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## Report On

Application for Grant of Equipment Authorization of the  
IPS Group Inc.

MSCM Multiple Space Parking Meter Controller Module

FCC Part 15 Subpart C §15.231

IC RSS-Gen and RSS-210 Issue 8 December 2010

**Report No. SC1401258A**

**April 2014**



|                           |                                                                                                                                                                               |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>REPORT ON</b>          | Radio Testing of the<br>IPS Group Inc.<br>Multiple Space Parking Meter Controller Module                                                                                      |
| <b>TEST REPORT NUMBER</b> | SC1401258A                                                                                                                                                                    |
| <b>PREPARED FOR</b>       | IPS Group Inc.<br>5601 Oberlin Drive<br>San Diego, CA 92121                                                                                                                   |
| <b>CONTACT PERSON</b>     | Gary Thomas<br>Sr. RF Design Engineer<br>(858) 768-2401 ext. 211<br>gary.thomas@ipsgroupinc.com                                                                               |
| <b>PREPARED BY</b>        | <br>Alex Chang<br><b>Name</b><br>Authorized Signatory<br>Title: EMC/Wireless Test Engineer   |
| <b>APPROVED BY</b>        | <br>Chip R. Fleury<br><b>Name</b><br>Authorized Signatory<br>Title: West Coast EMC Manager |
| <b>DATED</b>              | April 15, 2014                                                                                                                                                                |



## Revision History

| SC1401258A<br>IPS Group Inc.<br>MSCM<br>Multiple Space Parking Meter Controller Module |                 |              |        |                   |                |
|----------------------------------------------------------------------------------------|-----------------|--------------|--------|-------------------|----------------|
| DATE                                                                                   | OLD REVISION    | NEW REVISION | REASON | PAGES<br>AFFECTED | APPROVED BY    |
| 04/15/2014                                                                             | Initial Release |              |        |                   | Chip R. Fleury |
|                                                                                        |                 |              |        |                   |                |
|                                                                                        |                 |              |        |                   |                |
|                                                                                        |                 |              |        |                   |                |
|                                                                                        |                 |              |        |                   |                |

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## **SECTION 1**

### **REPORT SUMMARY**

Radio Testing of the  
IPS Group Inc.  
Multiple Space Parking Meter Controller Module



## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the IPS Group Inc. MSCM Multiple Space Parking Meter Controller Module to the requirements of the following:

- FCC Part 15 Subpart C §15.231
- IC RSS-Gen and RSS-210 Issue 8 December 2010.

|                               |                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Objective                     | To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.                                                                                                                                                                                                   |
| Manufacturer                  | IPS Group Inc.                                                                                                                                                                                                                                                                                                                                          |
| Model Number(s)               | M800                                                                                                                                                                                                                                                                                                                                                    |
| FCC ID Number                 | SGWIPS2010M800                                                                                                                                                                                                                                                                                                                                          |
| IC Number                     | 11583A-IPS2010M800                                                                                                                                                                                                                                                                                                                                      |
| Serial Number(s)              | N/A                                                                                                                                                                                                                                                                                                                                                     |
| Number of Samples Tested      | 3                                                                                                                                                                                                                                                                                                                                                       |
| Test Specification/Issue/Date | <ul style="list-style-type: none"><li>• FCC Part 15 Subpart C §15.231 (October 1, 2013).</li><li>• RSS-210 - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (Issue 8, December 2010).</li><li>• RSS-Gen - General Requirements and Information for the Certification of Radio Apparatus (Issue 3, December 2010).</li></ul> |
| Start of Test                 | February 19, 2014                                                                                                                                                                                                                                                                                                                                       |
| Finish of Test                | February 21, 2014                                                                                                                                                                                                                                                                                                                                       |
| Name of Engineer(s)           | Alex Chang                                                                                                                                                                                                                                                                                                                                              |
| Related Document(s)           | None. Supporting documents for EUT certification are separate exhibits.                                                                                                                                                                                                                                                                                 |



## 1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart C §15.231 with cross-reference to the corresponding IC RSS standard is shown below.

| Section | §15.231 Spec Clause | RSS               | Test Description                                                                                                                            | Result    | Comments/<br>Base Standard |
|---------|---------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------------------|
| 2.1     | §15.207 (a)         | RSS-Gen 7.2.4     | Conducted Emissions                                                                                                                         | N/A *     |                            |
| 2.2     | §15.231(a)(2)       | RSS-210 A1.1.1(b) | Transmission Verification For Transmitter Activated Automatically                                                                           | N/A **    |                            |
| 2.3     | §15.231(a)(3)       | —                 | Polling Or Supervision Transmissions, Including Data, To Determine System Integrity Of Transmitters Used In Security Or Safety Applications | Compliant |                            |
| 2.3     | §15.231(e)          | RSS-210 A1.1.2    | Field Strength Of Emissions                                                                                                                 | Compliant |                            |
| 2.4     | §15.231(c)          | RSS-210 A1.1.3    | Bandwidth Requirement                                                                                                                       | Compliant |                            |
| 2.5     | —                   | RSS-Gen 6.0       | Receiver Spurious Emissions                                                                                                                 | Compliant |                            |

\* Not applicable. EUT is battery operated device.

\*\* EUT is a transmitter that activates automatically, however provisions of §15.231(a)(3) applies.

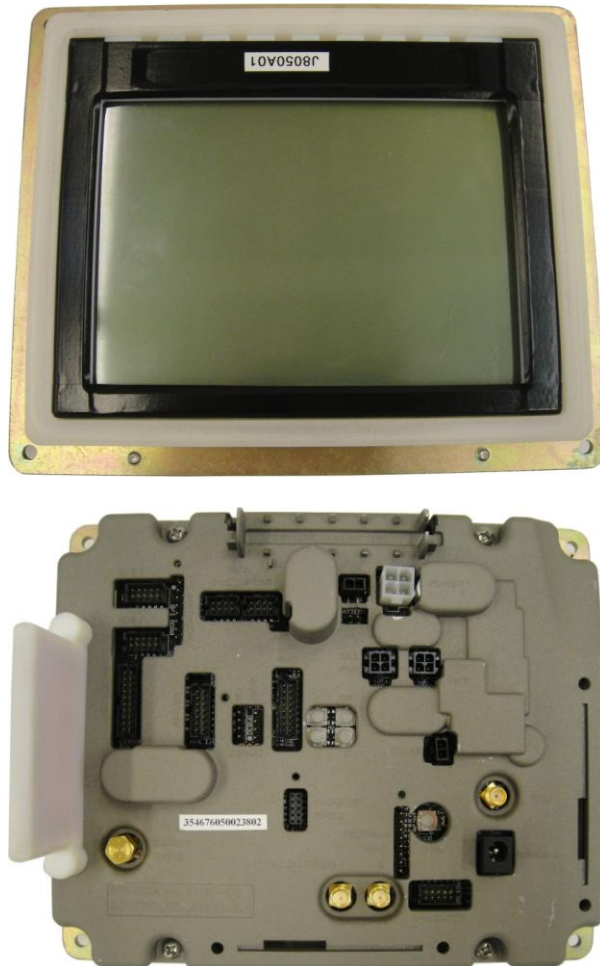
### 1.3 PRODUCT INFORMATION

#### 1.3.1 EUT General Description

The Equipment Under Test (EUT) was an IPS Group Inc. MSCM Multiple Space Parking Meter Controller Module as shown in the photograph below. This controller module is intended to be used across a number of IPS Multi Space Parking Meter platforms. These platforms include IPS designed multi space parking terminals as well as a number of existing designs that can be upgraded and retrofitted with this IPS technology. Parking terminals equipped with the MSCM may be configured as Pay and Display, Pay by Space, Pay by Plate and other configurations.

The MSCM consist of a large LCD display and a controller section enclosed in a protective mechanical housing. The controller PCBA supports a number of integrated features and interfaces to a number of optional peripheral units.

ISM/SRD 400 MHz band transmission Low, Mid, and High channels were verified in this test report.



**Equipment Under Test**



### 1.3.2 EUT General Description

EUT Description MSCM Multiple Space Parking Meter Controller Module

Model Number(s) M800

Rated Voltage External Battery Pack 3.7 VDC (Nominal).

Mode Verified 400 MHz Transmit Mode

| Capability | Item                     | Description                        |
|------------|--------------------------|------------------------------------|
|            | 2G Bands                 | GSM 850, GSM 900, DCS1800, PCS1900 |
|            | 3G Bands                 | FDD B2, B4, and B5                 |
|            | RFID                     | 13.56 MHz                          |
|            | ISM/SRD Band Transceiver | 400 MHz                            |

Primary Unit (EUT)

☐ Production

☒ Pre-Production

☐ Engineering

|                              |                     |                         |
|------------------------------|---------------------|-------------------------|
| Antenna Detail Specification | <b>Manufacturer</b> | RETECH                  |
|                              | <b>Model</b>        | RHA-601                 |
|                              | <b>Type</b>         | SMA-Female (Rubber Pad) |
|                              | <b>Frequency</b>    | 144/430 MHz             |
|                              | <b>Gain</b>         | 0dBi                    |
|                              | <b>Max. Power</b>   | 10 Watts                |
|                              | <b>Length</b>       | 45mm                    |
|                              | <b>V.S.W.R</b>      | Less 1.5                |
|                              | <b>Weight</b>       | 12g                     |

### 1.3.3 Maximum Radiated Output Power

| Transmitter Frequency (MHz) | Field Strength (dBμV/m @ 3 meters) | Part 15.231(e) limits in dBμV/m |
|-----------------------------|------------------------------------|---------------------------------|
|                             | FSK modulation                     |                                 |
| 410                         | 75.7                               | 79.5                            |
| <b>420</b>                  | <b>76.9</b>                        | <b>80.0</b>                     |
| 430                         | 75.8                               | 80.4                            |

## 1.4 EUT TEST CONFIGURATION

### 1.4.1 Test Configuration Description

| Test Configuration | Description                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------|
| A                  | Radiated emission test configuration. Measurement was performed while EUT configured in continuously transmission mode.      |
| B                  | Antenna conducted port test configuration. Measurement was performed while EUT configured in continuously transmission mode. |
| C                  | Antenna conducted port test configuration. Measurement was performed while EUT configured in normal transmission mode.       |

### 1.4.2 EUT Exercise Software

None. No special software was used to exercise the EUT. The EUT with built-in firmware revision 42.60.9 used during the investigation.

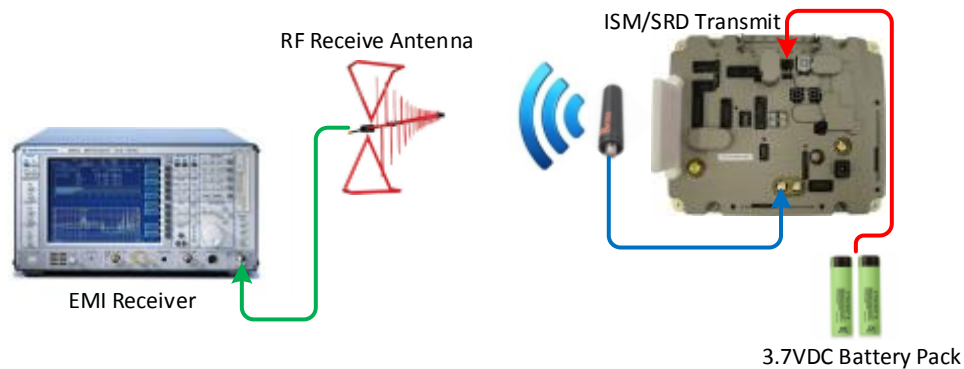
### 1.4.3 Support Equipment and I/O cables

| Manufacturer | Equipment/Cable | Description |
|--------------|-----------------|-------------|
| —            | —               | —           |

#### 1.4.4 Simplified Test Configuration Diagram

### EUT – MSCM Controller Module

#### Radiated Emission Test Configuration



#### Conducted (Antenna Port) Test Configuration



**Not To Scale – Illustration Purpose Only**  
Objects may not represent actual image of  
original equipment/s or set-up.

## 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: N/A          |                        |                          |
| 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.

## 1.7 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 conducted and 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 LOCATION

### 1.8.1 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.

### 1.8.2 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.

## 1.9 TEST FACILITY REGISTRATION

### 1.9.1 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 §2.498 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.



#### **1.9.2 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**

Radio Testing of the  
IPS Group Inc.  
Multiple Space Parking Meter Controller Module

## 2.1 CONDUCTED EMISSIONS

### 2.1.1 Specification Reference

Part 15 Subpart C §15.207(a)

### 2.1.2 Standard Applicable

An intentional radiator 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).

| 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

Not applicable. EUT is a battery operate device.



## **2.2 TRANSMISSION VERIFICATION FOR TRANSMITTER ACTIVATED AUTOMATICALLY**

### **2.2.1 Specification Reference**

Part 15 Subpart C §15.231(a)(2)

### **2.2.2 Standard Applicable**

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

### **2.2.3 Equipment Under Test and Modification State**

- Test not applicable. When activated, the EUT transmits short burst (<521.7μS) every two seconds until the EUT information/data are relayed then returns to dormant state until the next EUT (sensor) event.
- The manufacturer declares that the EUT based from its intended application falls under the Security or Safety Application category. Therefore Part 15 Subpart C §15.231(a)(3) applies. Please refer to Section 2.3 of this test report for details.



## **2.3 POLLING OR SUPERVISION TRANSMISSIONS, INCLUDING DATA, TO DETERMINE SYSTEM INTEGRITY OF TRANSMITTERS USED IN SECURITY OR SAFETY APPLICATIONS**

### **2.3.1 Specification Reference**

Part 15 Subpart C §15.231(a)(3)

### **2.3.2 Standard Applicable**

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

### **2.3.3 Equipment Under Test and Modification State**

Serial No: N/A/ Test Configuration A

### **2.3.4 Data of Test/Initial of test personnel who performed the test**

February 21, 2014/AC

### **2.3.5 Test Equipment Used**

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

### **2.3.6 Environmental Conditions/Test Location**

Test performed at TUV SUD America Inc. Rancho Bernardo facility.

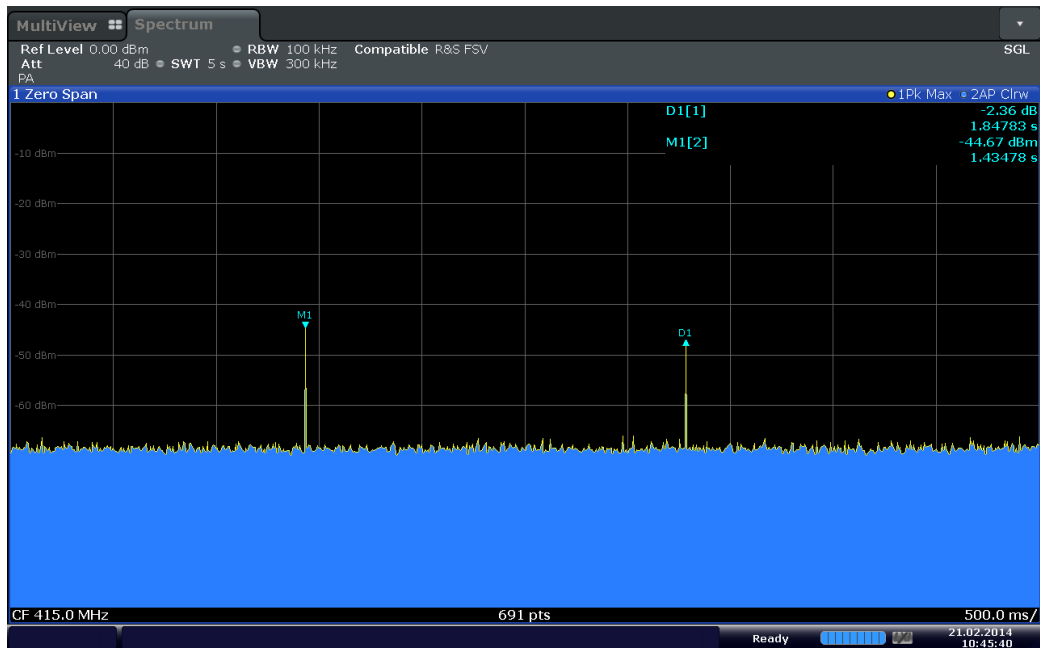
|                     |          |
|---------------------|----------|
| Ambient Temperature | 25.0°C   |
| Relative Humidity   | 32.4%    |
| ATM Pressure        | 98.8 Kpa |

### **2.3.7 Calculations**

EUT transmits short burst ( $<521.7\mu\text{S}$ ) every two seconds when activated. Calculation presented is based from continuous transmission for one hour. EUT in normal operation does not transmit continuously for an hour:

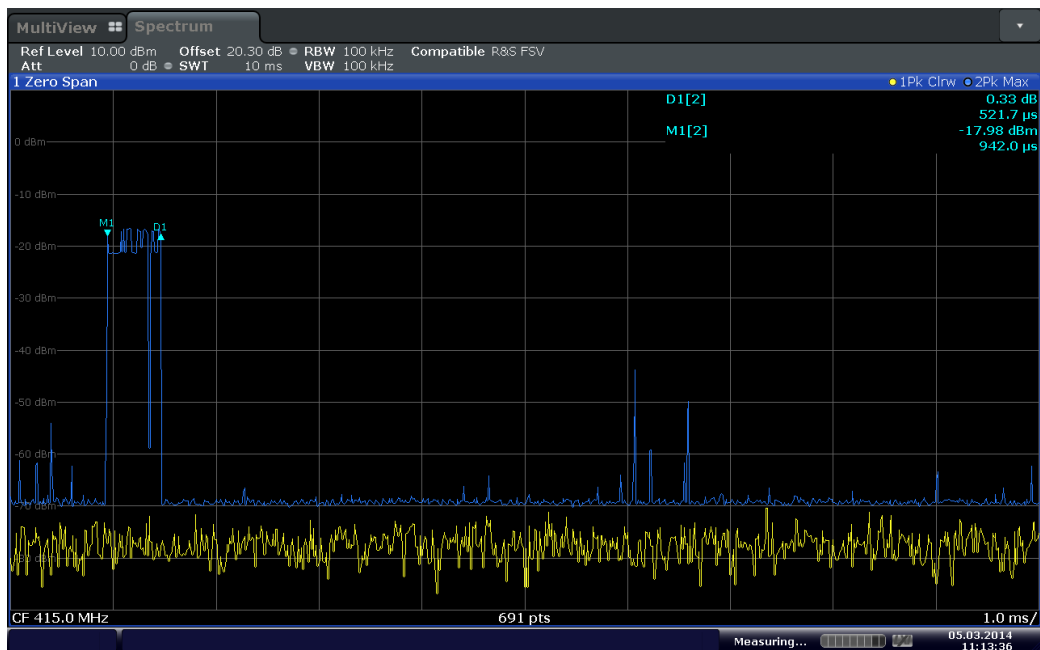
|                              |   |                                                         |
|------------------------------|---|---------------------------------------------------------|
| Total transmission in 1 hour | : | $521.7\mu\text{S} \times 1800$ (EUT transmissions/hour) |
|                              | : | 939.06 mS                                               |
|                              | : | <b>939.06 mS &lt; 2 seconds (EUT complies)</b>          |

### 2.3.8 Test Result Plot



Date: 21 FEB 2014 10:45:41

Normal operation of the EUT showing two (2) short burst 0.0005217ms) and two seconds apart.



Date: 5 MAR 2014 11:13:36

Single transmission burst / duty Cycle 10ms sweep

## 2.4 FIELD STRENGTH OF EMISSIONS

### 2.4.1 Specification Reference

Part 15 Subpart C §15.231(b)

### 2.4.2 Standard Applicable

(b) In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

| Fundamental frequency (MHz) | Field strength of fundamental (microvolts/meter) | Field strength of spurious emissions (microvolts/meter) |
|-----------------------------|--------------------------------------------------|---------------------------------------------------------|
| 40.66-40.70                 | 2,250                                            | 225                                                     |
| 70-130                      | 1,250                                            | 125                                                     |
| 130-174                     | <sup>1</sup> 1,250 to 3,750                      | <sup>1</sup> 125 to 375                                 |
| 174-260                     | 3,750                                            | 375                                                     |
| 260-470                     | <sup>1</sup> 3,750 to 12,500                     | <sup>1</sup> 375 to 1,250                               |
| Above 470                   | 12,500                                           | 1,250                                                   |

<sup>1</sup>Linear Interpolations

### 2.4.3 Equipment Under Test and Modification State

Serial No: N/A/ Test Configuration A

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

February 20, 2014/AC

### 2.4.5 Test Equipment Used

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

### 2.4.6 Environmental Conditions/Test Location

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

|                     |          |
|---------------------|----------|
| Ambient Temperature | 24.7°C   |
| Relative Humidity   | 39.7%    |
| ATM Pressure        | 99.1 kPa |



#### 2.4.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10<sup>th</sup> harmonic (5GHz), up to 18GHz presented.
- EUT ISM/SRD 400MHz radio antenna port was terminated with 50Ω when verifying radiated emission in receive mode.
- There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
- Only the considered worst case configuration presented for radiated emissions above 1GHz.
- Measurement was done using EMC32 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 2.3.8 for sample computation.

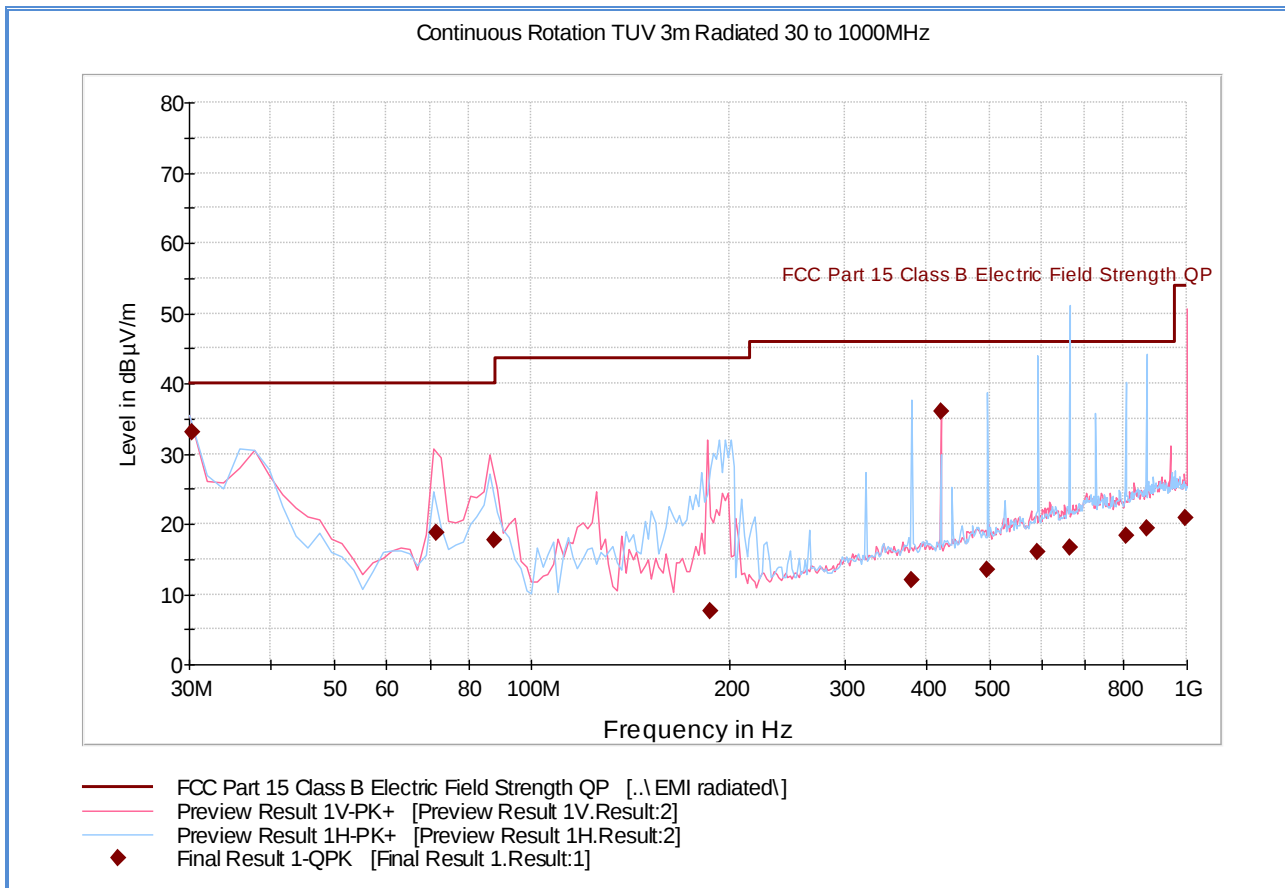
#### 2.4.8 Sample Computation (Radiated Emission)

|                                                       |                            |       |       |
|-------------------------------------------------------|----------------------------|-------|-------|
| Measuring equipment raw measurement (dbμV) @ 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 (dbμV/m) @ 30MHz |                            |       | 11.8  |

#### 2.4.9 Test Results

See attached plots.

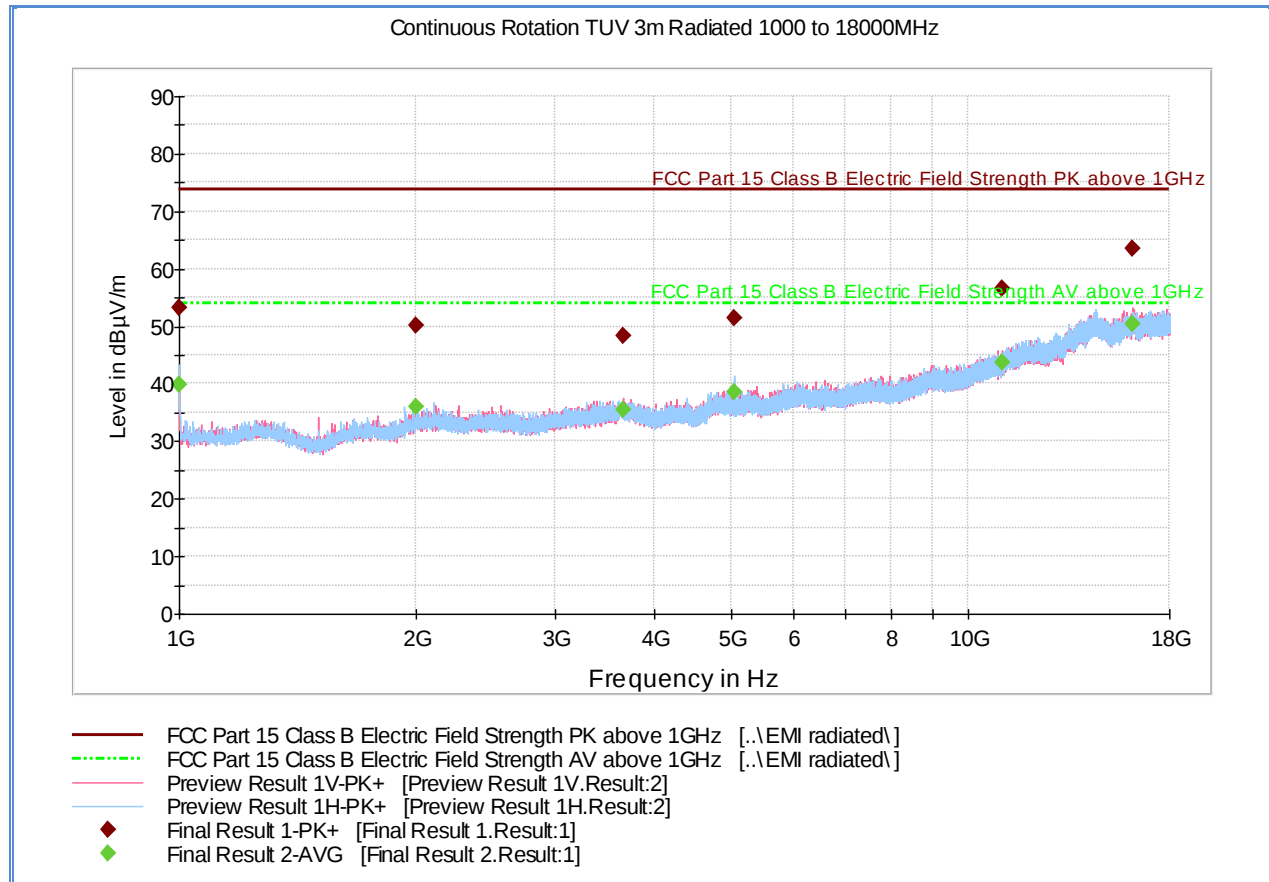
#### 2.4.10 Test Results Below 1GHz (Receive Mode)



#### 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) |
|-----------------|--------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 30.240000       | 33.1               | 1000.0          | 120.000         | 146.0       | H            | 64.0          | -10.5      | 6.9         | 40.0           |
| 71.421643       | 18.7               | 1000.0          | 120.000         | 200.0       | V            | 342.0         | -21.4      | 21.3        | 40.0           |
| 87.452745       | 17.7               | 1000.0          | 120.000         | 300.0       | V            | 18.0          | -20.4      | 22.3        | 40.0           |
| 187.551022      | 7.5                | 1000.0          | 120.000         | 214.0       | V            | 268.0         | -15.9      | 36.0        | 43.5           |
| 378.979800      | 12.0               | 1000.0          | 120.000         | 243.0       | H            | 291.0         | -8.8       | 34.0        | 46.0           |
| 420.721443      | 36.0               | 1000.0          | 120.000         | 100.0       | V            | 190.0         | -8.3       | 10.0        | 46.0           |
| 495.293066      | 13.6               | 1000.0          | 120.000         | 250.0       | H            | 302.0         | -6.1       | 32.4        | 46.0           |
| 591.183567      | 16.0               | 1000.0          | 120.000         | 156.0       | H            | 302.0         | -3.2       | 30.0        | 46.0           |

## 2.4.11 Test Results Above 1GHz (Receive Mode)



### Peak Data

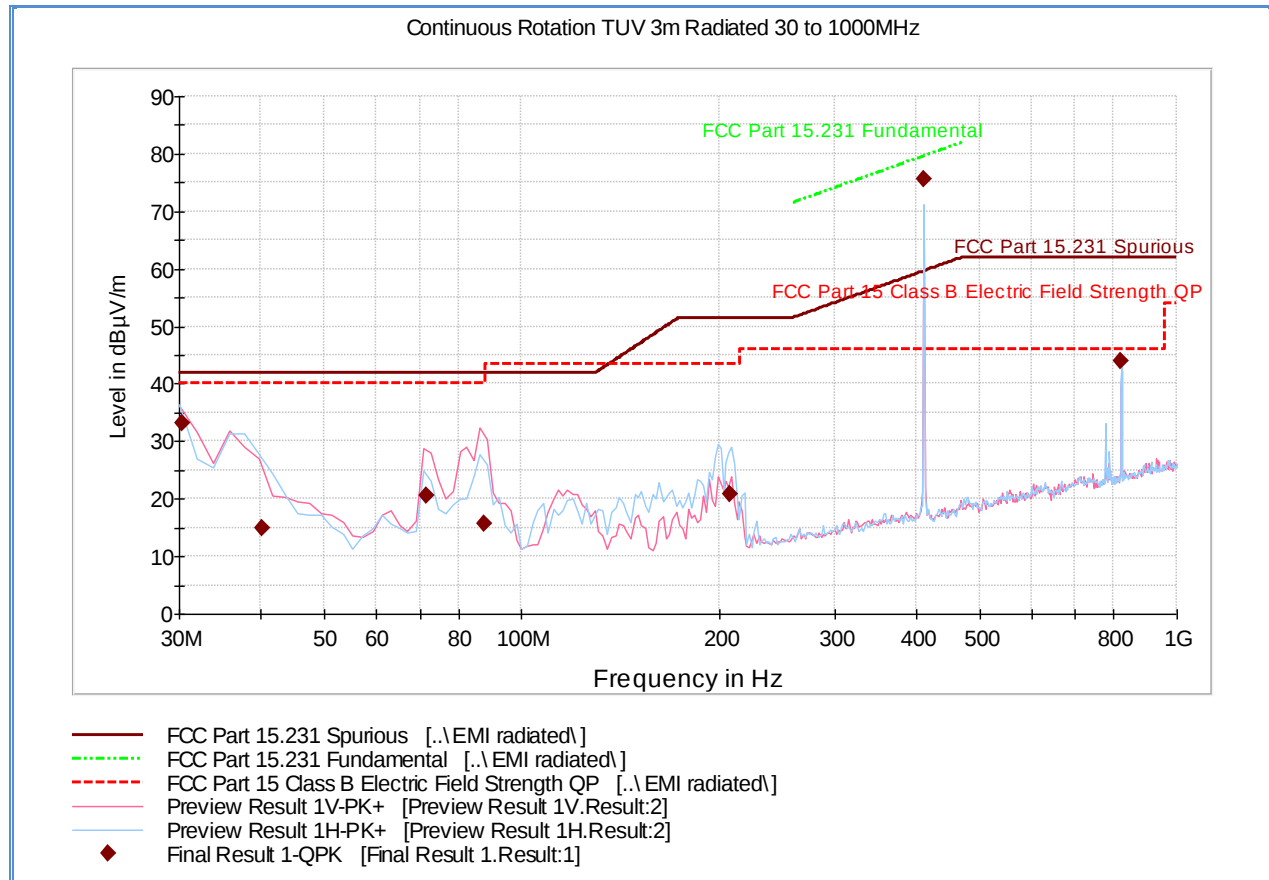
| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 1000.000000     | 53.2             | 1000.0          | 1000.000        | 270.0       | H            | 20.0          | -1.0       | 20.7        | 73.9           |
| 1999.966667     | 50.0             | 1000.0          | 1000.000        | 403.0       | H            | 225.0         | 2.1        | 23.9        | 73.9           |
| 3649.533333     | 48.2             | 1000.0          | 1000.000        | 300.0       | V            | 3.0           | 5.7        | 25.7        | 73.9           |
| 5049.033333     | 51.5             | 1000.0          | 1000.000        | 203.0       | H            | 47.0          | 8.0        | 22.4        | 73.9           |
| 11055.466666    | 56.6             | 1000.0          | 1000.000        | 363.0       | V            | 20.0          | 16.5       | 17.3        | 73.9           |
| 16171.366666    | 63.4             | 1000.0          | 1000.000        | 335.0       | V            | 10.0          | 23.0       | 10.5        | 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     | 39.9             | 1000.0          | 1000.000        | 270.0       | H            | 20.0          | -1.0       | 14.0        | 53.9           |
| 1999.966667     | 36.0             | 1000.0          | 1000.000        | 403.0       | H            | 225.0         | 2.1        | 17.9        | 53.9           |
| 3649.533333     | 35.5             | 1000.0          | 1000.000        | 300.0       | V            | 3.0           | 5.7        | 18.4        | 53.9           |
| 5049.033333     | 38.5             | 1000.0          | 1000.000        | 203.0       | H            | 47.0          | 8.0        | 15.4        | 53.9           |
| 11055.466666    | 43.8             | 1000.0          | 1000.000        | 363.0       | V            | 20.0          | 16.5       | 10.1        | 53.9           |
| 16171.366666    | 50.5             | 1000.0          | 1000.000        | 335.0       | V            | 10.0          | 23.0       | 3.4         | 53.9           |

**Test Notes:** No significant emissions observed above 6GHz. Measurement above 6GHz are noise floor figures.

## 2.4.12 Test Results Below 1GHz (Low Channel 410 MHz)

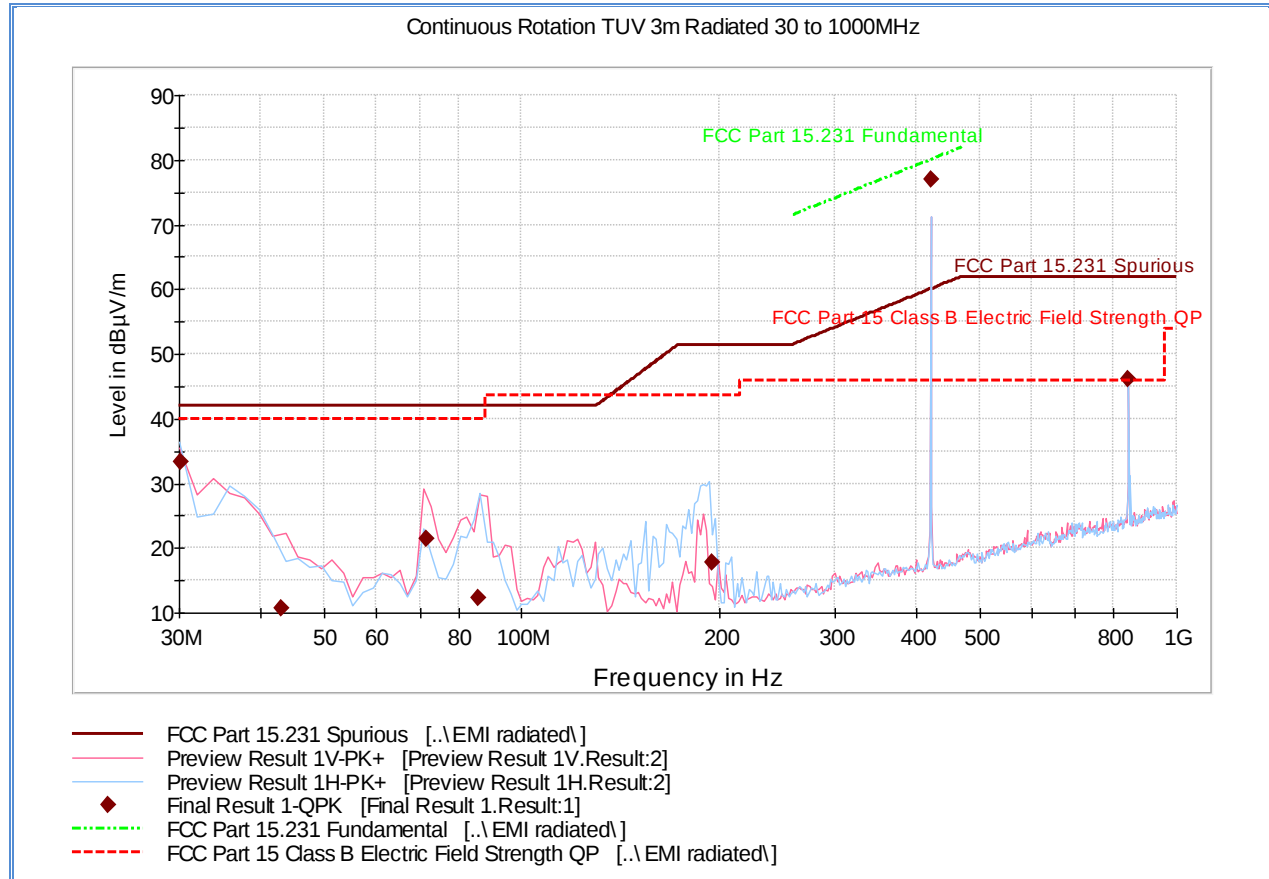


### Quasi Peak Data

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|--------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 30.240000       | 33.2               | 1000.0          | 120.000         | 128.0       | H            | 351.0         | -10.5      | 6.8         | 40.0           |
| 40.207214       | 15.0               | 1000.0          | 120.000         | 400.0       | H            | 15.0          | -16.0      | 25.0        | 40.0           |
| 71.541643       | 20.5               | 1000.0          | 120.000         | 200.0       | V            | 103.0         | -21.4      | 19.5        | 40.0           |
| 87.612745       | 15.7               | 1000.0          | 120.000         | 109.0       | V            | -12.0         | -20.3      | 24.3        | 40.0           |
| 207.757675      | 20.9               | 1000.0          | 120.000         | 115.0       | H            | 51.0          | -15.6      | 22.6        | 43.5           |
| 410.922004      | 75.7               | 1000.0          | 120.000         | 189.0       | H            | 72.0          | -8.3       | 3.8         | 79.5           |
| 821.346212      | 43.9               | 1000.0          | 120.000         | 100.0       | H            | 321.0         | 1.2        | 2.1         | 46.0           |

**Test Notes:** There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.

## 2.4.13 Test Results Below 1GHz (Mid Channel 420 MHz)

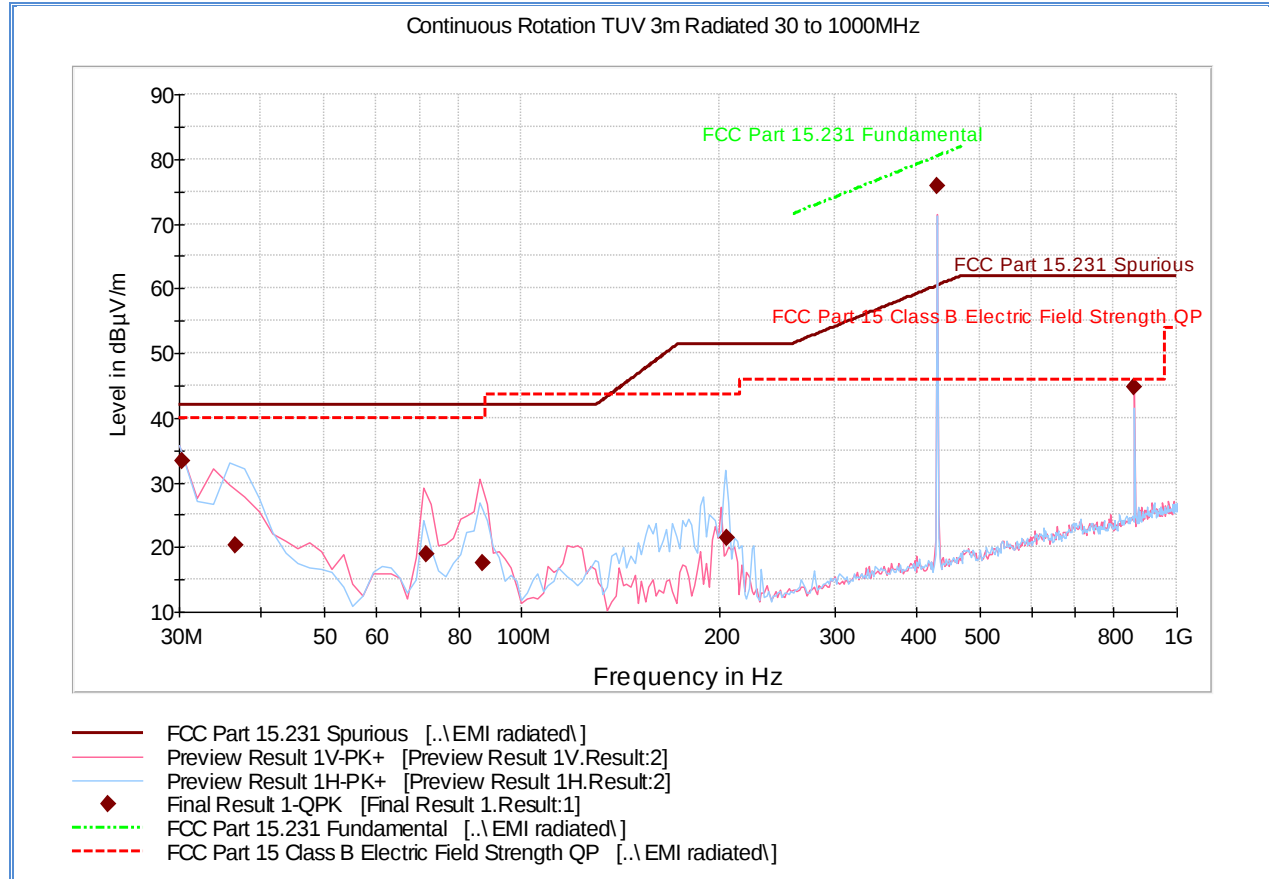


### Quasi Peak Data

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|--------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 30.200000       | 33.2               | 1000.0          | 120.000         | 150.0       | H            | 292.0         | -10.5      | 6.8         | 40.0           |
| 42.847214       | 10.7               | 1000.0          | 120.000         | 100.0       | V            | 272.0         | -16.9      | 29.3        | 40.0           |
| 71.541643       | 21.5               | 1000.0          | 120.000         | 200.0       | V            | 223.0         | -21.4      | 18.5        | 40.0           |
| 85.892745       | 12.3               | 1000.0          | 120.000         | 300.0       | H            | 342.0         | -20.5      | 27.7        | 40.0           |
| 195.326573      | 17.9               | 1000.0          | 120.000         | 116.0       | H            | 20.0          | -16.1      | 25.6        | 43.5           |
| 420.721443      | 76.9               | 1000.0          | 120.000         | 150.0       | V            | 156.0         | -8.3       | 3.1         | 80.0           |
| 840.945090      | 46.0               | 1000.0          | 120.000         | 100.0       | V            | 178.0         | 1.5        | 15.9        | 61.9 *)        |

\*) 840.945MHz is not in the restricted bands (FCC Part 15.231 Spurious limit apply).

#### 2.4.14 Test Results Below 1GHz (High Channel 430 MHz)

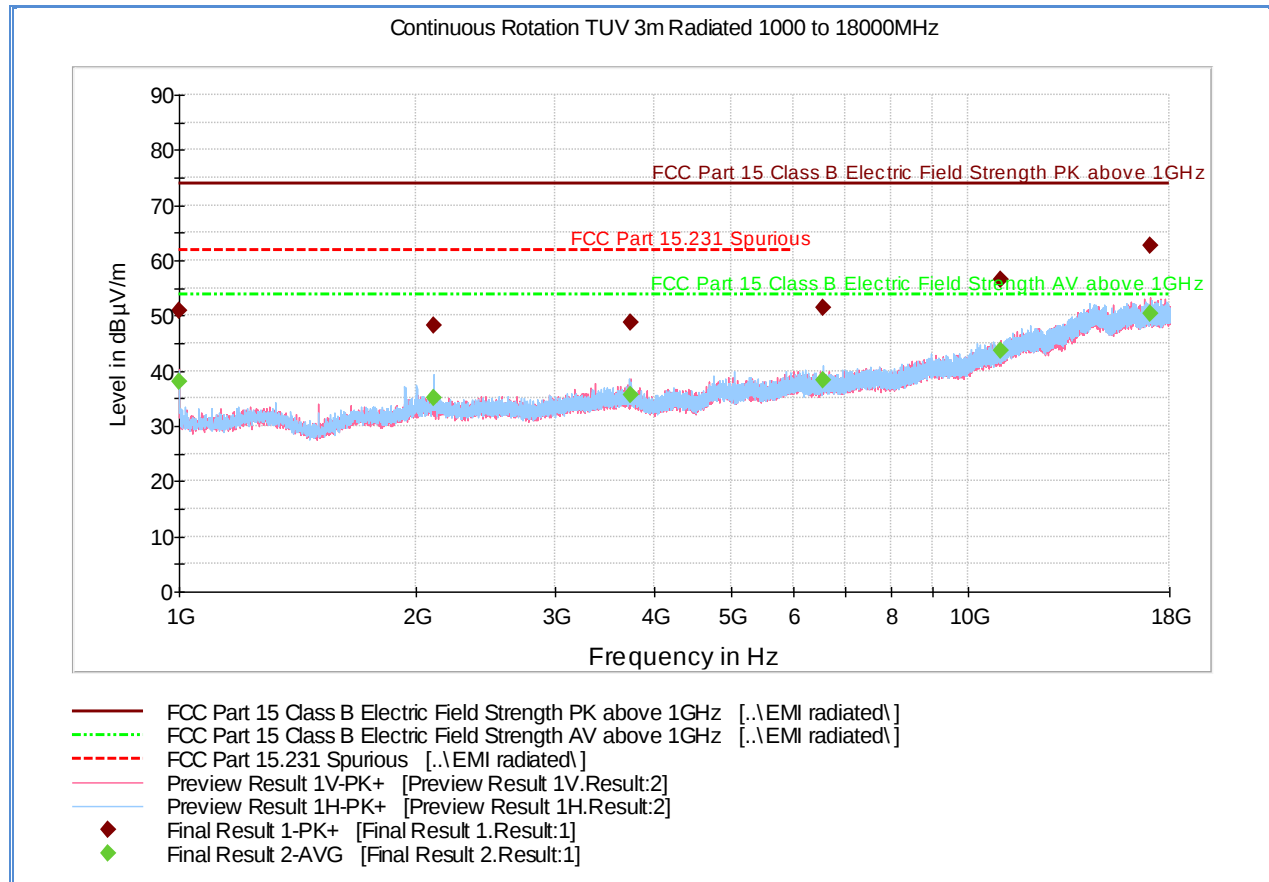


#### Quasi Peak Data

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|--------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 30.240000       | 33.2               | 1000.0          | 120.000         | 128.0       | H            | 291.0         | -10.5      | 6.8         | 40.0           |
| 36.591663       | 20.3               | 1000.0          | 120.000         | 350.0       | H            | -15.0         | -14.2      | 19.7        | 40.0           |
| 71.581643       | 19.0               | 1000.0          | 120.000         | 200.0       | V            | 356.0         | -21.4      | 21.0        | 40.0           |
| 87.332745       | 17.5               | 1000.0          | 120.000         | 300.0       | V            | 18.0          | -20.4      | 22.5        | 40.0           |
| 206.109900      | 21.5               | 1000.0          | 120.000         | 150.0       | H            | 209.0         | -15.8      | 22.0        | 43.5           |
| 430.520882      | 75.8               | 1000.0          | 120.000         | 100.0       | V            | 227.0         | -7.9       | 4.5         | 80.4           |
| 860.543968      | 44.8               | 1000.0          | 120.000         | 100.0       | V            | 7.0           | 1.6        | 1.2         | 46.0           |

**Test Notes:** There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.

## 2.4.15 Test Results Above 1GHz (Worst case configuration present – Low Channel)



### Peak Data

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 1000.000000     | 50.9             | 1000.0          | 1000.000        | 257.0       | V            | 3.0           | -1.0       | 23.0        | 73.9           |
| 2102.966667     | 48.1             | 1000.0          | 1000.000        | 124.0       | H            | 60.0          | 2.2        | 25.8        | 73.9           |
| 3729.866667     | 48.8             | 1000.0          | 1000.000        | 164.0       | V            | 111.0         | 5.8        | 25.1        | 73.9           |
| 6556.400000     | 51.3             | 1000.0          | 1000.000        | 177.0       | H            | 166.0         | 10.2       | 22.6        | 73.9           |
| 11019.466667    | 56.6             | 1000.0          | 1000.000        | 200.0       | V            | 11.0          | 16.4       | 17.3        | 73.9           |
| 17051.933333    | 62.7             | 1000.0          | 1000.000        | 191.0       | V            | 212.0         | 23.4       | 11.2        | 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     | 38.0             | 1000.0          | 1000.000        | 257.0       | V            | 3.0           | -1.0       | 15.9        | 53.9           |
| 2102.966667     | 35.0             | 1000.0          | 1000.000        | 124.0       | H            | 60.0          | 2.2        | 18.9        | 53.9           |
| 3729.866667     | 35.5             | 1000.0          | 1000.000        | 164.0       | V            | 111.0         | 5.8        | 18.4        | 53.9           |
| 6556.400000     | 38.2             | 1000.0          | 1000.000        | 177.0       | H            | 166.0         | 10.2       | 15.7        | 53.9           |
| 11019.466667    | 43.8             | 1000.0          | 1000.000        | 200.0       | V            | 11.0          | 16.4       | 10.1        | 53.9           |
| 17051.933333    | 50.3             | 1000.0          | 1000.000        | 191.0       | V            | 212.0         | 23.4       | 3.6         | 53.9           |

**Test Notes:** No significant emissions observed above 8GHz. Measurement above 8GHz are noise floor figures.



## **2.5 BANDWIDTH REQUIREMENT**

### **2.5.1 Specification Reference**

Part 15 Subpart C §15.231(c)

### **2.5.2 Standard Applicable**

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

### **2.5.3 Equipment Under Test and Modification State**

Serial No: N/A/ Test Configuration B

### **2.5.4 Date of Test/Initial of test personnel who performed the test**

February 21, 2014/AC

### **2.5.5 Test Equipment Used**

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

### **2.5.6 Environmental Conditions/Test Location**

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

|                     |          |
|---------------------|----------|
| Ambient Temperature | 25.0°C   |
| Relative Humidity   | 32.4%    |
| ATM Pressure        | 98.8 kPa |

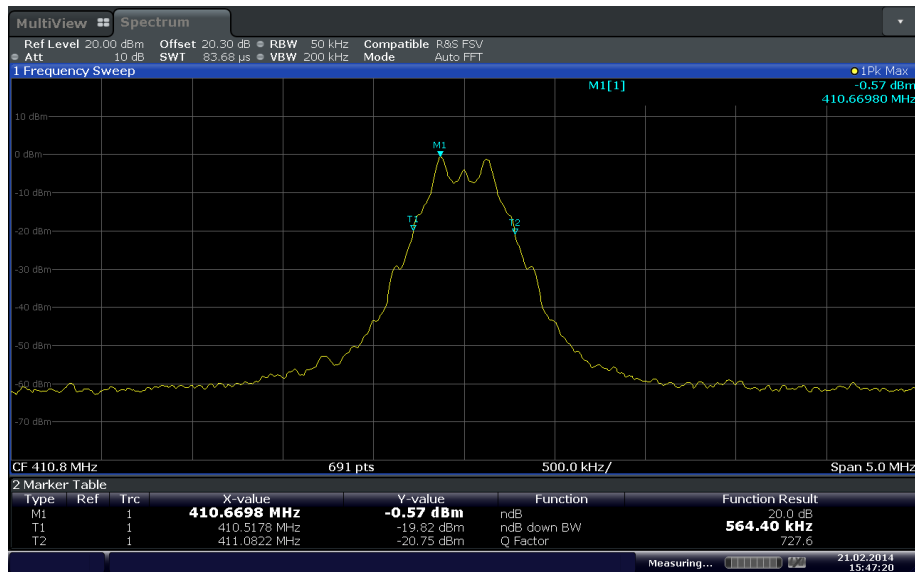
### **2.5.7 Additional Observations**

- This is a radiated test.
- An offset of 20.3dB was added to compensate for the external attenuator and cable used from the antenna port to spectrum analyzer.
- Span is set to encompass the whole emission
- RBW is 1% of the span while VBW is greater than 3X RBW.
- Sweep is auto.
- Detector is peak.
- Max hold function activated.
- "x dB" function (20dB) under Occupied Bandwidth measurement of the spectrum analyzer was used for FCC requirement.
- Occupied bandwidth % power set to 99% for IC requirement.

## 2.5.8 Test Results

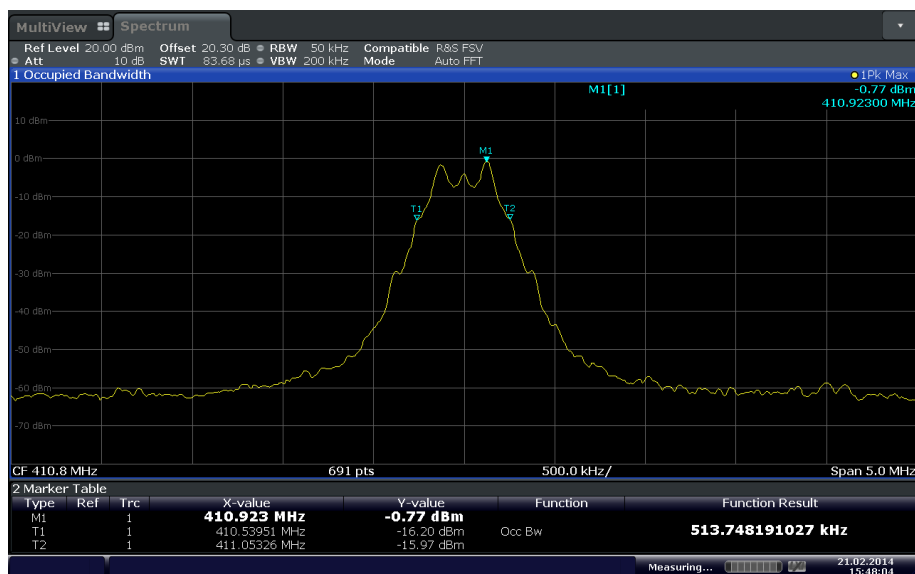
| Transmitter Frequency (MHz) | Modulation | 0.25% of the center frequency requirement | Measured 20dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|-----------------------------|------------|-------------------------------------------|-------------------------------|---------------------|
| 410                         | FSK        | <1.027 MHz                                | 564.4 kHz                     | 513.7 kHz           |
| 420                         | FSK        | <1.0515 MHz                               | 571.6 kHz                     | 513.7 kHz           |
| 430                         | FSK        | <1.0759 MHz                               | 564.4 kHz                     | 513.7 kHz           |

## 2.5.9 Test Results Plots



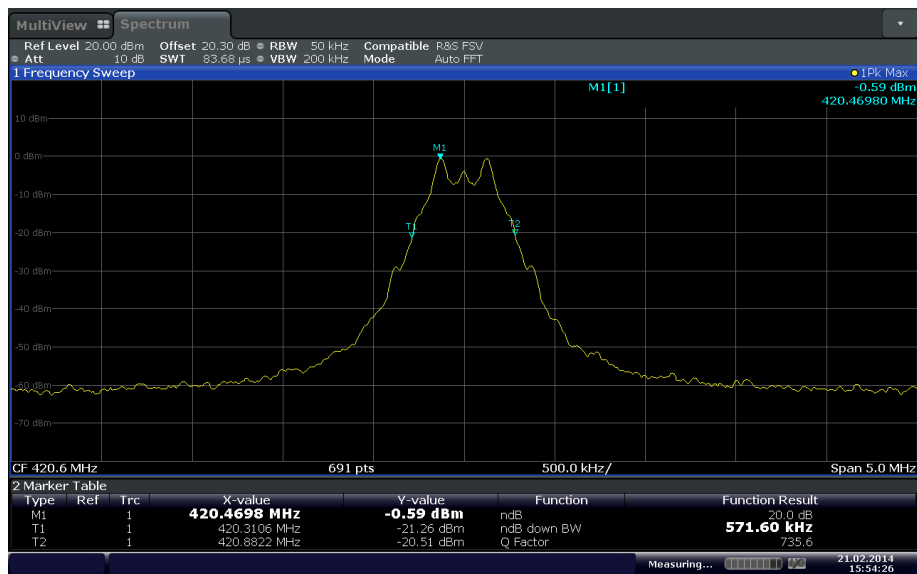
Date: 21.FEB.2014 15:47:20

### 20dB BW – Low Channel 410 MHz



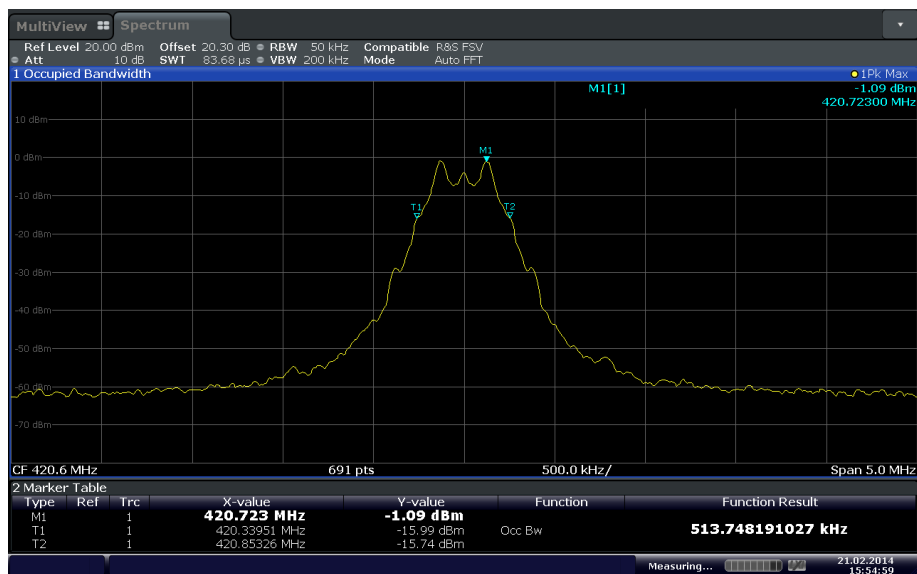
Date: 21.FEB.2014 15:48:04

### 99% BW – Low Channel 410 MHz



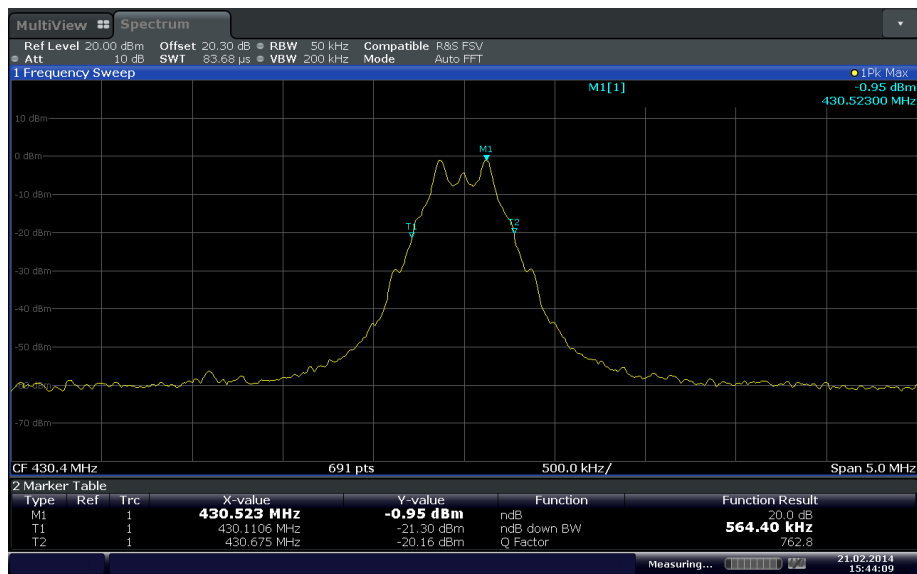
Date: 21.FEB.2014 15:54:26

### 20dB BW – Mid Channel 420 MHz



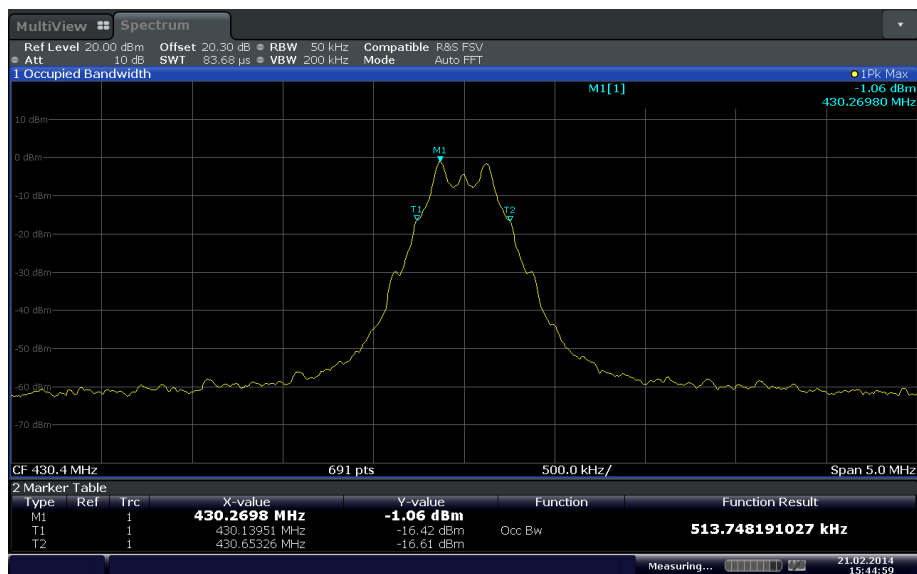
Date: 21.FEB.2014 15:54:59

### 99% BW – Mid Channel 420 MHz



Date: 21.FEB.2014 15:44:09

### 20dB BW – High Channel 430 MHz



Date: 21.FEB.2014 15:44:59

### 99% BW – High Channel 430 MHz

## 2.6 RECEIVER SPURIOUS EMISSIONS

### 2.6.1 Specification Reference

RSS-Gen 6.0

### 2.6.2 Standard Applicable

Receivers shall comply with the limits of spurious emissions set out in this section, measured over the frequency range determined in accordance with Section 4.10 of RSS-Gen.

**Table 2: Radiated Limits of Receiver Spurious Emissions**

| Frequency (MHz) | Field Strength (microvolts/m at 3 metres)* |
|-----------------|--------------------------------------------|
| 30-88           | 100                                        |
| 88-216          | 150                                        |
| 216-960         | 200                                        |
| Above 960       | 500                                        |

\*Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 7.2.7 of RSS-Gen.

### 2.6.3 Equipment Under Test and Modification State

Serial No: N/A/ Test Configuration A

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

February 20, 2014/AC

### 2.6.5 Test Equipment Used

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

### 2.6.6 Environmental Conditions/Test Location

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

|                     |          |
|---------------------|----------|
| Ambient Temperature | 24.7°C   |
| Relative Humidity   | 39.7%    |
| ATM Pressure        | 99.1 kPa |

### 2.6.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 3<sup>rd</sup> harmonic (up to 18GHz performed).
- Results identical to Section 2.3.10 and 2.3.11 of this test report.
- EUT in RX (Receive) mode configuration.



### **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 |
|--------------------------|---------------------------------------------|-----------------|---------------|----------------------------|------------------|--------------|
| Radiated Test Setup      |                                             |                 |               |                            |                  |              |
| 7582                     | Signal/Spectrum Analyzer                    | FSW26           | 101614        | Rhode & Schwarz            | 11/19/13         | 11/19/14     |
| Radiated Test Setup      |                                             |                 |               |                            |                  |              |
| 1002                     | Bilog Antenna                               | 3142C           | 00058717      | ETS-Lindgren               | 01/21/13         | 01/21/14     |
| 7575                     | Double-ridged waveguide horn antenna        | 3117            | 00155511      | EMCO                       | 03/25/13         | 03/25/14     |
| 8628                     | Pre-amplifier                               | QLJ 01182835-JO | 8986002       | QuinStar Technologies Inc. | 09/03/13         | 09/03/14     |
| 1040                     | EMI Test Receiver                           | ESIB40          | 100292        | Rhode & Schwarz            | 07/31/13         | 07/31/14     |
| 1016                     | Pre-amplifier                               | PAM-0202        | 187           | PAM                        | 10/08/13         | 10/08/14     |
| Miscellaneous            |                                             |                 |               |                            |                  |              |
| 6452                     | Multimeter                                  | 3478A           | 2911A52177    | Hewlett Packard            | 08/02/13         | 08/02/14     |
| 7560                     | Barometer/Temperature /Humidity Transmitter | iBTHX-W         | 1240476       | Omega                      | 01/30/14         | 01/30/15     |
| 1123                     | DC Power Supply                             | E3631A          | N/A           | Hewlett Packard            | Verified by 6452 |              |
|                          | 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                               | Preamplifier               | 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)

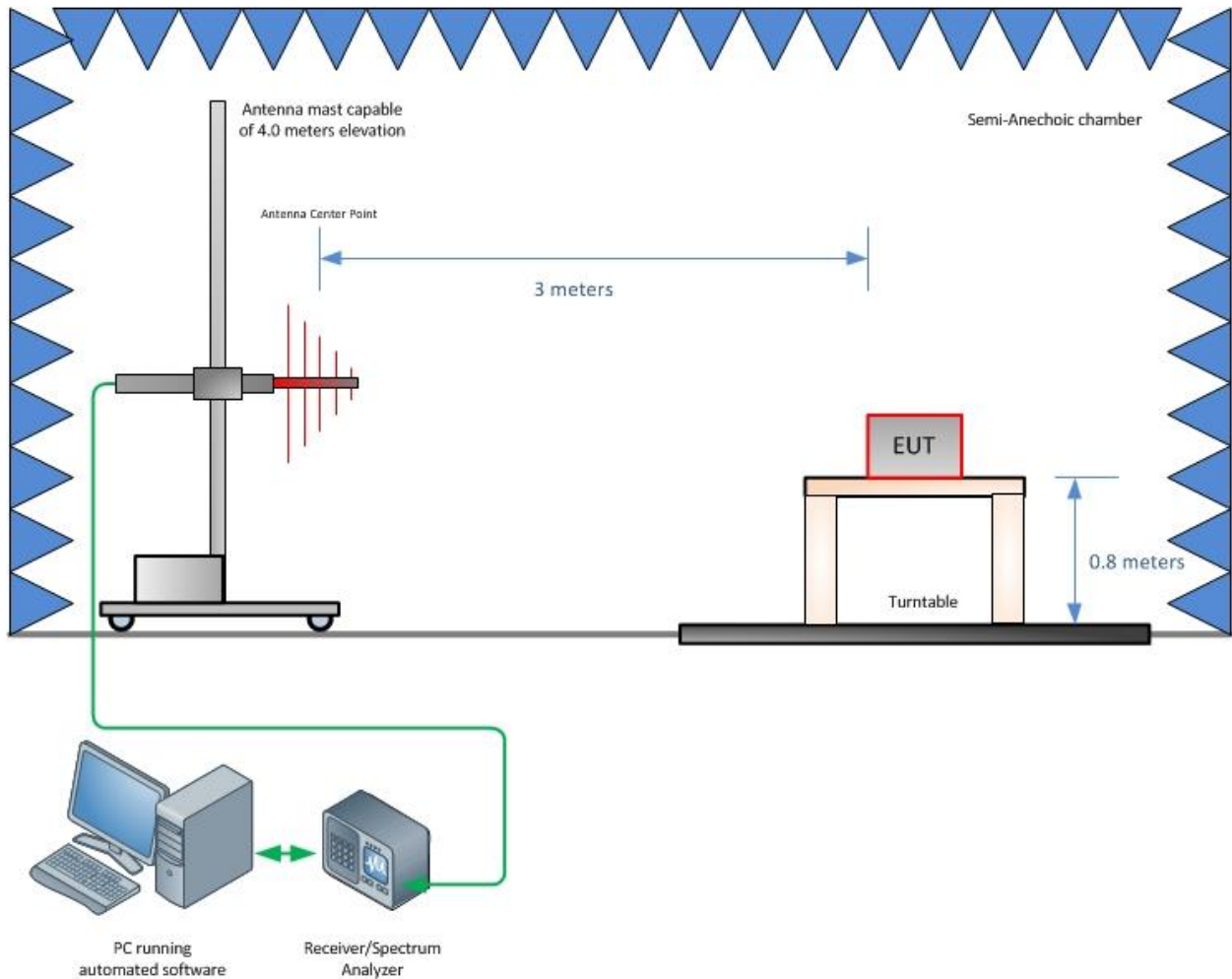
| Contribution                    |                            | Probability Distribution Type | Probability Distribution $x_i$ | Standard Uncertainty $u(x_i)$ | $[u(x_i)]^2$ |
|---------------------------------|----------------------------|-------------------------------|--------------------------------|-------------------------------|--------------|
| 1                               | Receiver/Spectrum Analyzer | Rectangular                   | 0.57                           | 0.33                          | 0.11         |
| 2                               | Cables                     | Rectangular                   | 0.70                           | 0.40                          | 0.16         |
| 3                               | Preamplifier               | 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         |



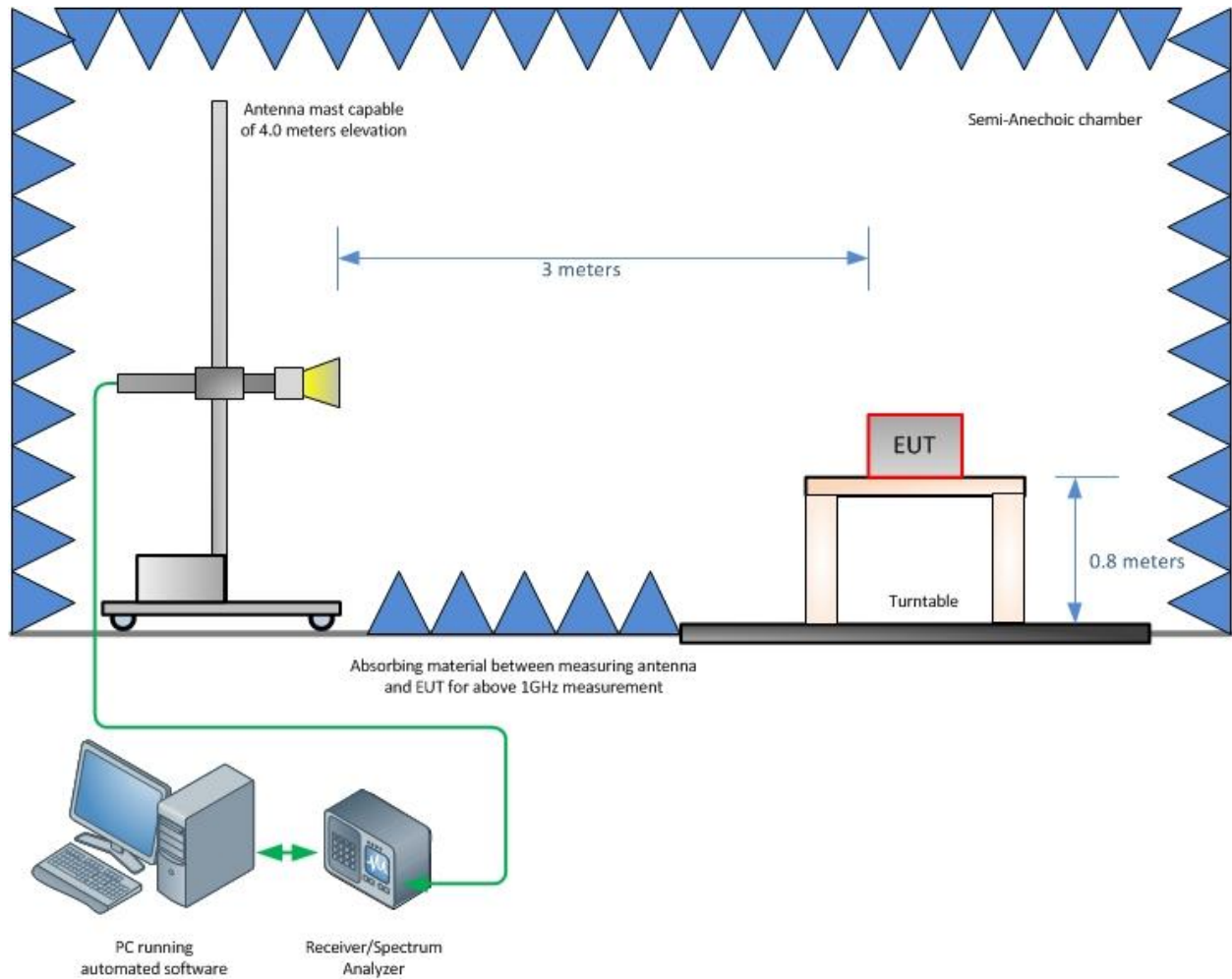
## **SECTION 4**

### **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**



## 5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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