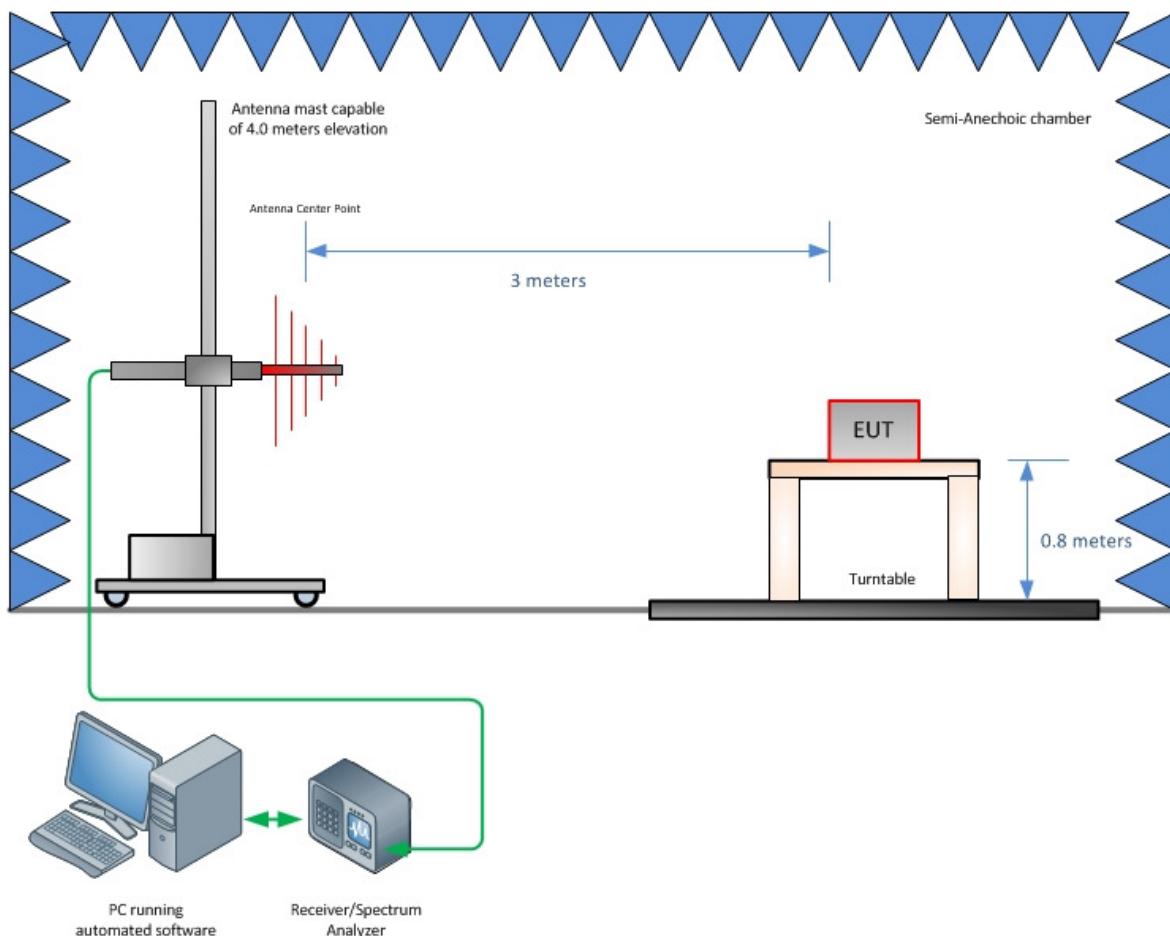
| Contribution |                            | Probability Distribution Type | Probability Distribution $x_i$ | Standard Uncertainty $u(x_i)$   | $[u(x_i)]^2$ |
|--------------|----------------------------|-------------------------------|--------------------------------|---------------------------------|--------------|
| 1            | Receiver/Spectrum Analyzer | Rectangular                   | 0.36                           | 0.21                            | 0.04         |
| 2            | Cables                     | Rectangular                   | 0.50                           | 0.29                            | 0.08         |
| 3            | LISN                       | Rectangular                   | 0.66                           | 0.38                            | 0.15         |
| 4            | Attenuator                 | Rectangular                   | 0.30                           | 0.17                            | 0.03         |
| 5            | EUT Setup                  | Rectangular                   | 1.00                           | 0.58                            | 0.33         |
|              |                            |                               |                                | Combined Uncertainty ( $u_c$ ): | 0.80         |
|              |                            |                               |                                | Coverage Factor ( $k$ ):        | 2            |
|              |                            |                               |                                | Expanded Uncertainty:           | 1.59         |



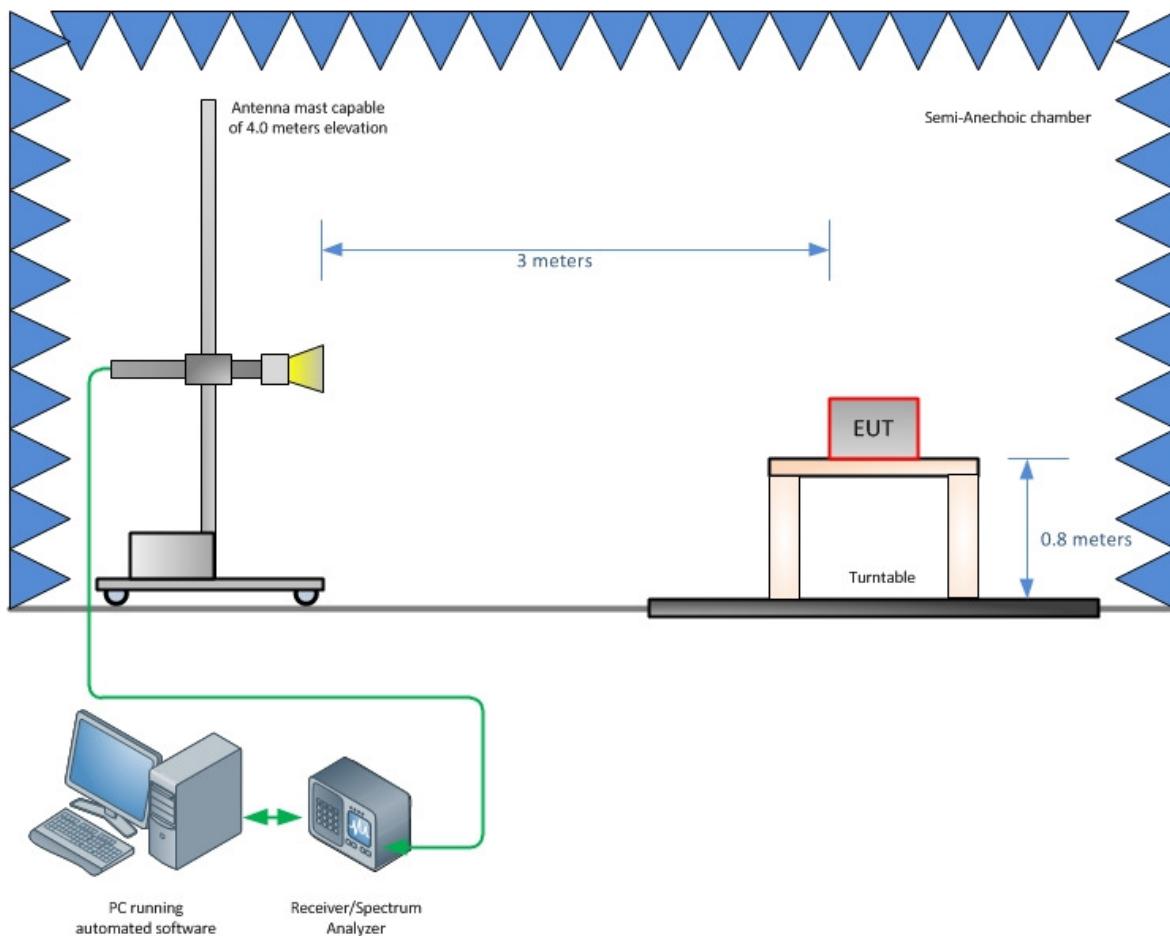
## SECTION 4

### DIAGRAM OF TEST SETUP

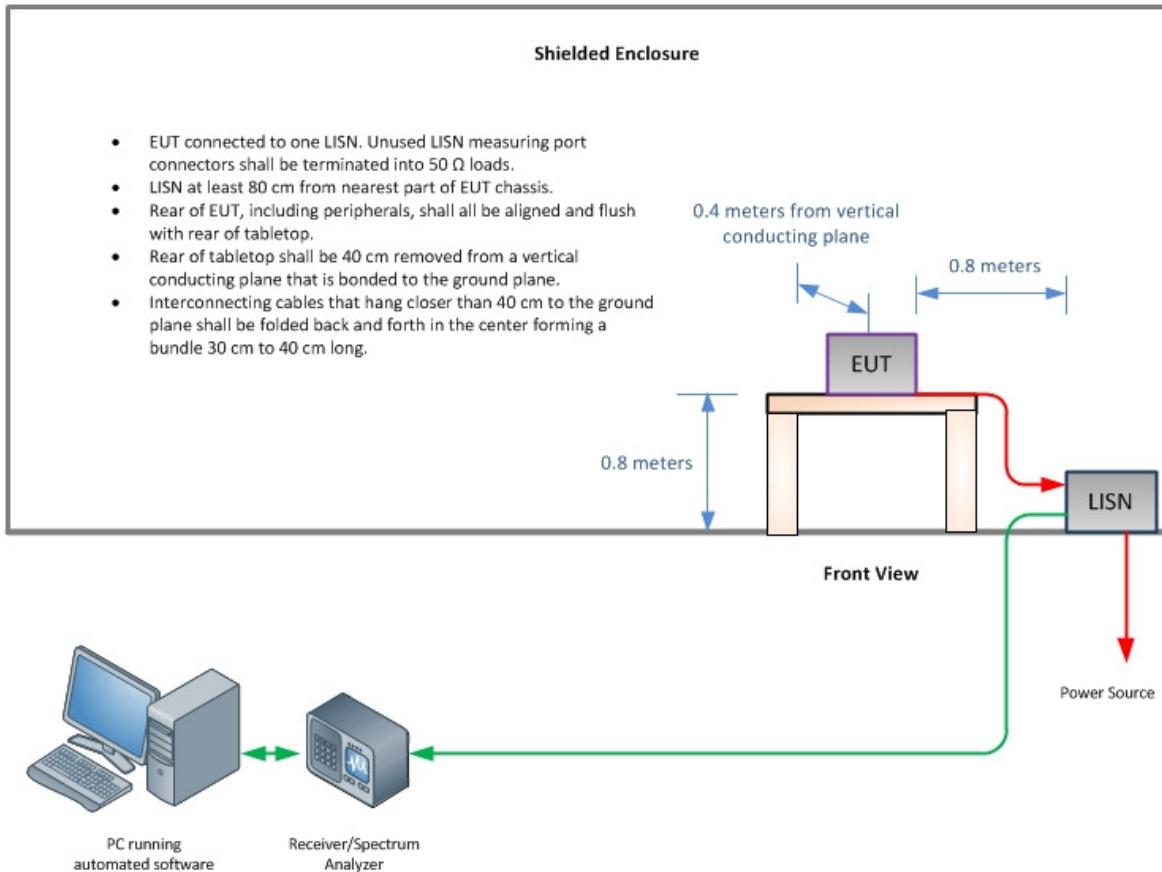
#### 4.1 RADIATED EMISSION TEST SETUP (BELOW 1GHZ)



#### 4.2 RADIATED EMISSION TEST SETUP (ABOVE 1GHZ)



#### 4.3 CONDUCTED EMISSION TEST SETUP





## SECTION 5

### ACCREDITATION, DISCLAIMERS AND COPYRIGHT



## 5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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