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# Report On

EMC Evaluation of  
Hughes Network Systems  
Thuraya IP+ Broadband Satellite IP Modem

FCC Part 15 Subpart B

**Report No. SC1410492A**

**November 2014**



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** Radio Testing of the  
Hughes Network Systems  
Thuraya IP+ Broadband Satellite IP Modem

**TEST REPORT NUMBER** SC1410492A

**PREPARED FOR** Hughes Network Systems  
9605 Scranton Road, Suite 500  
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**DATED** November 20, 2014



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## Revision History

| SC1410492A<br>Hughes Network Systems<br>Thuraya IP+ Broadband Satellite IP Modem |                 |              |        |                   |                    |
|----------------------------------------------------------------------------------|-----------------|--------------|--------|-------------------|--------------------|
| DATE                                                                             | OLD REVISION    | NEW REVISION | REASON | PAGES<br>AFFECTED | APPROVED BY        |
| 11/20/2014                                                                       | Initial Release |              |        |                   | Ferdinand Custodio |
|                                                                                  |                 |              |        |                   |                    |
|                                                                                  |                 |              |        |                   |                    |
|                                                                                  |                 |              |        |                   |                    |
|                                                                                  |                 |              |        |                   |                    |

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## **SECTION 1**

### **REPORT SUMMARY**

EMC Evaluation of the  
Hughes Network Systems  
Thuraya IP+ Broadband Satellite IP Modem



## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Thuraya IP+ Broadband Satellite IP Modem to the requirements of FCC Part 15 Subpart B.

|                                     |                                                                                                                                                        |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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                        | Hughes Network Systems                                                                                                                                 |
| Model Name                          | Thuraya IP+                                                                                                                                            |
| Model Number(s)                     | 9104                                                                                                                                                   |
| Serial Number(s)                    | EUT#3-EMC                                                                                                                                              |
| Number of Samples Tested            | 1                                                                                                                                                      |
| Highest Frequency Generated or Used | 2462 MHz                                                                                                                                               |
| Test Specification/Issue/Date       | FCC Part 15 Subpart B (October 1, 2013)                                                                                                                |
| Start of Test                       | October 30, 2014                                                                                                                                       |
| Finish of Test                      | October 31, 2014                                                                                                                                       |
| Name of Engineer(s)                 | Alex Chang                                                                                                                                             |
| Related Document(s)                 | None                                                                                                                                                   |



## 1.2 BRIEF SUMMARY OF RESULTS

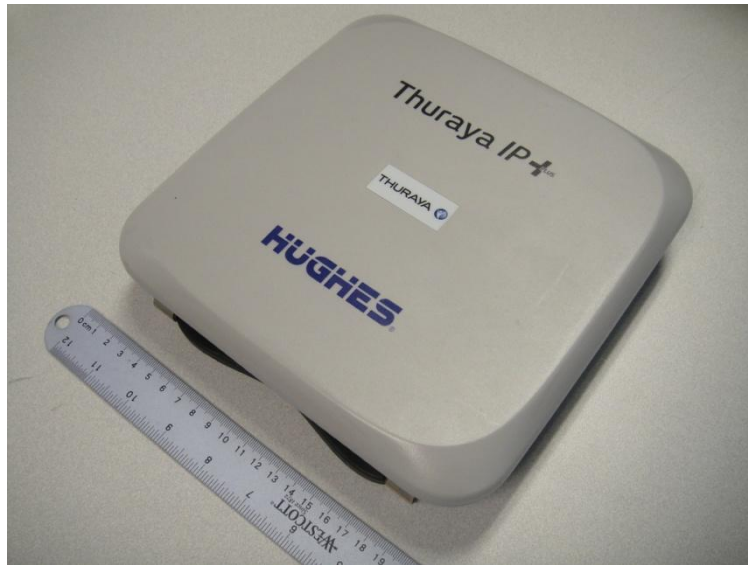
A brief summary of the tests carried out in accordance with FCC Part 15 Subpart B is shown below.

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

### 1.3 PRODUCT INFORMATION

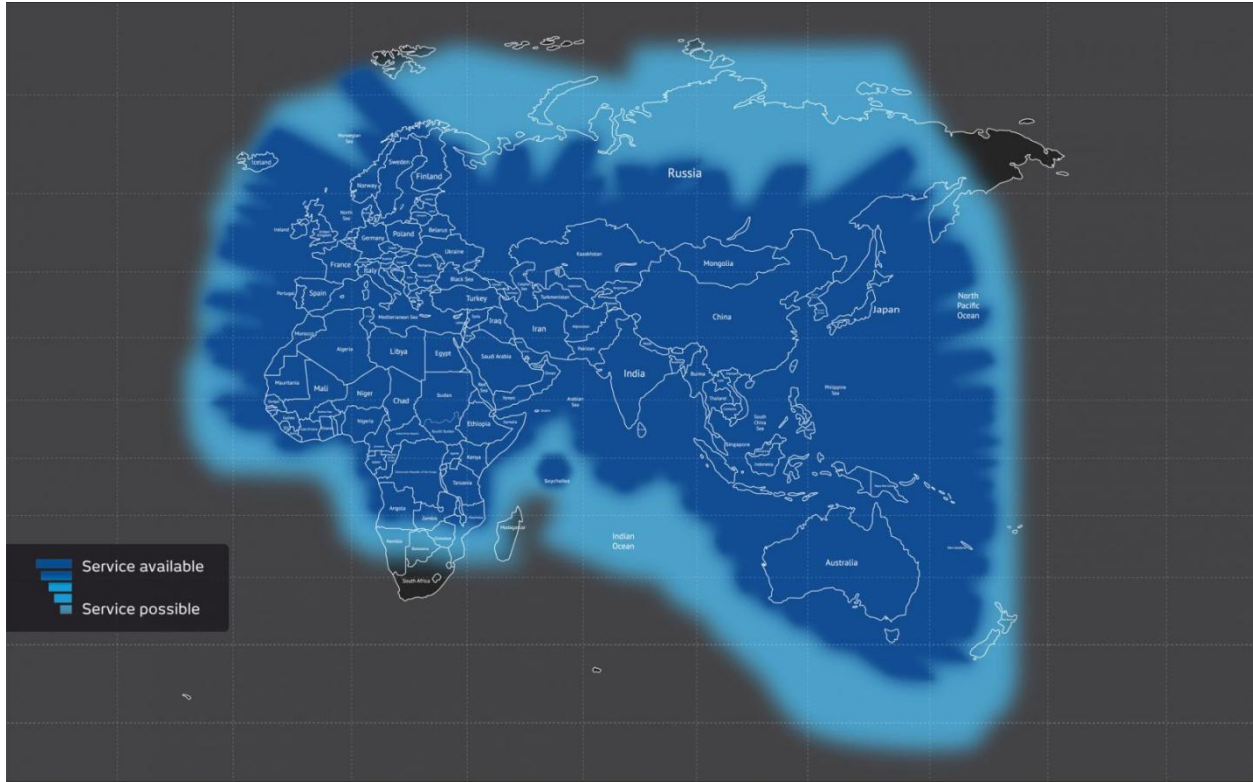
#### 1.3.1 Technical Description

The Equipment Under Test (EUT) was a Hughes Network Systems Thuraya IP+ Broadband Satellite IP Modem model 9104 as shown in the photograph below. The EUT is a broadband satellite IP modem and Wi-Fi Access Point. It is a self-contained communications system designed to provide users with IP network access via satellite. It can use Ethernet or Wi-Fi interfaces for network access. The 9104 allows you to simultaneously send and receive IP packet data via Ethernet and Wi-Fi interfaces over the Thuraya satellite network— see Section 1.3.2 for map coverage.



**Equipment Under Test**

### 1.3.2 Thuraya Satellite Coverage Map



### 1.3.3 Labelling Requirement for Part 15 (Verification) Device

See FCC Publication Number: 784748 for details:

<https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?id=27980&switch=P>

## 1.1 EUT TEST CONFIGURATION

### 1.1.1 Test Configuration Description

| Test Configuration | Description                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Default            | All radio of the EUT in standby (receive) mode. Satellite and GPS ports were in non active mode; no cable(s) or 50Ω termination connected during evaluation. |

### 1.1.2 EUT Exercise Software

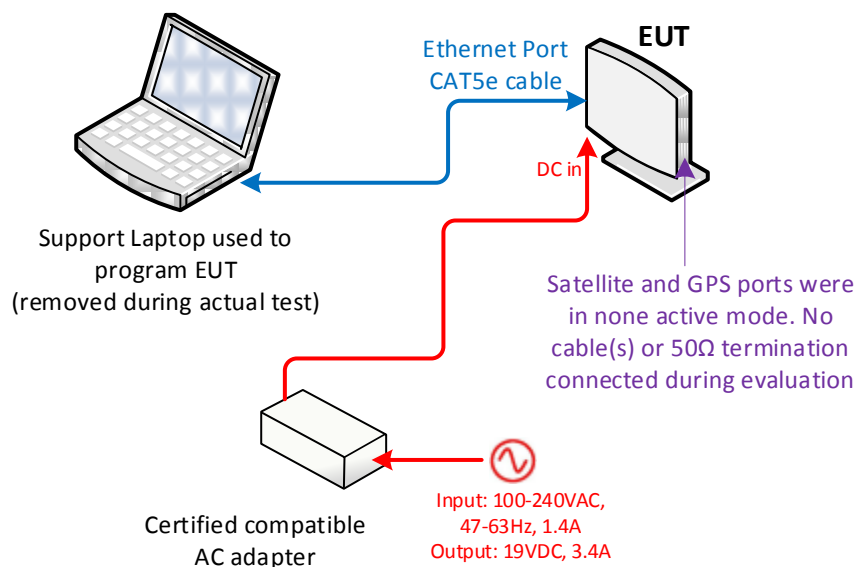
None. No special software used to exercise the EUT.

### 1.1.3 Support Equipment and I/O cables

| Manufacturer | Equipment/Cable       | Description                             |
|--------------|-----------------------|-----------------------------------------|
| Hughes       | AC Adapter for EUT    | Model: STD-1934PA                       |
| Toshiba      | Laptop                | Model Satellite Pro 4600 S/N 91225670PU |
| Toshiba      | Laptop External PSU   | Model PA3049U-1ACA S/N 0008A0184957G    |
| HP           | Mouse for Laptop      | Model M-UD43 S/N LZA03401471            |
| -            | CAT5e (Laptop to EUT) | 2.1m unshielded RJ45 connector          |

### 1.1.4 Simplified Test Configuration Diagram

#### Emission Test Setup



## 1.2 DEVIATIONS FROM THE STANDARD

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

## 1.3 MODIFICATION RECORD

| Description of Modification | Modification Fitted By | Date Modification Fitted |
|-----------------------------|------------------------|--------------------------|
| Serial Number: EUT#3-EMC    |                        |                          |
| N/A                         | —                      | —                        |

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.

## 1.4 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.

## 1.5 TEST FACILITY LOCATION

### 1.5.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 Fax: 858 546 0364.

### 1.5.2 TÜV SÜD America Inc. (Rancho Bernardo)

Sony Electronics Inc., Building #8, 16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 942 5542 Fax: 858 546 0364.

## 1.6 TEST FACILITY REGISTRATION

### 1.6.1 FCC – Registration No.: US1146

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.



**1.6.2 Industry Canada (IC) Registration No.: 3067A**

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

**1.6.3 BSMI – Laboratory Code: SL2-IN-E-028R (US0102)**

TUV Product Service Inc. (San Diego) is a recognized EMC testing laboratory by the BSMI under the MRA (Mutual Recognition Arrangement) with the United States. Accreditation includes CNS 13438 up to 6GHz.

**1.6.4 VCCI – Registration No. A-0132**

TUV SUD America Inc. (San Diego) is a VCCI registered measurement facility which includes radiated field strength measurement, radiated field strength measurement above 1GHz, mains port interference measurement and telecommunication port interference measurement.



## **SECTION 2**

### **TEST DETAILS**

EMC Evaluation of the  
Hughes Network Systems  
Thuraya IP+ Broadband Satellite IP Modem

## 2.1 CONDUCTED EMISSION

### 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: EUT#3-EMC / Default Test Configuration

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

October 31, 2014 / AC

### 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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

|                     |          |
|---------------------|----------|
| Ambient Temperature | 25.0 °C  |
| Relative Humidity   | 54.1 %   |
| ATM Pressure        | 99.0 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.

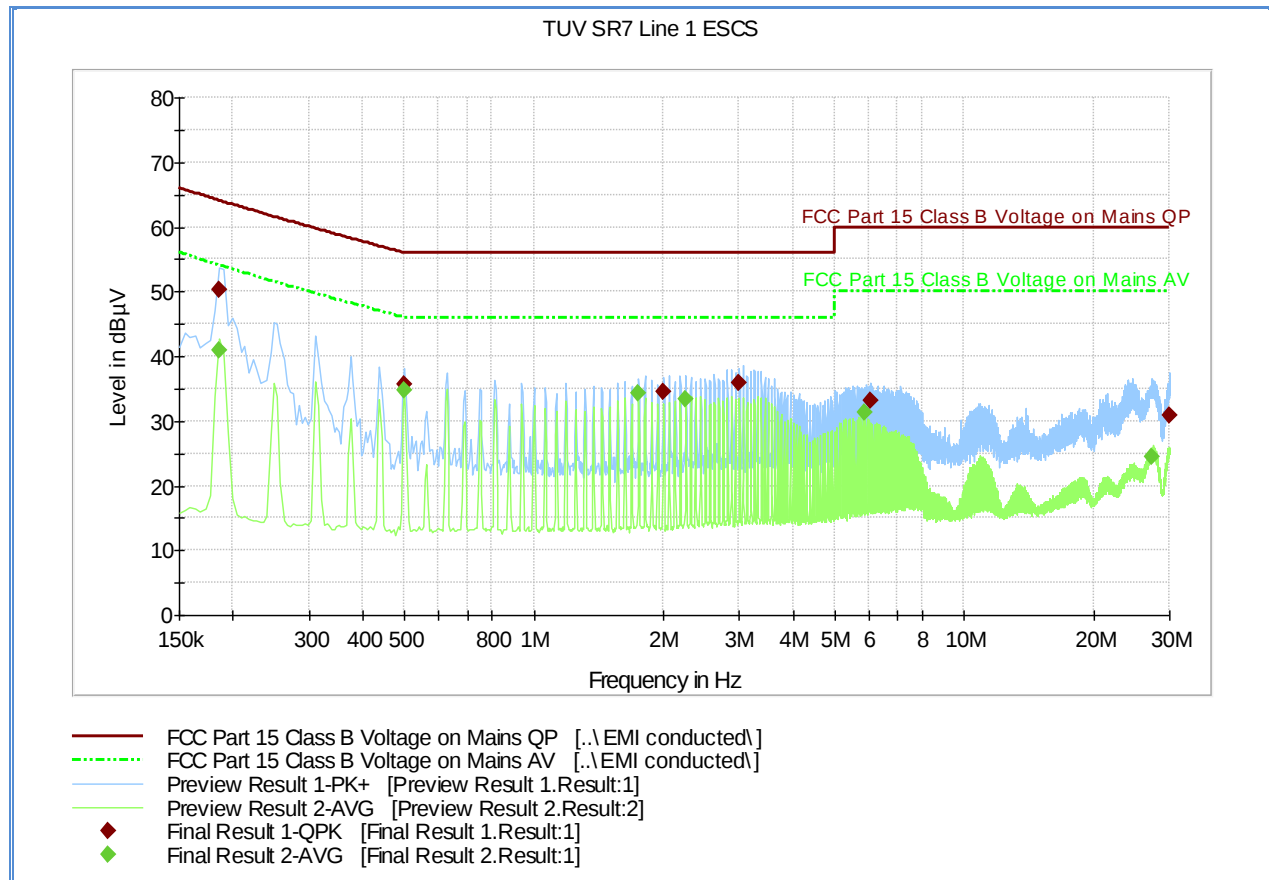
### 2.1.8 Sample Computation (Conducted Emission – Quasi Peak)

|                                                            |                                |      |      |
|------------------------------------------------------------|--------------------------------|------|------|
| 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 FCC Class B 120VAC 60Hz (Line 1)



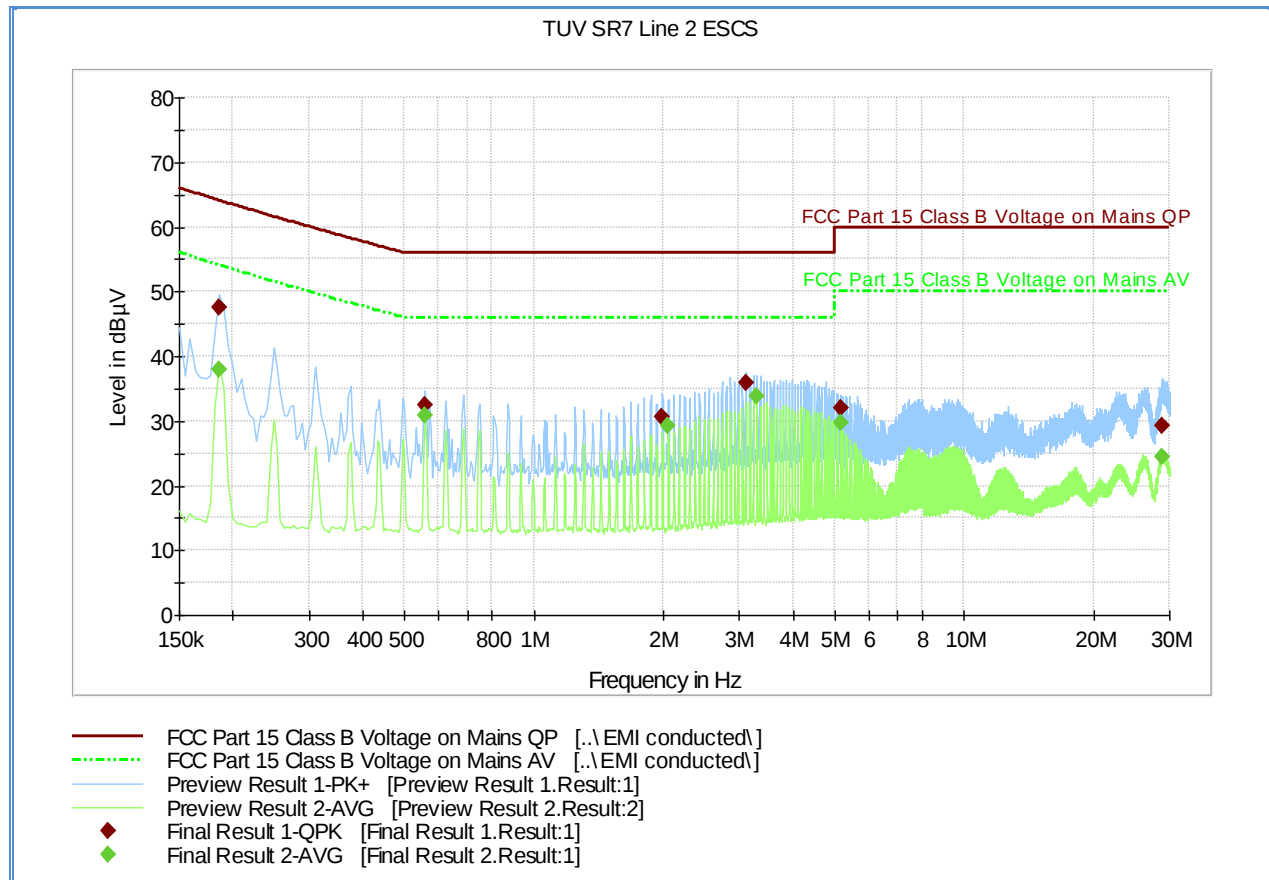
## Quasi Peak

| Frequency (MHz) | QuasiPeak (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin - QPK (dB) | Limit - QPK (dBµV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------------|--------------------|
| 0.186000        | 50.3             | 1000.0          | 9.000           | Off    | L1   | 20.1       | 13.7              | 64.1               |
| 0.501000        | 35.6             | 1000.0          | 9.000           | Off    | L1   | 20.0       | 20.4              | 56.0               |
| 1.995000        | 34.5             | 1000.0          | 9.000           | Off    | L1   | 20.2       | 21.5              | 56.0               |
| 2.994000        | 35.8             | 1000.0          | 9.000           | Off    | L1   | 20.4       | 20.2              | 56.0               |
| 6.045000        | 33.0             | 1000.0          | 9.000           | Off    | L1   | 20.6       | 27.0              | 60.0               |
| 29.922000       | 30.8             | 1000.0          | 9.000           | Off    | L1   | 21.0       | 29.2              | 60.0               |

## Average

| Frequency (MHz) | Average (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin - Ave (dB) | Limit - Ave (dBµV) |
|-----------------|----------------|-----------------|-----------------|--------|------|------------|-------------------|--------------------|
| 0.186000        | 41.0           | 1000.0          | 9.000           | Off    | L1   | 20.1       | 13.0              | 54.1               |
| 0.501000        | 34.8           | 1000.0          | 9.000           | Off    | L1   | 20.0       | 11.2              | 46.0               |
| 1.747500        | 34.2           | 1000.0          | 9.000           | Off    | L1   | 20.1       | 11.8              | 46.0               |
| 2.247000        | 33.3           | 1000.0          | 9.000           | Off    | L1   | 20.4       | 12.7              | 46.0               |
| 5.860500        | 31.3           | 1000.0          | 9.000           | Off    | L1   | 20.6       | 18.7              | 50.0               |
| 27.357000       | 24.5           | 1000.0          | 9.000           | Off    | L1   | 20.9       | 25.5              | 50.0               |

## 2.1.11 FCC Class B 120VAC 60Hz (Line 2)



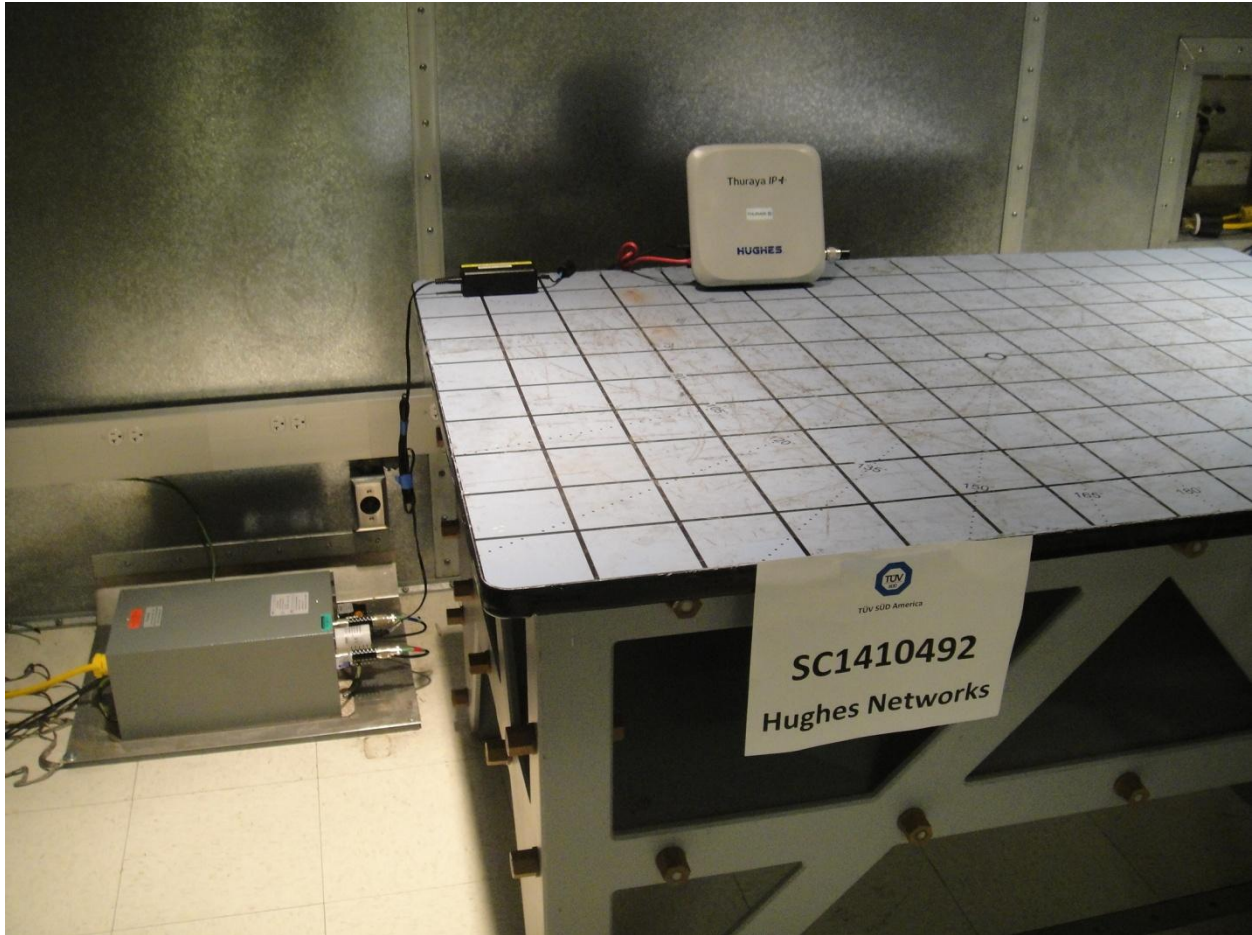
## Quasi Peak

| Frequency (MHz) | QuasiPeak (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin - QPK (dB) | Limit - QPK (dBµV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------------|--------------------|
| 0.186000        | 47.6             | 1000.0          | 9.000           | Off    | N    | 20.1       | 16.5              | 64.1               |
| 0.559500        | 32.4             | 1000.0          | 9.000           | Off    | N    | 20.0       | 23.6              | 56.0               |
| 1.990500        | 30.7             | 1000.0          | 9.000           | Off    | N    | 20.1       | 25.3              | 56.0               |
| 3.106500        | 35.8             | 1000.0          | 9.000           | Off    | N    | 20.4       | 20.2              | 56.0               |
| 5.154000        | 32.1             | 1000.0          | 9.000           | Off    | N    | 20.5       | 27.9              | 60.0               |
| 28.900500       | 29.3             | 1000.0          | 9.000           | Off    | N    | 20.8       | 30.7              | 60.0               |

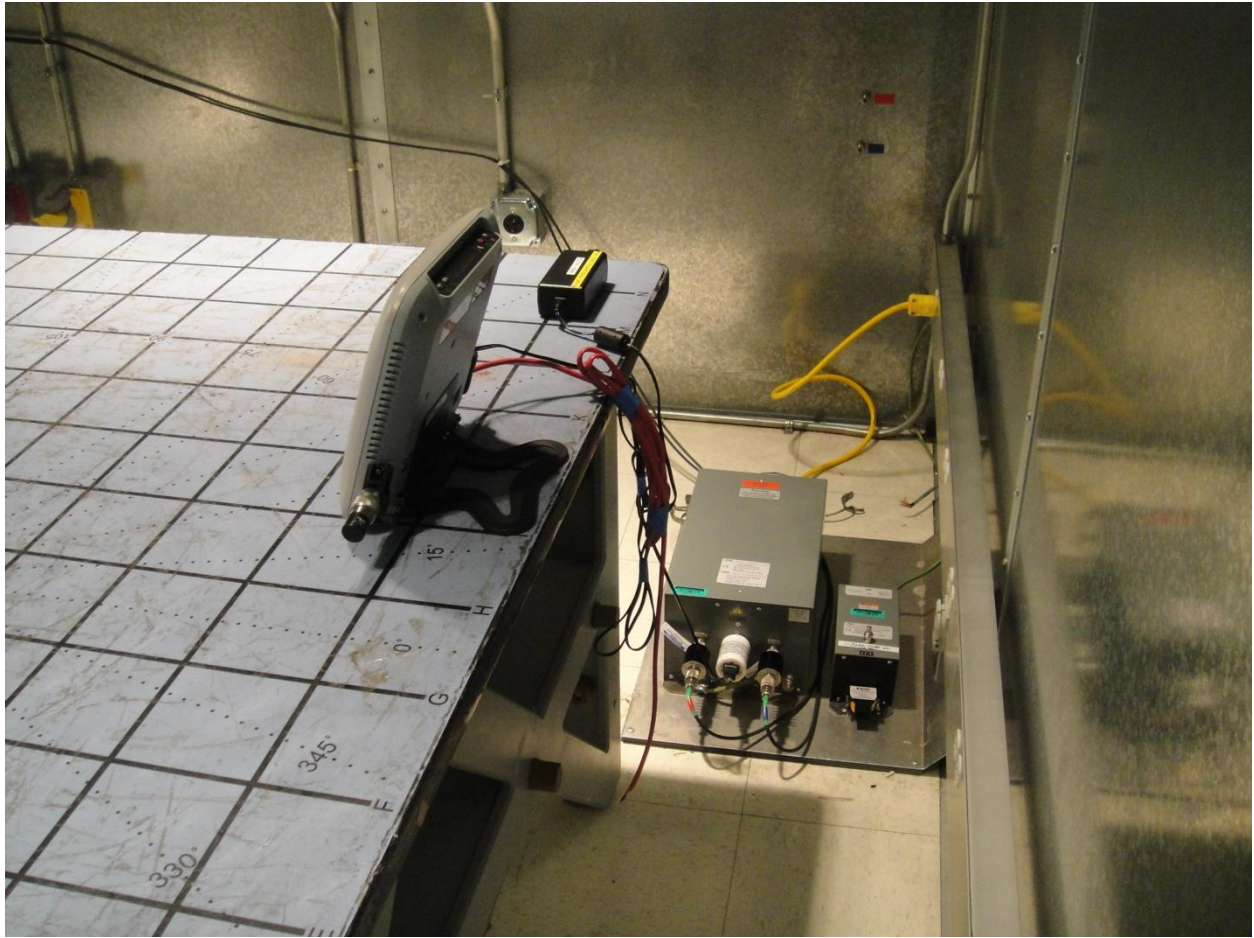
## Average

| Frequency (MHz) | Average (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin - Ave (dB) | Limit - Ave (dBµV) |
|-----------------|----------------|-----------------|-----------------|--------|------|------------|-------------------|--------------------|
| 0.186000        | 37.9           | 1000.0          | 9.000           | Off    | N    | 20.1       | 16.2              | 54.1               |
| 0.559500        | 30.9           | 1000.0          | 9.000           | Off    | N    | 20.0       | 15.1              | 46.0               |
| 2.049000        | 29.3           | 1000.0          | 9.000           | Off    | N    | 20.2       | 16.7              | 46.0               |
| 3.291000        | 33.8           | 1000.0          | 9.000           | Off    | N    | 20.3       | 12.2              | 46.0               |
| 5.154000        | 29.7           | 1000.0          | 9.000           | Off    | N    | 20.5       | 20.3              | 50.0               |
| 28.806000       | 24.4           | 1000.0          | 9.000           | Off    | N    | 20.8       | 25.6              | 50.0               |

**2.1.12 Test Setup Photo (Front)**



**2.1.13 Test Setup Photo (Back)**



## 2.2 RADIATED EMISSION

### 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: EUT#3-EMC / Default Test Configuration

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

October 30, 2014 / AC

### 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

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

|                     |          |
|---------------------|----------|
| Ambient Temperature | 23.1 °C  |
| Relative Humidity   | 45.8 %   |
| ATM Pressure        | 99.3 kPa |

### 2.2.7 Additional Observations

- The spectrum was searched from 30MHz to the 5<sup>th</sup> harmonic (12.5GHz, up to 18GHz presented) and verified to Class B limits.
- Verification was performed at 3 meters.
- 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.

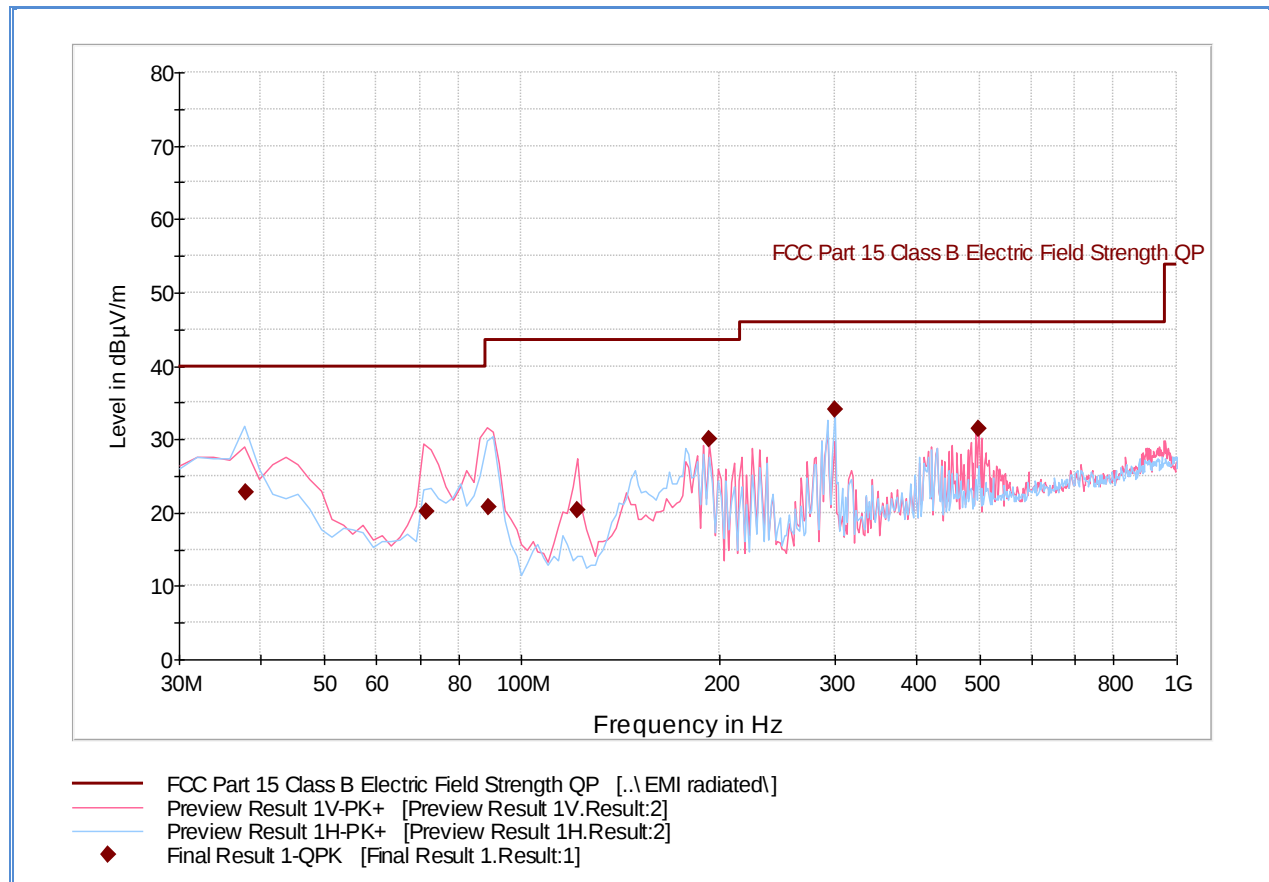
### 2.2.8 Sample Computation (Radiated Emission)

|                                                             |                            |       |       |
|-------------------------------------------------------------|----------------------------|-------|-------|
| 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  |       |
| Reported QuasiPeak Final Measurement (db $\mu$ V/m) @ 30MHz |                            |       | 11.8  |

### 2.2.9 Test Results

See attached plots.

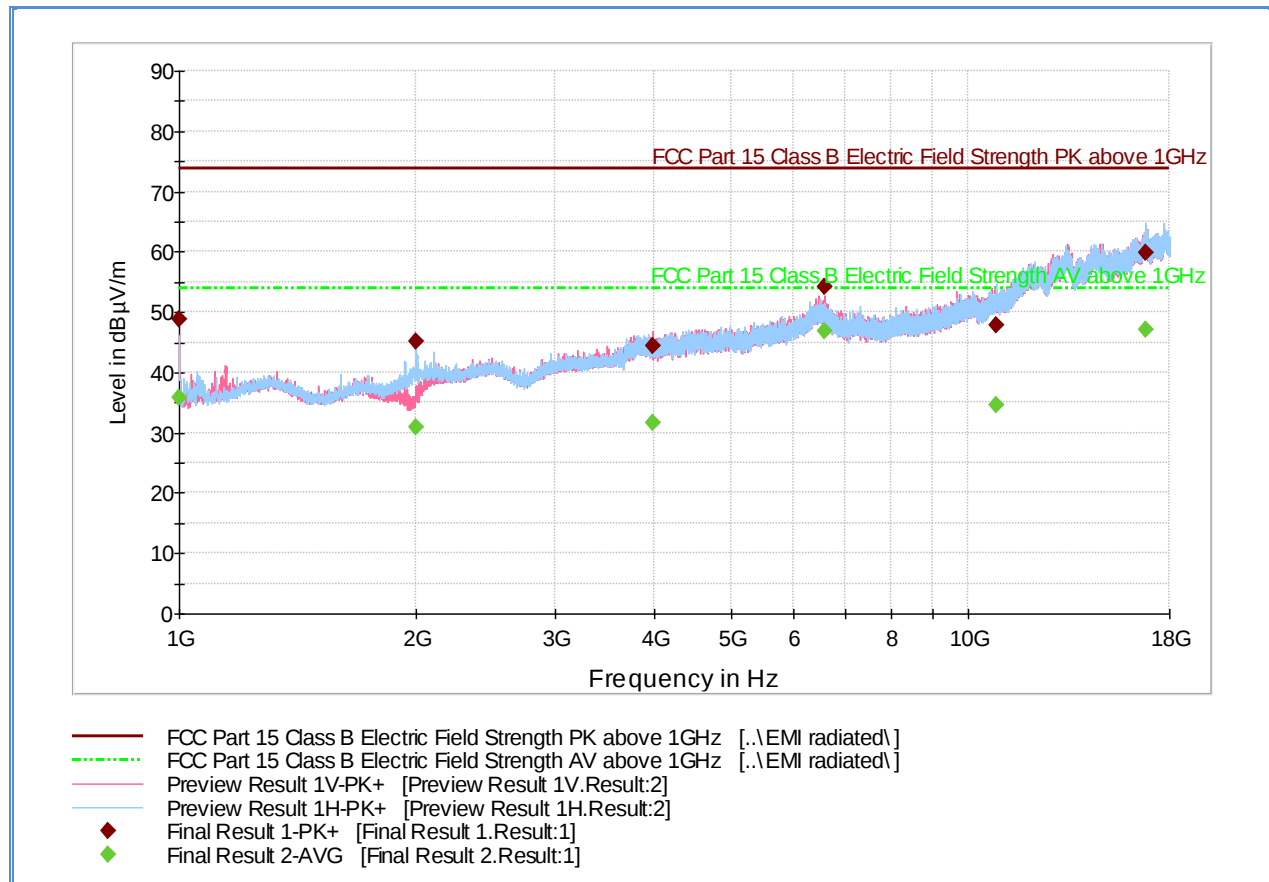
## 2.2.10 Below 1GHz Radiated Emission Test



### 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) |
|-----------------|--------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 37.815551       | 22.8               | 1000.0          | 120.000         | 400.0       | H            | 0.0           | -14.7      | 17.2        | 40.0           |
| 71.661643       | 20.2               | 1000.0          | 120.000         | 116.0       | V            | 228.0         | -21.4      | 19.8        | 40.0           |
| 88.820521       | 20.7               | 1000.0          | 120.000         | 100.0       | V            | -4.0          | -20.1      | 22.8        | 43.5           |
| 121.282725      | 20.4               | 1000.0          | 120.000         | 100.0       | V            | -11.0         | -19.5      | 23.1        | 43.5           |
| 192.846573      | 30.1               | 1000.0          | 120.000         | 100.0       | V            | 134.0         | -15.4      | 13.4        | 43.5           |
| 300.000401      | 34.0               | 1000.0          | 120.000         | 100.0       | H            | -7.0          | -11.2      | 12.0        | 46.0           |
| 497.636954      | 31.5               | 1000.0          | 120.000         | 100.0       | V            | 171.0         | -6.0       | 14.5        | 46.0           |

## 2.2.11 Above 1GHz Radiated Emission Test



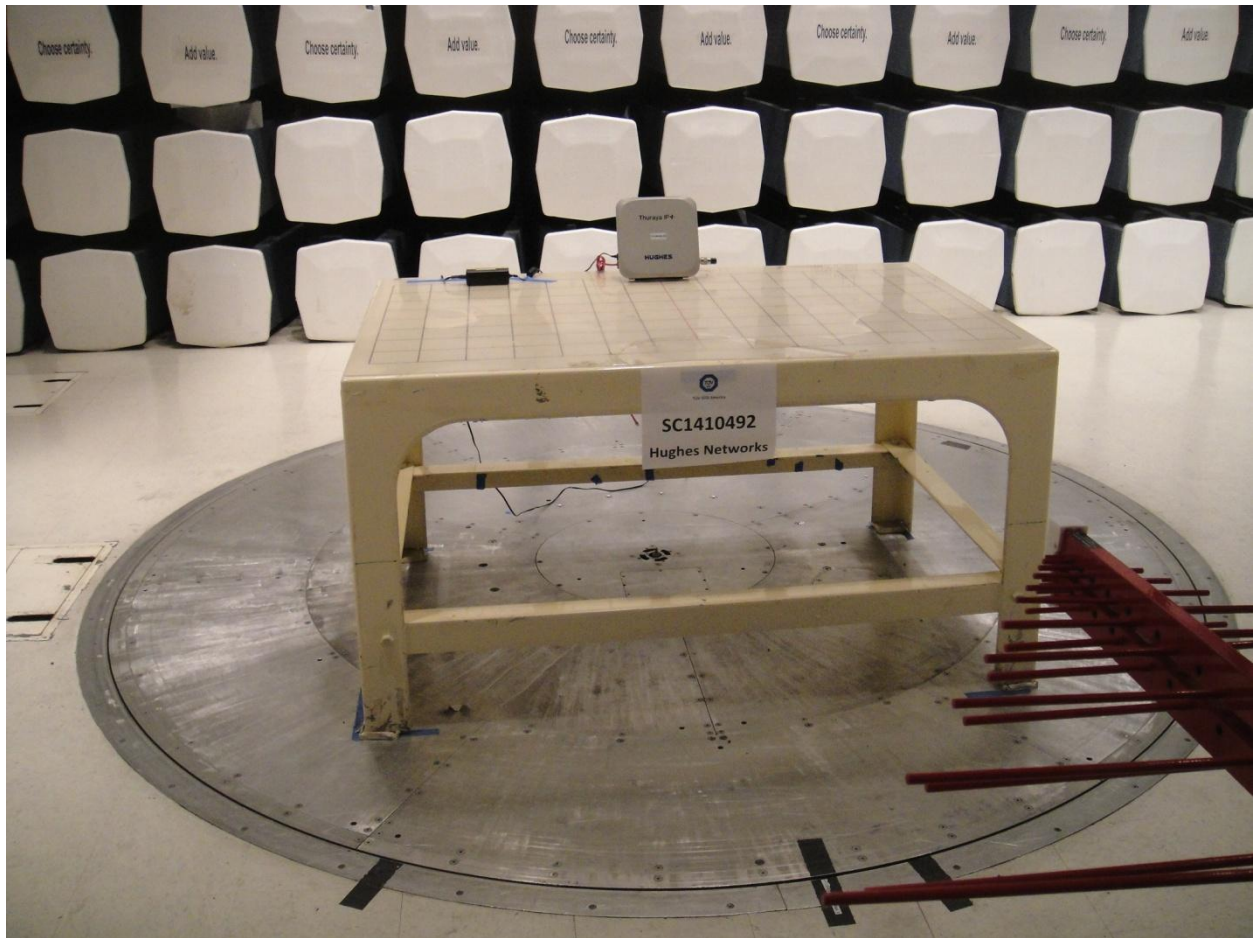
### Peak Data

| Frequency (MHz) | Max Peak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|-------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 1000.000000     | 48.8              | 1000.0          | 1000.000        | 178.6       | V            | 46.0          | -7.0       | 25.1        | 73.9           |
| 1999.233333     | 45.2              | 1000.0          | 1000.000        | 301.2       | H            | 50.0          | -1.0       | 28.7        | 73.9           |
| 3977.266667     | 44.4              | 1000.0          | 1000.000        | 333.1       | V            | 329.0         | 5.9        | 29.5        | 73.9           |
| 6565.433333     | 54.1              | 1000.0          | 1000.000        | 346.1       | V            | 155.0         | 12.8       | 19.8        | 73.9           |
| 10876.233333    | 47.9              | 1000.0          | 1000.000        | 302.2       | H            | 239.0         | 16.7       | 26.0        | 73.9           |
| 16777.666666    | 59.9              | 1000.0          | 1000.000        | 355.1       | H            | 20.0          | 25.9       | 14.0        | 73.9           |

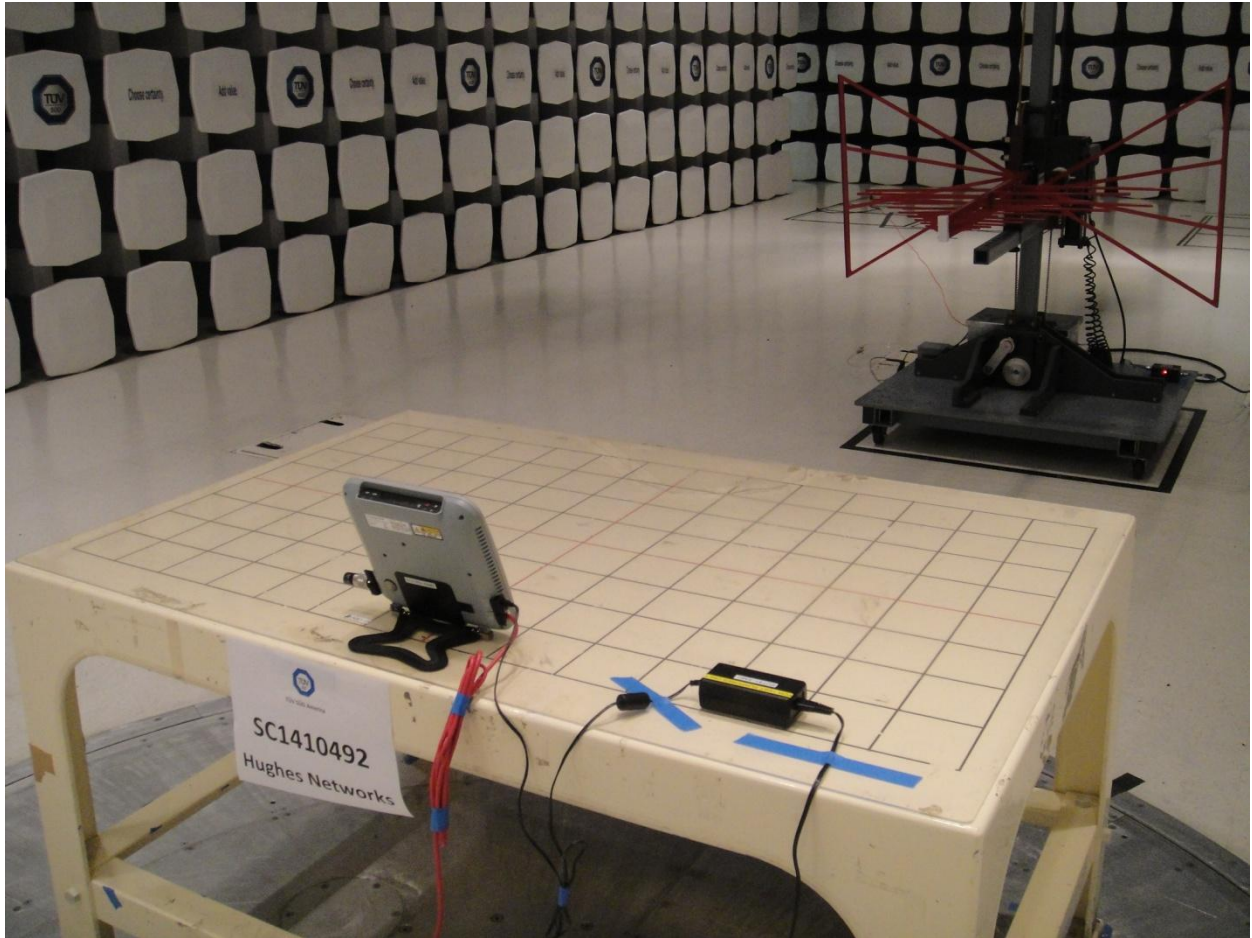
### Average Data

| Frequency (MHz) | Average (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 1000.000000     | 35.7             | 1000.0          | 1000.000        | 178.6       | V            | 46.0          | -7.0       | 18.2        | 53.9           |
| 1999.233333     | 30.8             | 1000.0          | 1000.000        | 301.2       | H            | 50.0          | -1.0       | 23.1        | 53.9           |
| 3977.266667     | 31.7             | 1000.0          | 1000.000        | 333.1       | V            | 329.0         | 5.9        | 22.2        | 53.9           |
| 6565.433333     | 46.8             | 1000.0          | 1000.000        | 346.1       | V            | 155.0         | 12.8       | 7.1         | 53.9           |
| 10876.233333    | 34.7             | 1000.0          | 1000.000        | 302.2       | H            | 239.0         | 16.7       | 19.2        | 53.9           |
| 16777.666666    | 47.1             | 1000.0          | 1000.000        | 355.1       | H            | 20.0          | 25.9       | 6.8         | 53.9           |

### 2.2.12 Test Setup Photo (Below 1GHz Front)



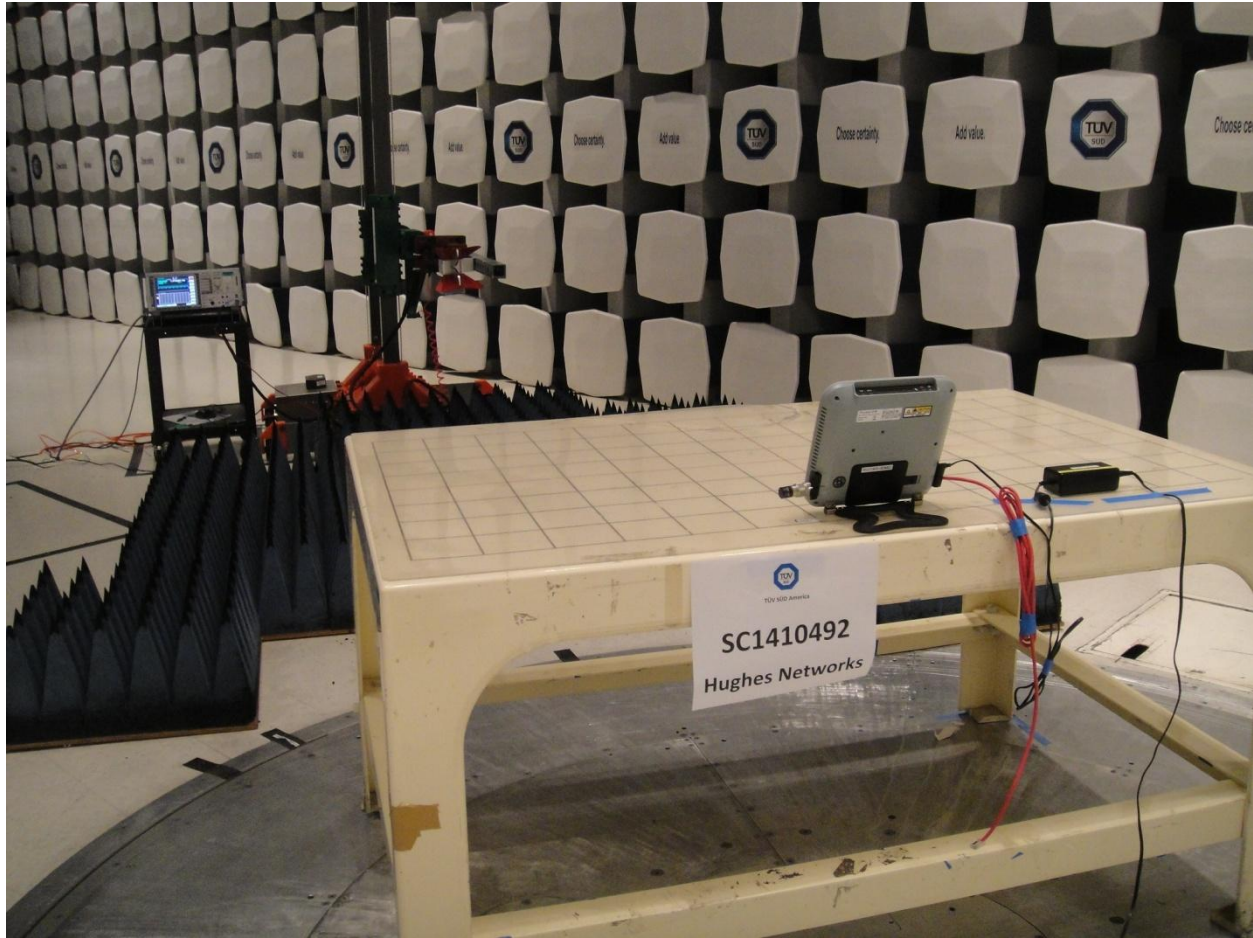
### 2.2.13 Test Setup Photo (Below 1GHz Back)



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



### 2.2.15 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      |                                             |                     |               |                            |          |              |
| 1024                     | EMI Test Receiver                           | ESCS 30             | 847793/001    | Rhode & Schwarz            | 04/05/14 | 04/05/15     |
| 7568                     | LISN                                        | FCC-LISN-50-25-2-10 | 120305        | Fischer Custom Comm.       | 09/02/14 | 09/02/15     |
| 8822                     | 20dB Attenuator                             | 34-20-34            | N/A           | MCE / Weinschel            | 01/30/14 | 01/30/15     |
| 8824                     | 20dB Attenuator                             | 34-20-34            | N/A           | MCE / Weinschel            | 01/30/14 | 01/30/15     |
| Radiated Emissions       |                                             |                     |               |                            |          |              |
| 1040                     | EMI Test Receiver                           | ESIB40              | 100292        | Rhode & Schwarz            | 08/29/14 | 08/29/15     |
| 1002                     | Bilog Antenna                               | 3142C               | 00058717      | ETS-Lindgren               | 01/30/14 | 01/30/16     |
| 1016                     | Pre-amplifier                               | PAM-0202            | 187           | PAM                        | 05/05/14 | 05/05/15     |
| 7575                     | Double-ridged waveguide horn antenna        | 3117                | 00155511      | EMCO                       | 04/08/14 | 04/08/15     |
| 8628                     | Pre-amplifier                               | QLJ 01182835-JO     | 8986002       | QuinStar Technologies Inc. | 04/03/14 | 04/03/15     |
| 1049                     | EMI Test Receiver                           | ESU                 | 100133        | Rhode & Schwarz            | 03/17/14 | 03/17/15     |
| Miscellaneous            |                                             |                     |               |                            |          |              |
| 7560                     | Barometer/Temperature /Humidity Transmitter | iBTHX-W             | 1240476       | Omega                      | 01/30/14 | 01/30/15     |
|                          | Test Software                               | EMC32               | V8.53         | 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 Conducted Emissions Measurement

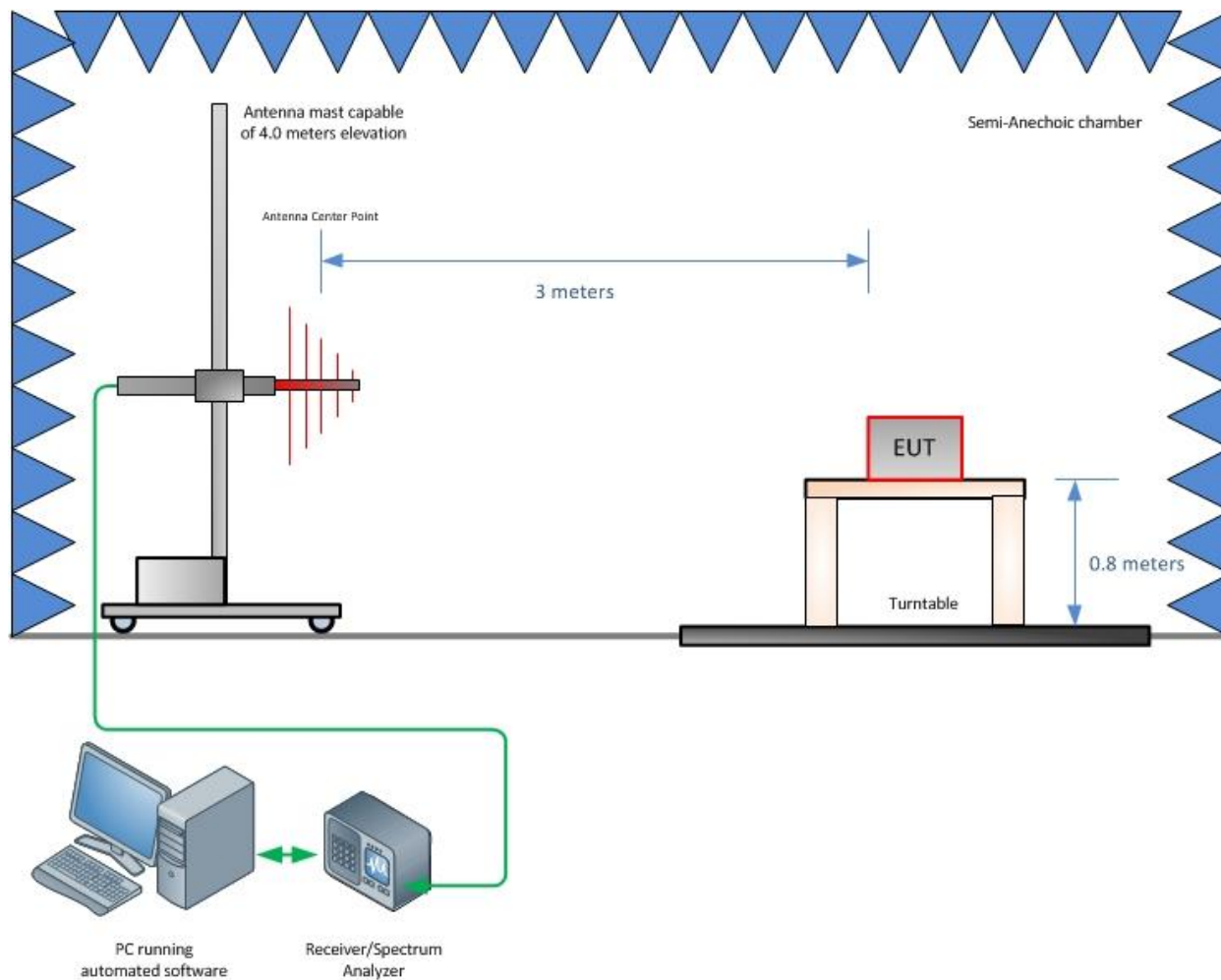
| Contribution                    |                            | Probability Distribution Type | Probability Distribution $x_i$ | Standard Uncertainty $u(x_i)$ | $[u(x_i)]^2$ |
|---------------------------------|----------------------------|-------------------------------|--------------------------------|-------------------------------|--------------|
| 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         |
|                                 | Attenuator                 | Rectangular                   | 0.30                           | 0.17                          | 0.03         |
| Combined Uncertainty ( $u_c$ ): |                            |                               |                                |                               | 0.80         |
| Coverage Factor (k):            |                            |                               |                                |                               | 2            |
| Expanded Uncertainty:           |                            |                               |                                |                               | 1.59         |



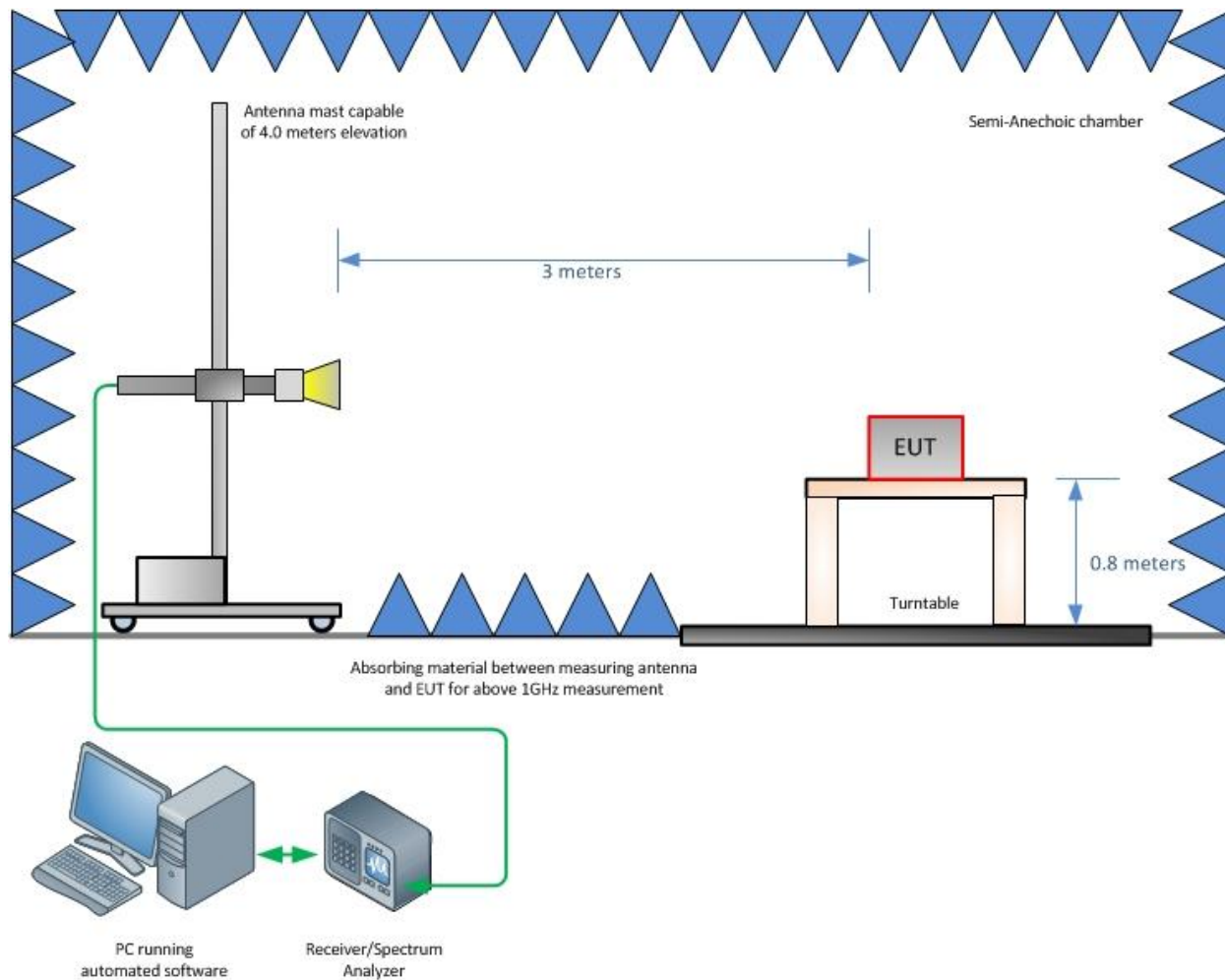
## **SECTION 4**

### **DIAGRAM OF TEST SETUP**

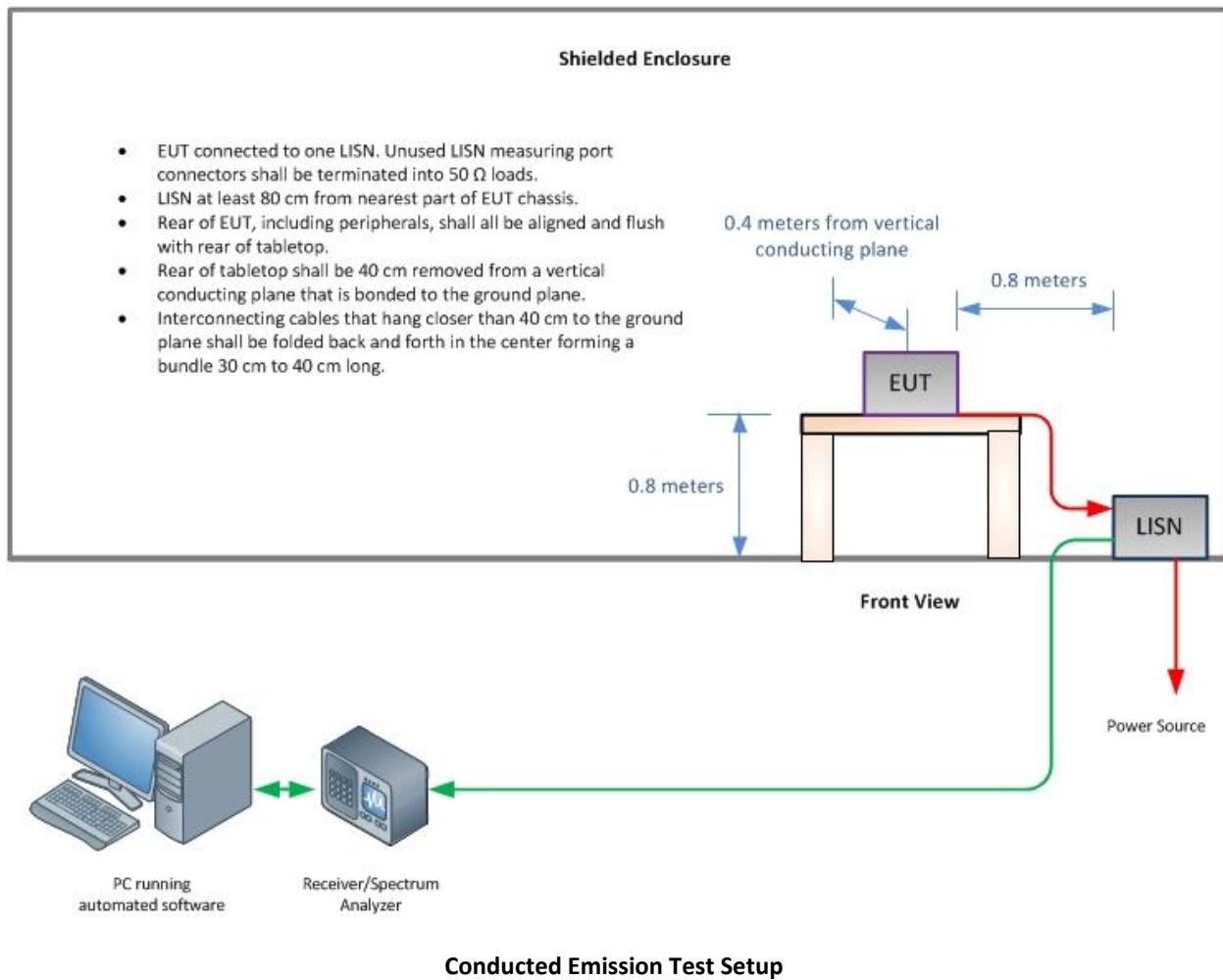
#### 4.1 TEST SETUP DIAGRAM



**Radiated Emission Test Setup (Below 1GHz)**



**Radiated Emission Test Setup (Above 1GHz)**





## **SECTION 5**

### **ACCREDITATION, DISCLAIMERS AND COPYRIGHT**



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