



## FCC / ISED & Test Report

For:  
**CalAmp**

Model Name:  
**LMU-3640 HSPA**

Product Description:  
**Telematics Gateway**

Applied Rules and Standards:

47 CFR Parts 22 and 24  
RSS: 132 Issue 3, 133 Issue 6

FCC ID: APV-3640HEB  
IC ID: 5843A-3640HEB

REPORT #: EMC\_CALAM\_064\_FCC\_22\_24  
DATE: 2018-06-20



A2LA Accredited

IC recognized #  
3462B-1

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CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

TABLE OF CONTENTS

|           |                                                                            |           |
|-----------|----------------------------------------------------------------------------|-----------|
| <b>1</b>  | <b>ASSESSMENT.....</b>                                                     | <b>3</b>  |
| <b>2</b>  | <b>ADMINISTRATIVE DATA .....</b>                                           | <b>4</b>  |
| 2.1       | IDENTIFICATION OF THE TESTING LABORATORY ISSUING THE EMC TEST REPORT ..... | 4         |
| 2.2       | IDENTIFICATION OF THE CLIENT .....                                         | 4         |
| 2.3       | IDENTIFICATION OF THE MANUFACTURER.....                                    | 4         |
| <b>3</b>  | <b>EQUIPMENT UNDER TEST (EUT).....</b>                                     | <b>5</b>  |
| 3.1       | EUT SPECIFICATIONS .....                                                   | 5         |
| 3.2       | EUT SAMPLE DETAILS .....                                                   | 6         |
| 3.3       | ACCESSORY EQUIPMENT (AE) DETAILS.....                                      | 6         |
| 3.4       | TEST SAMPLE CONFIGURATION .....                                            | 6         |
| <b>4</b>  | <b>SUBJECT OF INVESTIGATION .....</b>                                      | <b>7</b>  |
| 4.1       | DATES OF TESTING: .....                                                    | 7         |
| 4.2       | MEASUREMENT UNCERTAINTY .....                                              | 7         |
| 4.3       | ENVIRONMENTAL CONDITIONS DURING TESTING: .....                             | 7         |
| <b>5</b>  | <b>MEASUREMENT PROCEDURES .....</b>                                        | <b>8</b>  |
| 5.1       | RADIATED MEASUREMENT.....                                                  | 8         |
| 5.2       | SAMPLE CALCULATIONS FOR FIELD STRENGTH MEASUREMENTS .....                  | 10        |
| <b>6</b>  | <b>MEASUREMENT RESULTS SUMMARY .....</b>                                   | <b>11</b> |
| 6.1       | PART 22 / RSS-132 .....                                                    | 11        |
| 6.2       | PART 24 / RSS-133 .....                                                    | 11        |
| <b>7</b>  | <b>TEST RESULT DATA .....</b>                                              | <b>12</b> |
| 7.1       | RADIATED SPURIOUS EMISSIONS .....                                          | 12        |
| <b>8</b>  | <b>TEST SETUP PHOTOS .....</b>                                             | <b>32</b> |
| <b>9</b>  | <b>TEST EQUIPMENT AND ANCILLARIES USED FOR TESTING .....</b>               | <b>32</b> |
| <b>10</b> | <b>REVISION HISTORY .....</b>                                              | <b>33</b> |

## 1 Assessment

The following device as further described in section 3 of this report was evaluated against the applicable criteria specified in the Code of Federal Regulations Title 47 parts 22 and 24, and Industry Canada Standards RSS-GEN issue 5, RSS-132 issue 3 and RSS-133 issue 6.

No deficiencies were ascertained.

| Company Name | Product Description | Model Name    |
|--------------|---------------------|---------------|
| CalAmp       | Telematics Gateway  | LMU-3640 HSPA |

### Responsible for Testing Laboratory:

| 2018-06-20 | Compliance | James Donnellan<br>(Lab Manager-EMC) |           |
|------------|------------|--------------------------------------|-----------|
| Date       | Section    | Name                                 | Signature |

### Responsible for the Report:

| 2018-06-20 | Compliance | Kevin Wang<br>(Senior EMC Engineer) |           |
|------------|------------|-------------------------------------|-----------|
| Date       | Section    | Name                                | Signature |

The test results of this test report relate exclusively to the test item specified in Section 3.

CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

## 2 Administrative Data

### 2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

|                                    |                        |
|------------------------------------|------------------------|
| <b>Company Name:</b>               | CETECOM Inc.           |
| <b>Department:</b>                 | Compliance             |
| <b>Street Address:</b>             | 411 Dixon Landing Road |
| <b>City/Zip Code</b>               | Milpitas, CA 95035     |
| <b>Country</b>                     | USA                    |
| <b>Telephone:</b>                  | +1 (408) 586 6200      |
| <b>Fax:</b>                        | +1 (408) 586 6299      |
| <b>Compliance Manager:</b>         | James Donnellan        |
| <b>Responsible Project Leader:</b> | Kevin Wang             |

### 2.2 Identification of the Client

|                          |                          |
|--------------------------|--------------------------|
| <b>Applicant's Name:</b> | CalAmp                   |
| <b>Street Address:</b>   | 2177 Salk Ave, Suite 200 |
| <b>City/Zip Code</b>     | Carlsbad, CA 90228       |
| <b>Country</b>           | United States            |

### 2.3 Identification of the Manufacturer

|                               |                   |
|-------------------------------|-------------------|
| <b>Manufacturer's Name:</b>   | Same as Applicant |
| <b>Manufacturers Address:</b> | -----             |
| <b>City/Zip Code</b>          | -----             |
| <b>Country</b>                | -----             |

### 3 Equipment Under Test (EUT)

#### 3.1 EUT Specifications

|                                                       |                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Model No</b>                                       | LMU-3640 HSPA                                                                                                                                                                                                                                                                          |
| <b>HW Version</b>                                     | REV A                                                                                                                                                                                                                                                                                  |
| <b>SW Version</b>                                     | 6.2                                                                                                                                                                                                                                                                                    |
| <b>FCC-ID</b>                                         | APV-3640HEB                                                                                                                                                                                                                                                                            |
| <b>IC-ID:</b>                                         | 5843A-3640HEB                                                                                                                                                                                                                                                                          |
| <b>HVIN:</b>                                          | LMU3640HEB                                                                                                                                                                                                                                                                             |
| <b>PMN:</b>                                           | LMU3640HSPA                                                                                                                                                                                                                                                                            |
| <b>Product Description</b>                            | Telematics Gateway                                                                                                                                                                                                                                                                     |
| <b>Transceiver Technology / Type(s) of Modulation</b> | CINTERION EHS6<br>FCC ID: QIPEHS6; IC ID: 7830A-EHS6<br>GSM/GPRS/EDGE/UMTS/HSPA Module<br><br>TI CC2564, Dual -mode Bluetooth Controller<br>FCC ID: APV-3640LAB/APV-3640LVB<br>IC ID: 5843A-3640LAB/5843A-3640LVB<br>Bluetooth and Bluetooth Low Energy: GFSK / $\pi/4$ -DQPSK / 8DPSK |
| <b>Frequency Range</b>                                | GSM 850: 824.2-848.8;<br>GSM 1900: 1850.2-1909.8;<br>FDD II: 1850 – 1910;<br>FDD V: 824 - 849;<br><br>Bluetooth: 2402-2480;<br>Bluetooth Low Energy: 2402-2480;                                                                                                                        |
| <b>Max. declared antenna gain</b>                     | Ethertronic model: M830820; Peak Gain: 1.39dBi<br>Cellular Antenna, Peak Gain: 850MHz, 1.3dBi; 1900MHz, 2.4dBi (Calculated) <b>Note1</b>                                                                                                                                               |
| <b>Power Supply/ Rated Operating Voltage Range</b>    | 8V (Low) / 12-24V (Nominal) / 32V (Max), DC                                                                                                                                                                                                                                            |
| <b>Operating Temperature Range</b>                    | -30°C ~ +75°C                                                                                                                                                                                                                                                                          |
| <b>Sample Revision</b>                                | <input type="checkbox"/> Prototype <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production                                                                                                                                                              |

**Note1:** the Cellular Antenna gain was calculated as below:

|         | Max Measured EIRP<br>(dBm) | Max documented conducted output<br>power(dBm) | Antenna Gain<br>(dBi) |
|---------|----------------------------|-----------------------------------------------|-----------------------|
| GSM850  | 32.58                      | 32.33                                         | 0.25                  |
| GSM1900 | 31.615                     | 29.32                                         | 2.295                 |
| FDD V   | 24.592                     | 23.33                                         | 1.262                 |
| FDD II  | 25.753                     | 23.33                                         | 2.423                 |

### 3.2 EUT Sample details

| EUT # | Serial Number | HW Version | SW Version | Comments         |
|-------|---------------|------------|------------|------------------|
| 1     | E17B005458    | REV A      | 6.2        | Radiated Sample  |
| 2     | E17B005457    | REV A      | 6.2        | Conducted Sample |

### 3.3 Accessory Equipment (AE) details

| AE # | Type            | Model         | Manufacturer | Serial Number |
|------|-----------------|---------------|--------------|---------------|
| 1    | DC Power Supply | 3003B         | Protek       | -             |
| 2    | Laptop          | Latitude 5420 | Dell         | 161554860001  |

### 3.4 Test Sample Configuration

| Set-up # | EUT / AE used for set-up | Comments                                                              |
|----------|--------------------------|-----------------------------------------------------------------------|
| 1        | EUT#1+AE#1+AE#2          | Radiated Testing, the EUT is directly powered by the DC power supply. |

#### **4 Subject of Investigation**

The objective of the measurements done by CETECOM Inc. was to evaluate the compliance of the EUT against the relevant requirements specified in the Code of Federal Regulations Title 47 parts 22, 24 and ISSED Standards RSS-132 issue 3 and RSS-133 issue 6.

##### **4.1 Dates of Testing:**

05/18/2018 - 06/06/2018

##### **4.2 Measurement Uncertainty**

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

###### Radiated measurement

|                    |                                 |
|--------------------|---------------------------------|
| 9 kHz to 30MHz     | ±2.5 dB (Magnetic Loop Antenna) |
| 30 MHz to 1000 MHz | ±2.0 dB (Biconilog Antenna)     |
| 1 GHz to 40 GHz    | ±2.3 dB (Horn Antenna)          |

###### Conducted measurement

|                   |                |
|-------------------|----------------|
| 150 kHz to 30 MHz | ±0.7 dB (LISN) |
|-------------------|----------------|

|                          |         |
|--------------------------|---------|
| RF conducted measurement | ±0.5 dB |
|--------------------------|---------|

##### **4.3 Environmental Conditions during Testing:**

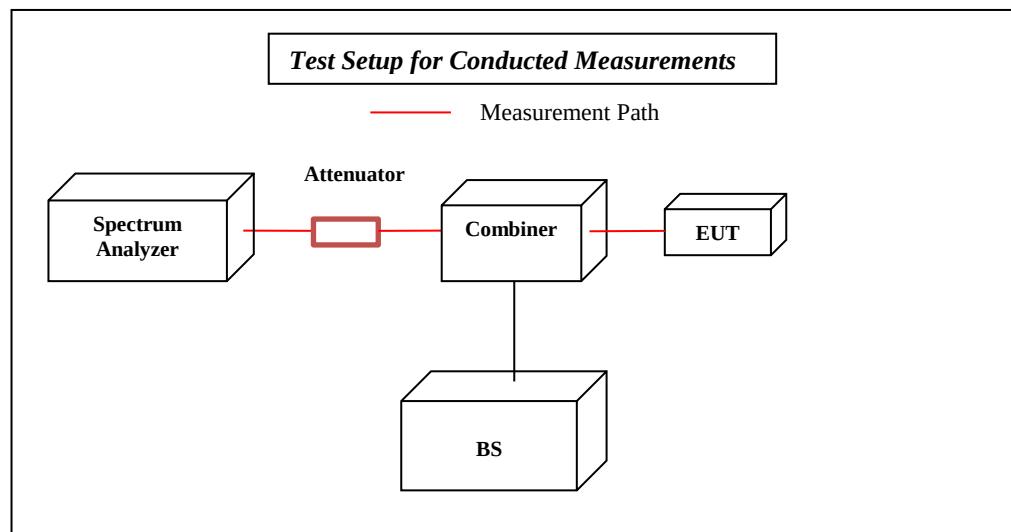
The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25°C
- Relative humidity: 40-60%

Deviating test conditions are indicated at individual test description where applicable.

## 5 Measurement Procedures

Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v02r02 – “Measurement Guidance for Certification of Licensed Digital Transmitters” and according to relevant parts of ANSI/TIA-603-D-2010 as detailed below.

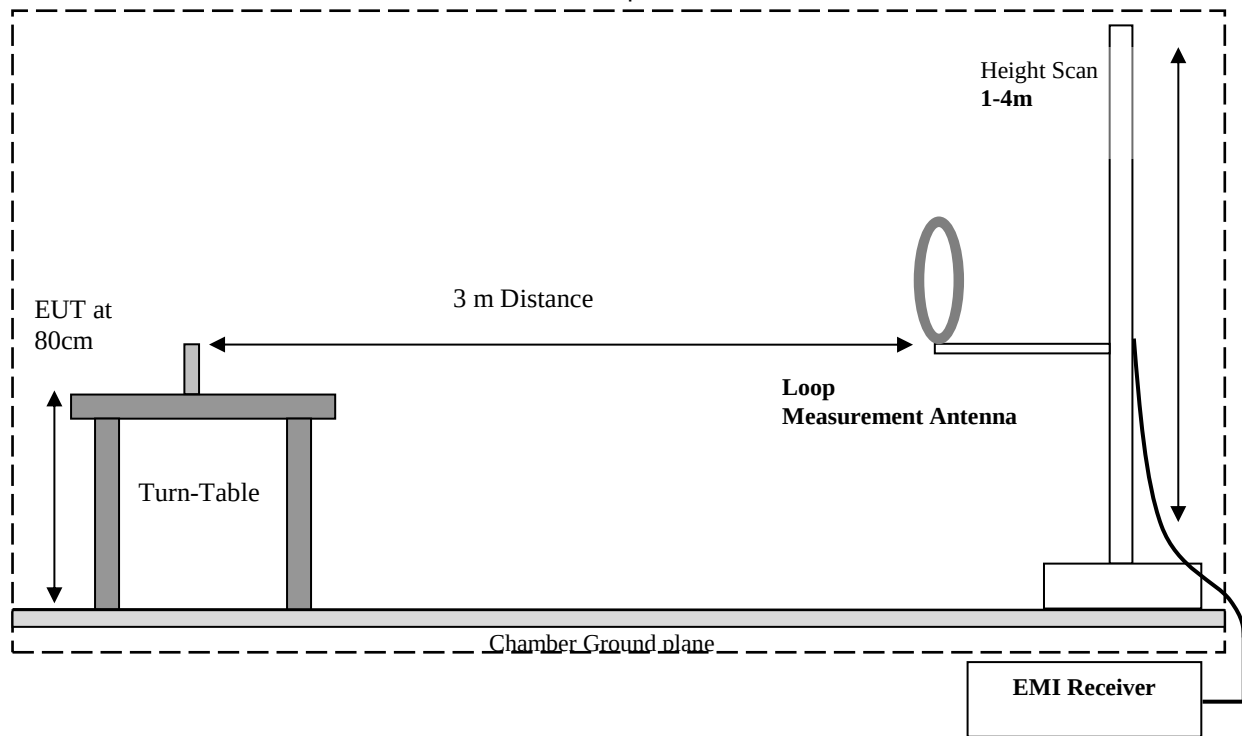


### 5.1 Radiated Measurement

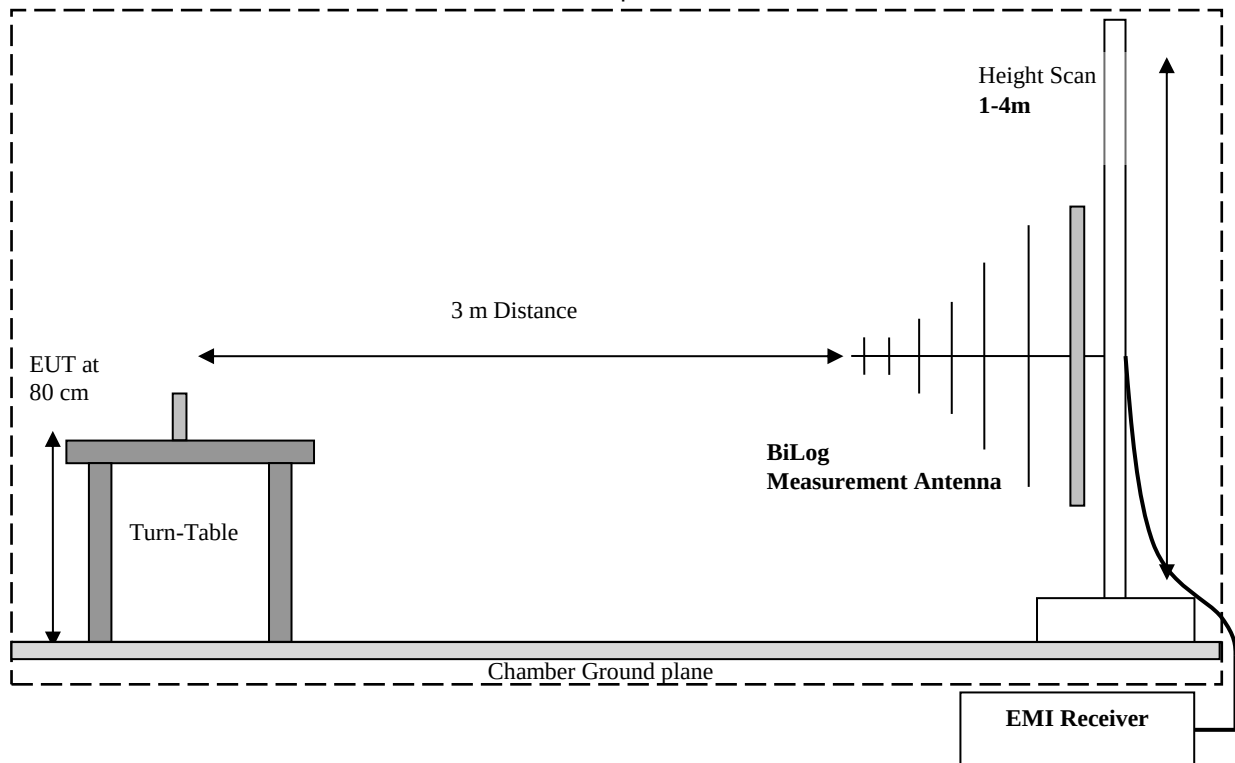
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

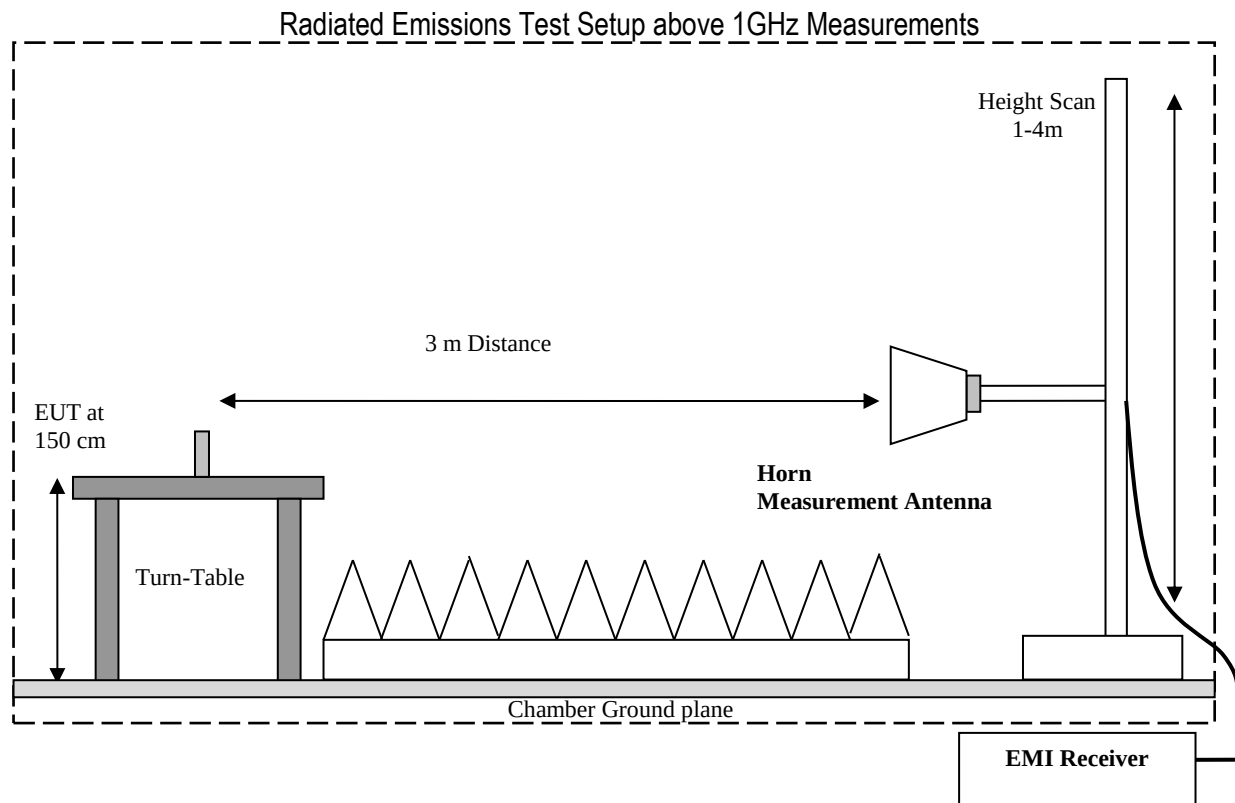


## Radiated Emissions Test Setup below 30MHz Measurements



## Radiated Emissions Test Setup 30MHz-1GHz Measurements





## 5.2 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

- Measured reading in dB $\mu$ V
- Cable Loss between the receiving antenna and SA in dB and
- Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} - \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

Example:

| Frequency (MHz) | Measured SA (dB $\mu$ V) | Cable Loss (dB) | Antenna Factor Correction (dB) | Field Strength Result (dB $\mu$ V/m) |
|-----------------|--------------------------|-----------------|--------------------------------|--------------------------------------|
| 1000            | 80.5                     | 3.5             | 14                             | 98.0                                 |

## 6 Measurement Results Summary

### 6.1 Part 22 / RSS-132

| Test Specification   | Test Case                    | Temperature and Voltage Conditions | Mode     | Pass                     | Fail                     | NA                       | NP                       | Result   |
|----------------------|------------------------------|------------------------------------|----------|--------------------------|--------------------------|--------------------------|--------------------------|----------|
| §2.1046; §22.913 (a) | RF Output Power              | Nominal                            | GSM/UMTS | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■                        | Note 2   |
| §2.1055; §22.355     | Frequency Tolerance          | Extreme Temperature and Voltage    | GSM/UMTS | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■                        | Note 2   |
| §2.1049; §22.917     | Occupied Bandwidth           | Nominal                            | GSM/UMTS | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■                        | Note 2   |
| §2.1051; §22.917     | Band Edge Compliance         | Nominal                            | GSM/UMTS | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■                        | Note 2   |
| §2.1051; §22.917     | Conducted Spurious Emissions | Nominal                            | GSM/UMTS | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■                        | Note 2   |
| §2.1053; §22.917     | Radiated Spurious Emissions  | Nominal                            | GSM/UMTS | ■                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Complies |

Note 1: NA= Not Applicable; NP= Not Performed.

Note 2: Data leveraged from modular approval, FCC ID: QIPEHS6; IC ID: 7830A-EHS6

### 6.2 Part 24 / RSS-133

| Test Specification   | Test Case                    | Temperature and Voltage Conditions | Mode     | Pass                     | Fail                     | NA                       | NP                       | Result   |
|----------------------|------------------------------|------------------------------------|----------|--------------------------|--------------------------|--------------------------|--------------------------|----------|
| §2.1046; §24.232 (a) | RF Output Power              | Nominal                            | GSM/UMTS | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■                        | Note 2   |
| §2.1055; §24.235     | Frequency Stability          | Extreme Temperature and Voltage    | GSM/UMTS | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■                        | Note 2   |
| §2.1049; §24.238     | Occupied Bandwidth           | Nominal                            | GSM/UMTS | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■                        | Note 2   |
| §2.1051; §24.238     | Band Edge Compliance         | Nominal                            | GSM/UMTS | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■                        | Note 2   |
| §2.1051; §24.238     | Conducted Spurious Emissions | Nominal                            | GSM/UMTS | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■                        | Note 2   |
| §2.1053; §24.238     | Radiated Spurious Emissions  | Nominal                            | GSM/UMTS | ■                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Complies |

Note 1: NA= Not Applicable; NP= Not Performed.

Note 2: Data leveraged from modular approval, FCC ID: QIPEHS6; IC ID: 7830A-EHS6

## 7 Test Result Data

### 7.1 Radiated Spurious Emissions

#### 7.1.1 Measurement utilizing KDB 971168 D01 Power Meas License Digital Systems v02r02, and according to ANSI/TIA-603-D-2010

##### Spectrum Analyzer Settings for FCC 22

| Frequency Range      | 30MHz – 1 GHz | 1 – 1.58 GHz | 1.58 – 9 GHz |
|----------------------|---------------|--------------|--------------|
| Resolution Bandwidth | 100 kHz       | 1 MHz        | 1 MHz        |
| Video Bandwidth      | 100 kHz       | 1 MHz        | 1 MHz        |
| Detector             | Peak          | Peak         | Peak         |
| Trace Mode           | Max Hold      | Max Hold     | Max Hold     |
| Sweep Time           | Auto          | Auto         | Auto         |

##### Spectrum Analyzer Settings for FCC 24

| Frequency Range      | 30MHz – 1 GHz | 1 – 2.7 GHz | 2.7 – 18 GHz | 18 – 19.1 GHz |
|----------------------|---------------|-------------|--------------|---------------|
| Resolution Bandwidth | 100 kHz       | 1 MHz       | 1 MHz        | 1 MHz         |
| Video Bandwidth      | 100 kHz       | 1 MHz       | 1 MHz        | 1 MHz         |
| Detector             | Peak          | Peak        | Peak         | Peak          |
| Trace Mode           | Max Hold      | Max Hold    | Max Hold     | Max Hold      |
| Sweep Time           | Auto          | Auto        | Auto         | Auto          |

#### 7.1.2 Limits:

##### 7.1.2.1 FCC Part 22.917 (a); FCC Part 24.238 (a); FCC Part 27.53 (h)

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

##### 7.1.2.2 RSS-132 Part 5.5; RSS-133 Part 6.5; RSS-139 Part 6.6 Transmitter Unwanted Emissions

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

i. In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least  $43 + 10 \log_{10} p$  (watts).

ii. After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least  $43 + 10 \log_{10} p$  (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

Note: The limit calculation result is a constant of -13 dBm.

**7.1.3 Test conditions and setup:**

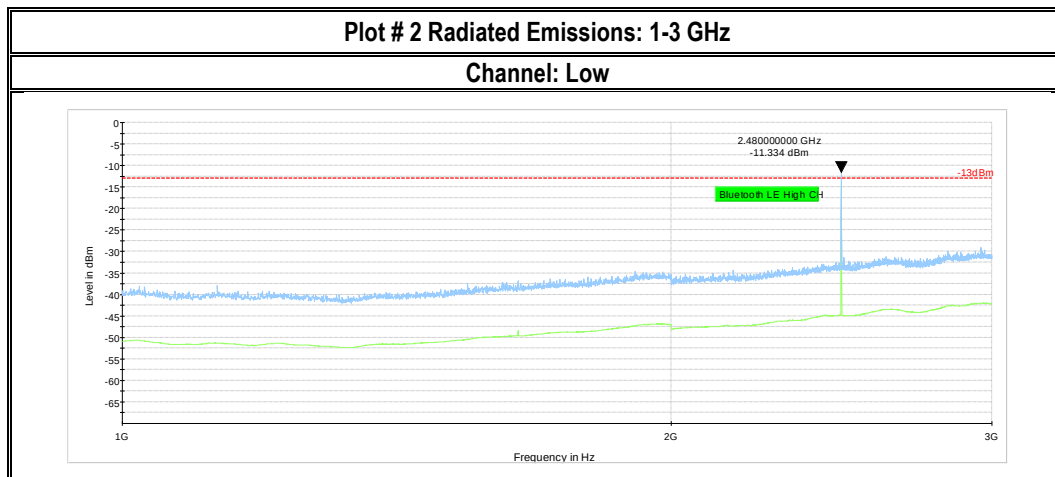
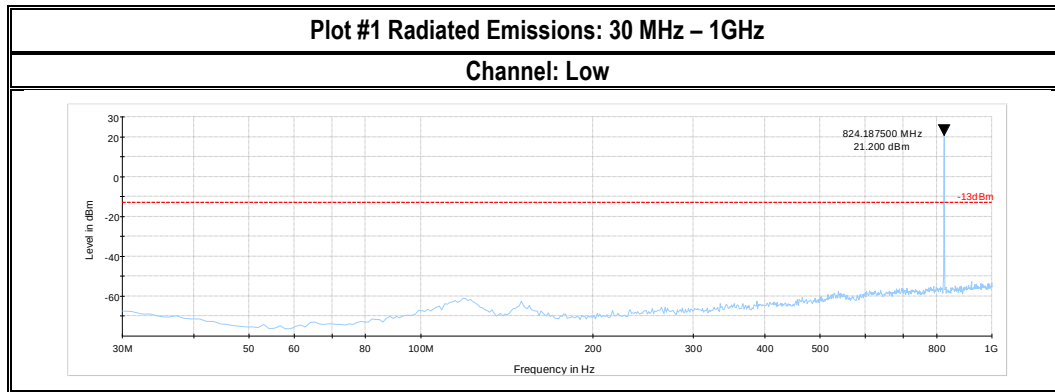
| Ambient Temperature (C) | EUT Set-Up # | EUT operating mode                                                                          | Power Input |
|-------------------------|--------------|---------------------------------------------------------------------------------------------|-------------|
| 22                      | 1            | GSM 850 / 1900 or FDD II / FDD V<br>+ Worst Case Bluetooth(Bluetooth<br>8DPSK High Channel) | 12VDC       |

**7.1.4 Measurement result:**

| Plot # | Channel | EUT operating mode | Scan Frequency  | Limit (dBm) | Result |
|--------|---------|--------------------|-----------------|-------------|--------|
| 1-3    | Low     | GSM 850            | 30 MHz – 18 GHz | -13         | Pass   |
| 4-7    | Mid     | GSM 850            | 9 kHz – 18 GHz  | -13         | Pass   |
| 8-10   | High    | GSM 850            | 30 MHz – 18 GHz | -13         | Pass   |
| 11-13  | Low     | GSM 1900           | 30 MHz – 18 GHz | -13         | Pass   |
| 14-18  | Mid     | GSM 1900           | 9 kHz – 26 GHz  | -13         | Pass   |
| 19-21  | High    | GSM 1900           | 30 MHz – 18 GHz | -13         | Pass   |
| 22-24  | Low     | FDD V              | 30 MHz – 18 GHz | -13         | Pass   |
| 25-28  | Mid     | FDD V              | 9 kHz – 18 GHz  | -13         | Pass   |
| 29-31  | High    | FDD V              | 30 MHz – 18 GHz | -13         | Pass   |
| 32-34  | Low     | FDD II             | 30 MHz – 18 GHz | -13         | Pass   |
| 35-39  | Mid     | FDD II             | 9 kHz – 26 GHz  | -13         | Pass   |
| 40-42  | High    | FDD II             | 30 MHz – 18 GHz | -13         | Pass   |

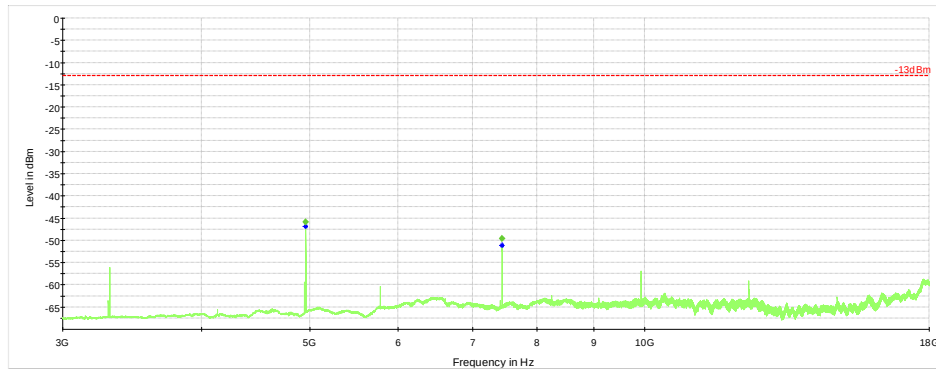
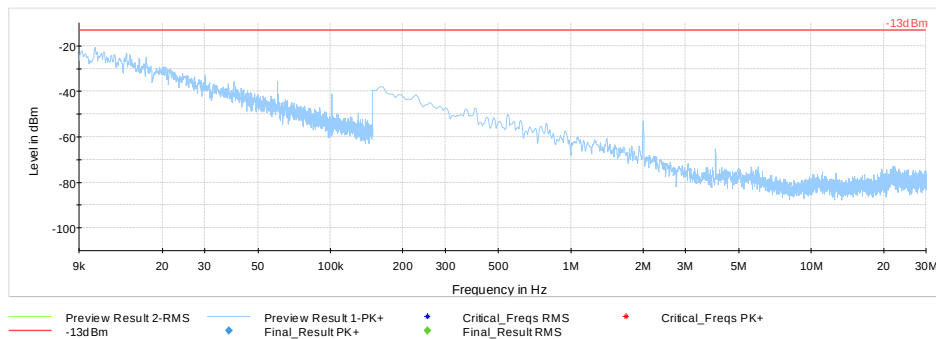
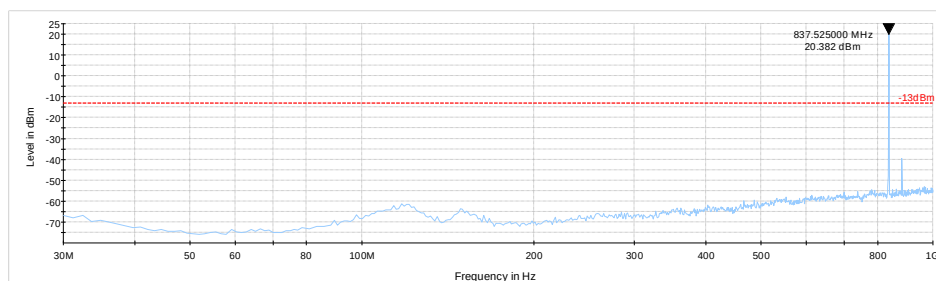
## 7.1.5 Measurement Plots:

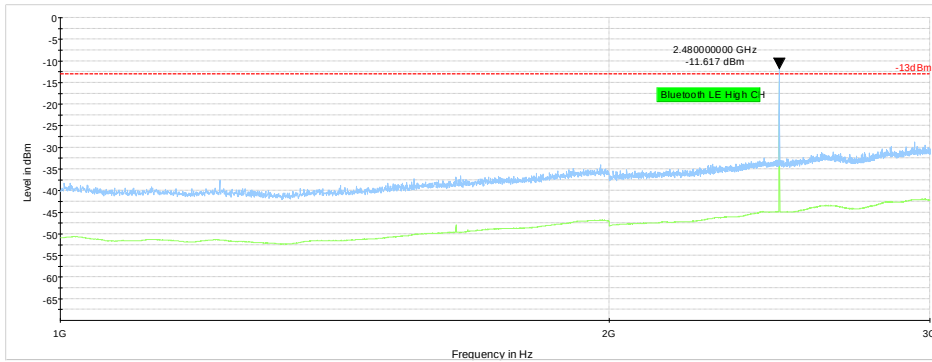
### 7.1.6 GSM 850



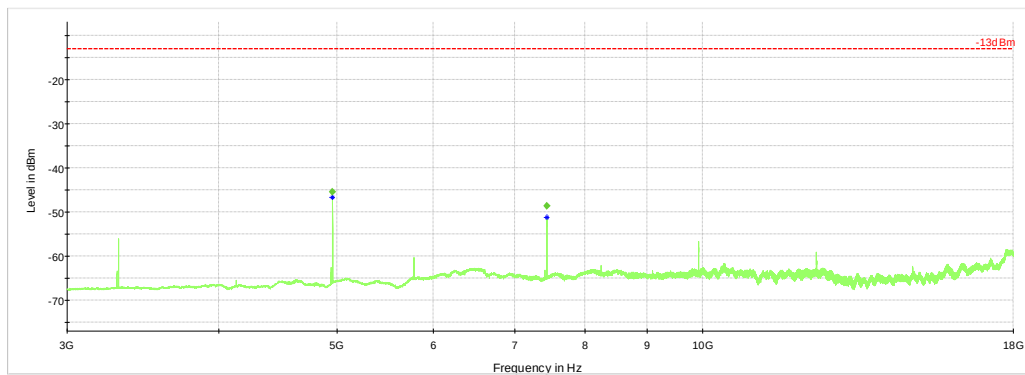
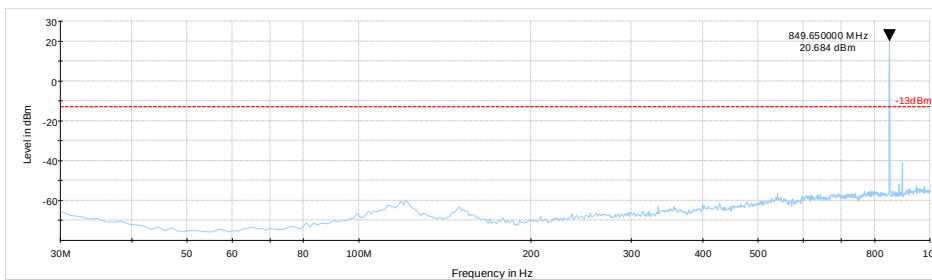
**Plot # 3 Radiated Emissions: 3-18 GHz****Channel: Low****Final Result**

| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 4960.000000     | ---           | -45.95    | ---         | ---         | 10.0            | 1000.000        | 267.0       | V   | 93.0          | -          |
| 7439.500000     | ---           | -49.54    | ---         | ---         | 10.0            | 1000.000        | 153.0       | H   | 18.0          | -95.4      |

**Plot # 4 Radiated Emissions: 9 kHz-30 MHz****Channel: Mid****Plot #5 Radiated Emissions: 30 MHz – 1GHz****Channel: Mid**

**Plot #6 Radiated Emissions: 1-3 GHz****Channel: Mid****Plot # 7 Radiated Emissions: 3-18 GHz****Channel: Mid****Final Result**

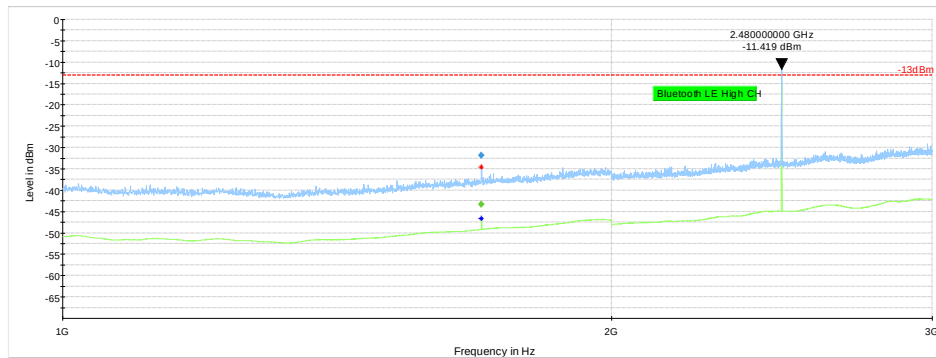
| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 4960.000000     | ---           | -45.54    | ---         | ---         | 10.0            | 1000.000        | 162.0       | V   | 92.0          | -100.0     |
| 7439.500000     | ---           | -48.64    | ---         | ---         | 10.0            | 1000.000        | 157.0       | H   | 20.0          | -95.4      |

**Plot # 8 Radiated Emissions: 30 MHz – 1GHz****Channel: High**

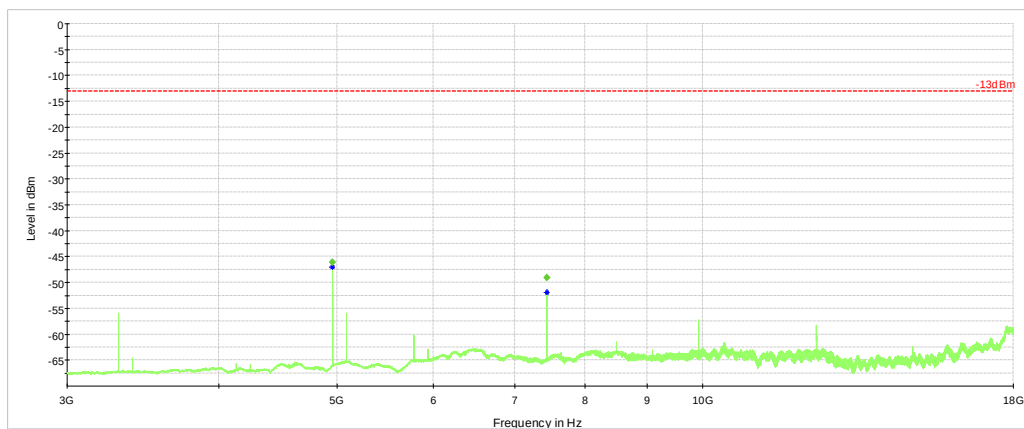


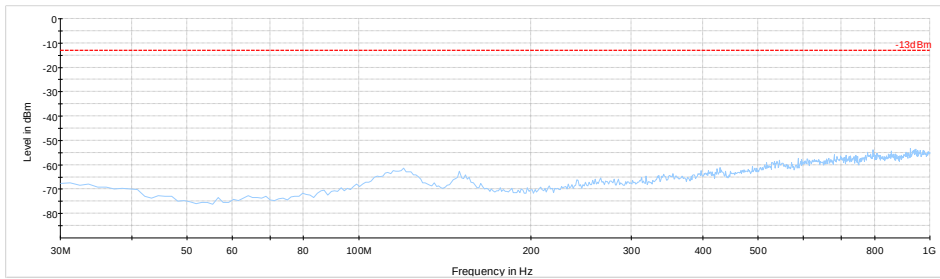
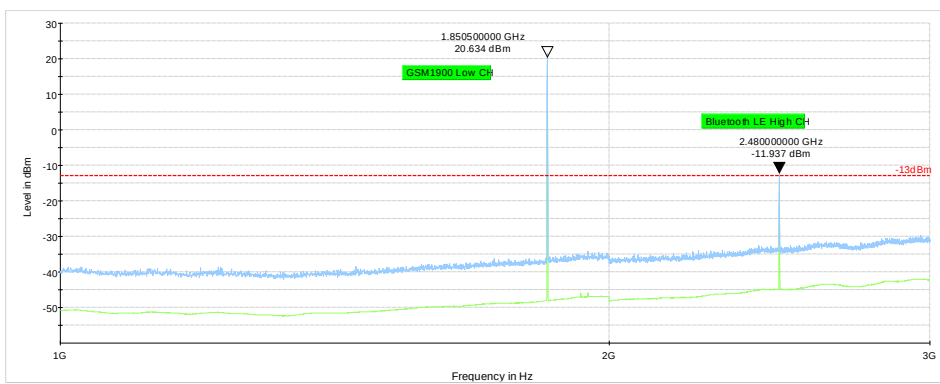
**Plot # 9 Radiated Emissions: 1-3 GHz****Channel: High****Final Result**

| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 1697.500000     | ---           | -43.39    | ---         | ---         | 500.0           | 1000.000        | 172.0       | H   | 46.0          | -62.9      |
| 1697.500000     | -31.85        | ---       | ---         | ---         | 500.0           | 1000.000        | 155.0       | H   | 46.0          | -62.9      |

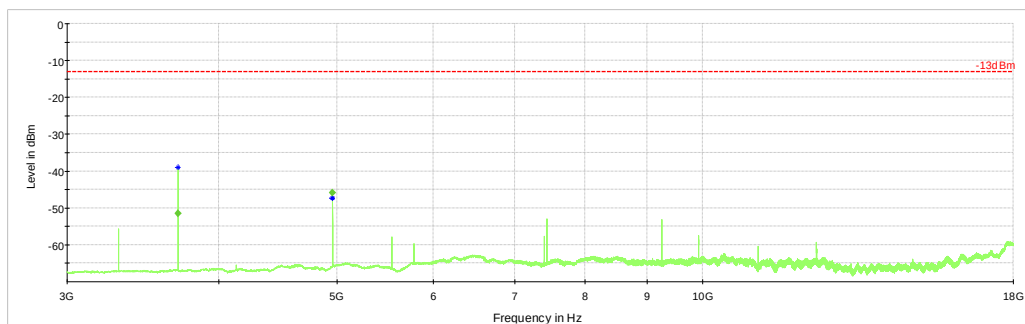
**Plot # 10 Radiated Emissions: 3-18 GHz****Channel: High****Final Result**

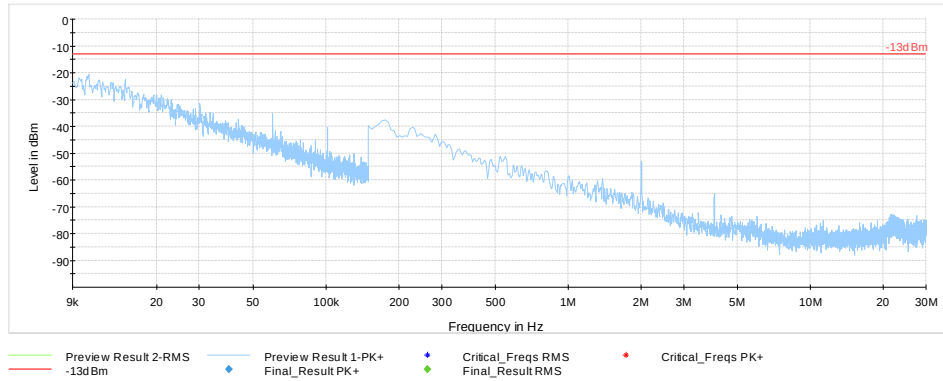
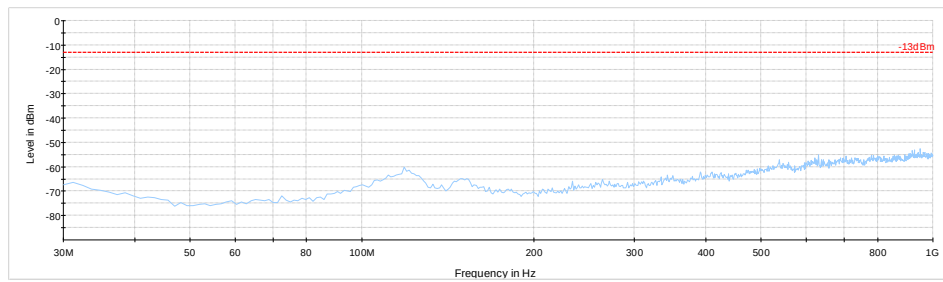
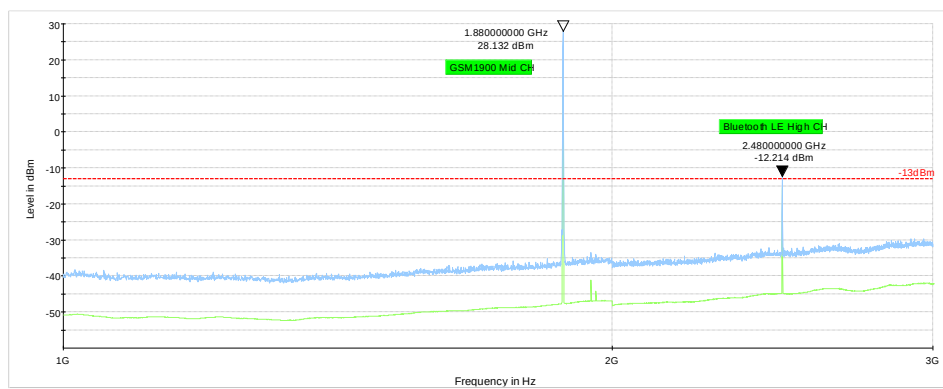
| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 4960.000000     | ---           | -46.11    | ---         | ---         | 10.0            | 1000.000        | 164.0       | V   | 93.0          | -100.0     |
| 7439.500000     | ---           | -49.05    | ---         | ---         | 10.0            | 1000.000        | 151.0       | H   | 18.0          | -95.4      |



**7.1.7 GSM 1900****Plot # 11 Radiated Emissions: 30 MHz – 1GHz****Channel: Low****Plot # 12 Radiated Emissions: 1-3 GHz****Channel: Low****Plot # 13 Radiated Emissions: 3-18 GHz****Channel: Low****Final Result**

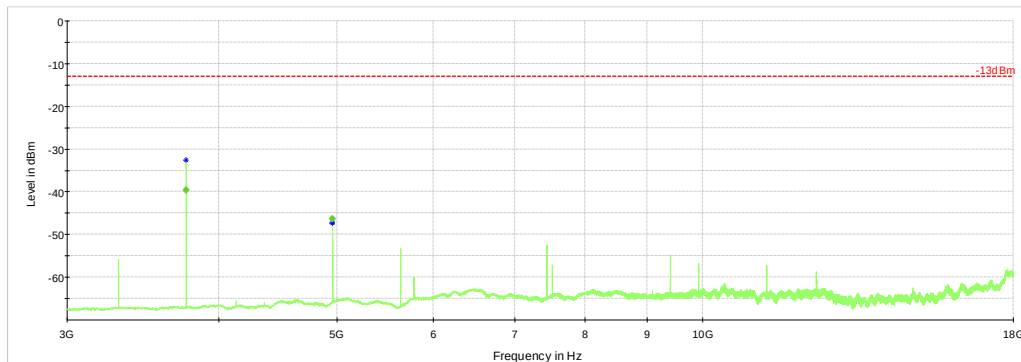
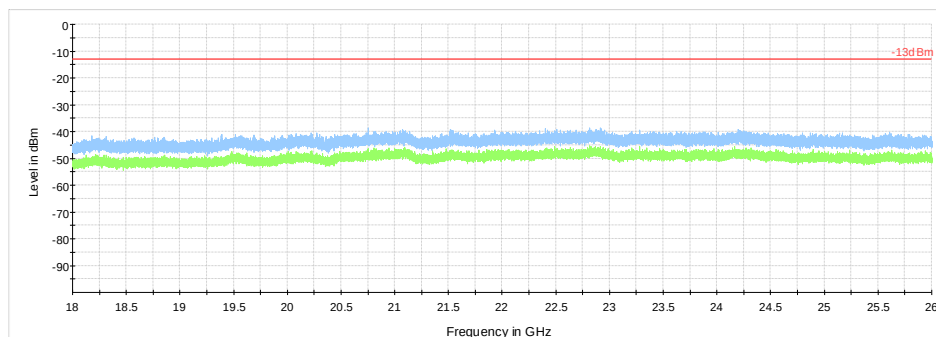
| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 3701.000000     | ---           | -51.49    | ---         | ---         | 10.0            | 1000.000        | 157.0       | V   | 101.0         | -101.8     |
| 4960.000000     | ---           | -45.93    | ---         | ---         | 10.0            | 1000.000        | 264.0       | V   | 96.0          | -100.0     |



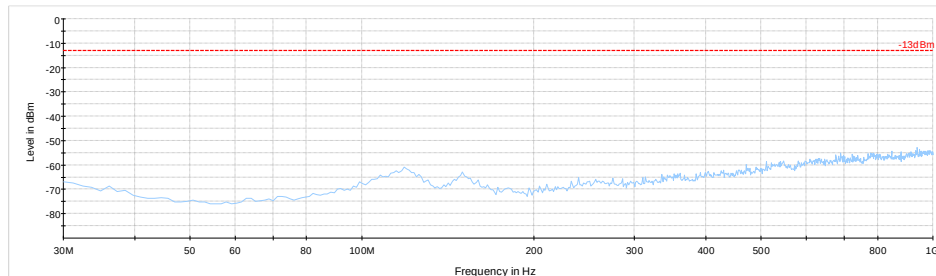
**Plot # 14 Radiated Emissions: 9 kHz-30 MHz****Channel: Mid****Plot #15 Radiated Emissions: 30 MHz – 1GHz****Channel: Mid****Plot #16 Radiated Emissions: 1-3 GHz****Channel: Mid**

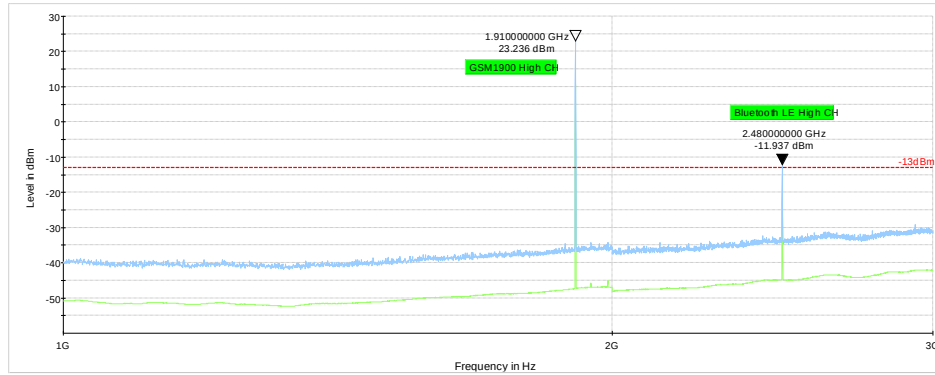
**Plot # 17 Radiated Emissions: 3-18 GHz****Channel: Mid****Final Result**

| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 3760.000000     | ---           | -39.69    | ---         | ---         | 10.0            | 1000.000        | 210.0       | H   | 181.0         | -101.6     |
| 4960.000000     | ---           | -46.30    | ---         | ---         | 10.0            | 1000.000        | 268.0       | V   | 94.0          | -100.0     |

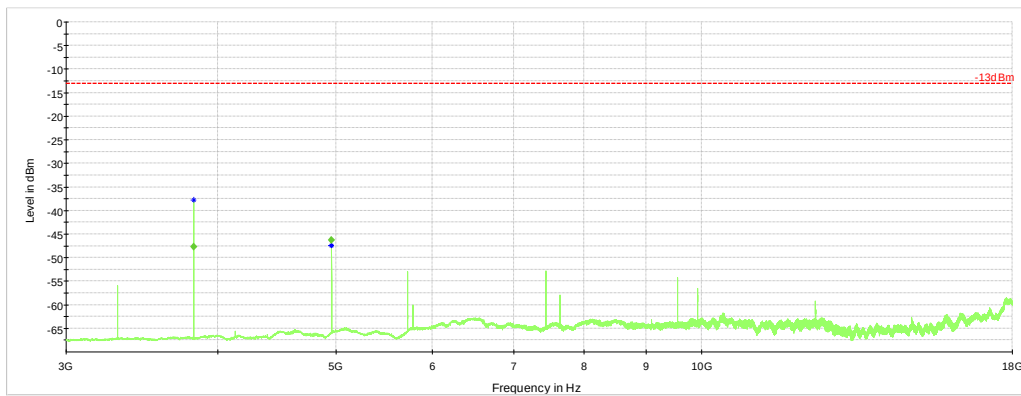
**Plot #18 Radiated Emissions: 18-26 GHz****Channel: Mid**

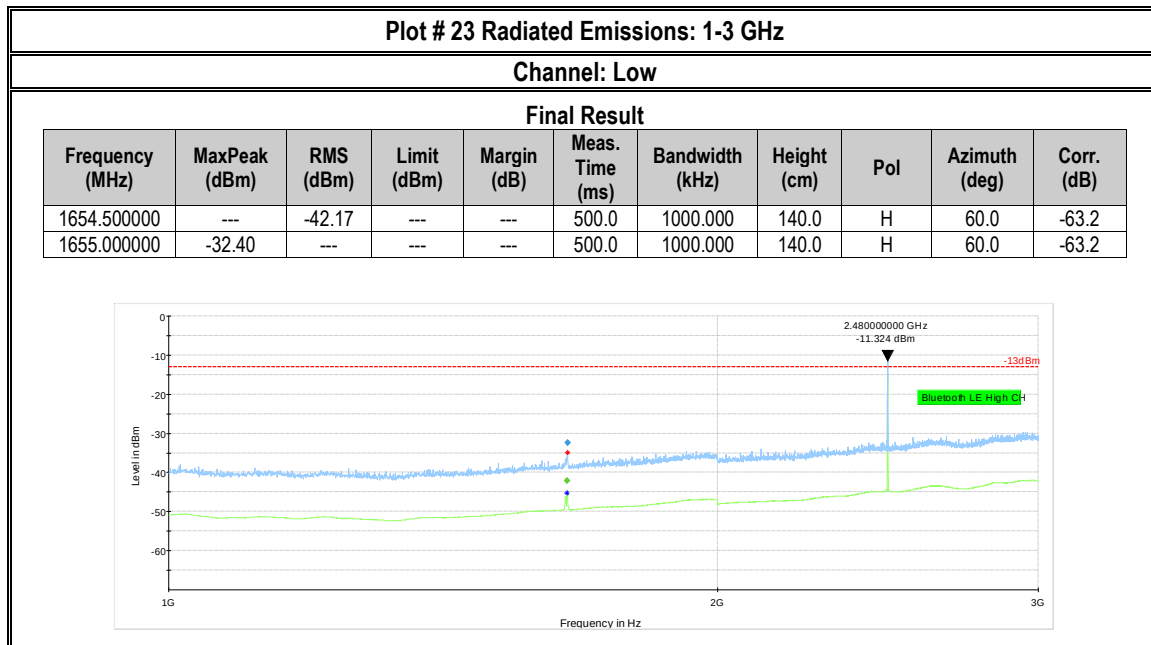
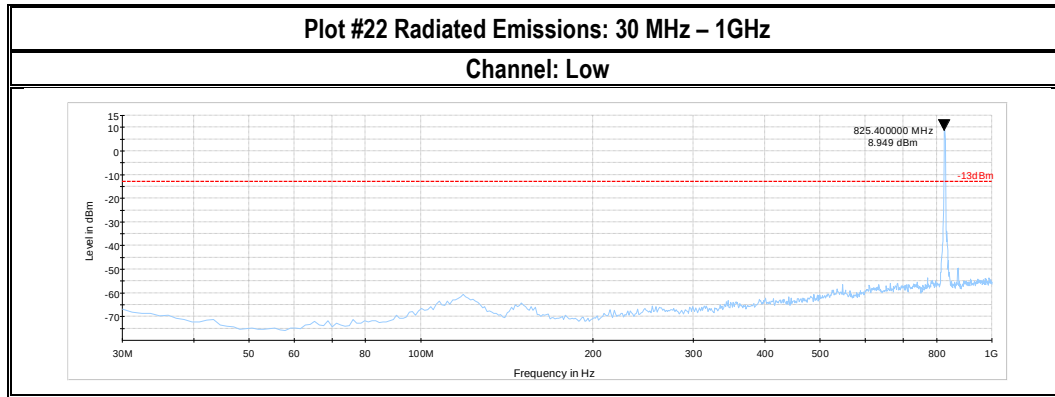
Preview Result 2-RMS    Preview Result 1-PK+    Critical\_Freqs RMS    Critical\_Freqs PK+  
-13dBm    Final\_Result PK+    Final\_Result RMS

**Plot #19 Radiated Emissions: 30 MHz – 1GHz****Channel: High**

**Plot #20 Radiated Emissions: 1-3 GHz****Channel: High****Plot # 21 Radiated Emissions: 3-18 GHz****Channel: High****Final Result**

| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 3820.000000     | ---           | -47.70    | ---         | ---         | 10.0            | 1000.000        | 152.0       | H   | 173.0         | -101.7     |
| 4960.000000     | ---           | -46.27    | ---         | ---         | 10.0            | 1000.000        | 266.0       | V   | 94.0          | -100.0     |



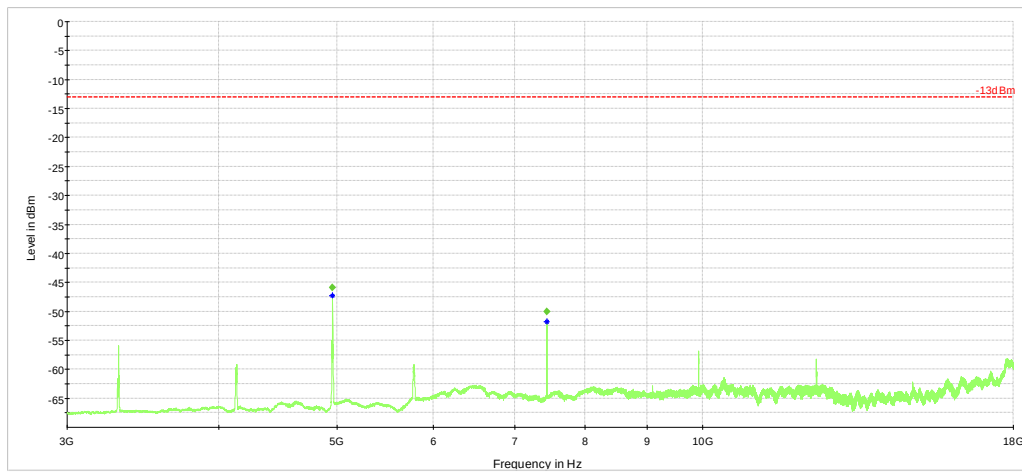
**7.1.8 FDD V**

## Plot # 24 Radiated Emissions: 3-18 GHz

Channel: Low

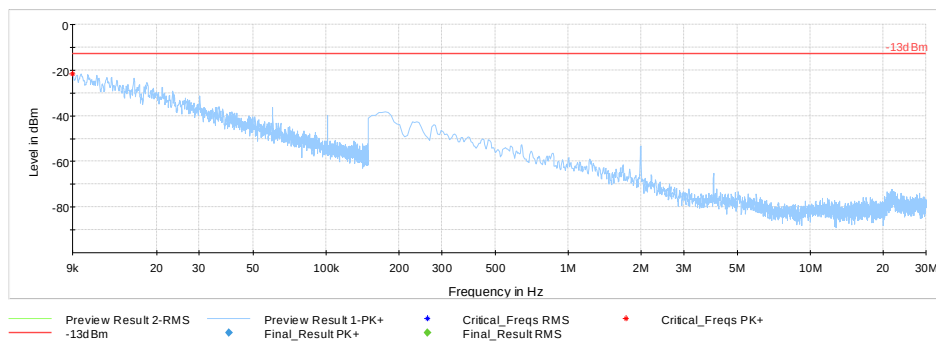
## Final Result

| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 4960.000000     | ---           | -45.94    | ---         | ---         | 10.0            | 1000.000        | 260.0       | V   | 96.0          | -100.0     |
| 7439.500000     | ---           | -50.09    | ---         | ---         | 10.0            | 1000.000        | 156.0       | H   | 19.0          | -95.4      |



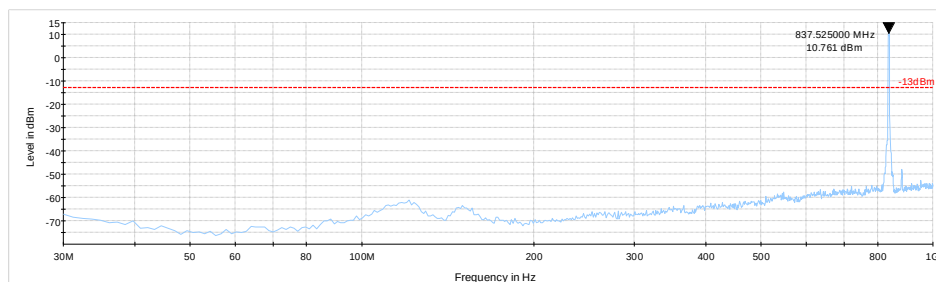
## Plot # 25 Radiated Emissions: 9 kHz-30 MHz

Channel: Mid



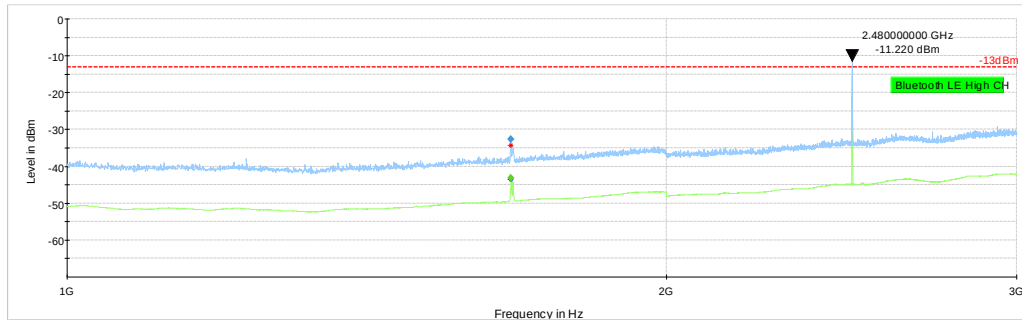
## Plot #26 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid

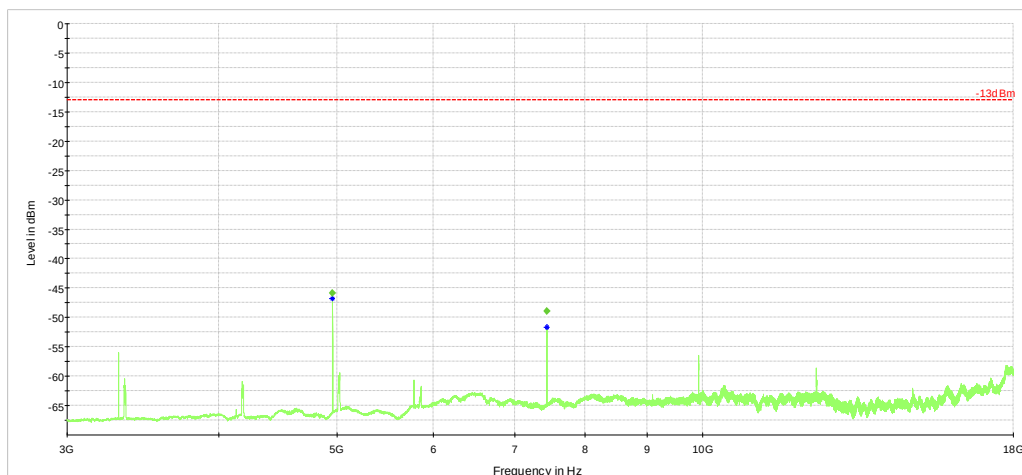


**Plot # 27 Radiated Emissions: 1-3 GHz****Channel: Mid****Final Result**

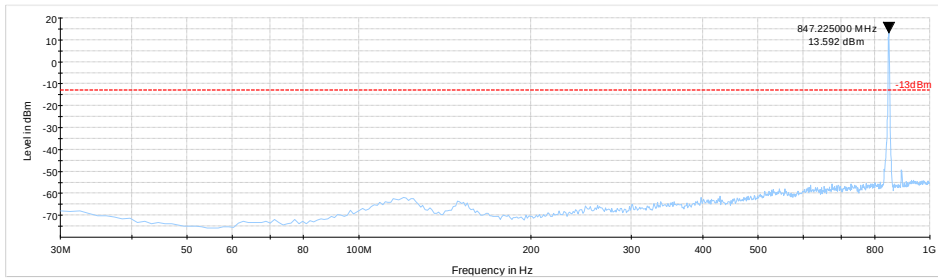
| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 1671.000000     | -32.62        | ---       | ---         | ---         | 500.0           | 1000.000        | 186.0       | H   | 54.0          | -63.1      |
| 1671.500000     | ---           | -43.11    | ---         | ---         | 500.0           | 1000.000        | 170.0       | H   | 54.0          | -63.1      |

**Plot # 28 Radiated Emissions: 3-18 GHz****Channel: Mid****Final Result**

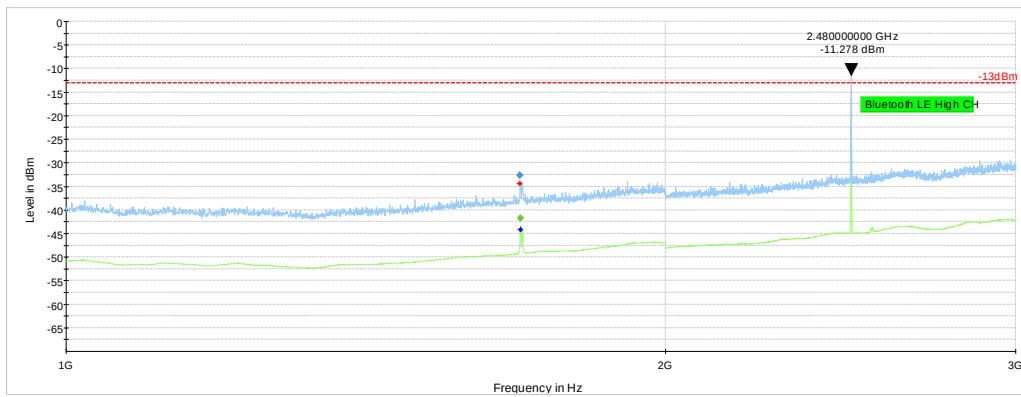
| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 4960.000000     | ---           | -45.86    | ---         | ---         | 10.0            | 1000.000        | 161.0       | V   | 93.0          | -100.0     |
| 7439.500000     | ---           | -48.94    | ---         | ---         | 10.0            | 1000.000        | 157.0       | H   | 20.0          | -95.4      |





**Plot #29 Radiated Emissions: 30 MHz – 1GHz****Channel: High****Plot # 30 Radiated Emissions: 1-3 GHz****Channel: High****Final Result**

| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 1690.500000     | -32.66        | ---       | ---         | ---         | 500.0           | 1000.000        | 172.0       | H   | 53.0          | -63.0      |
| 1691.500000     | ---           | -41.74    | ---         | ---         | 500.0           | 1000.000        | 154.0       | H   | 53.0          | -63.0      |

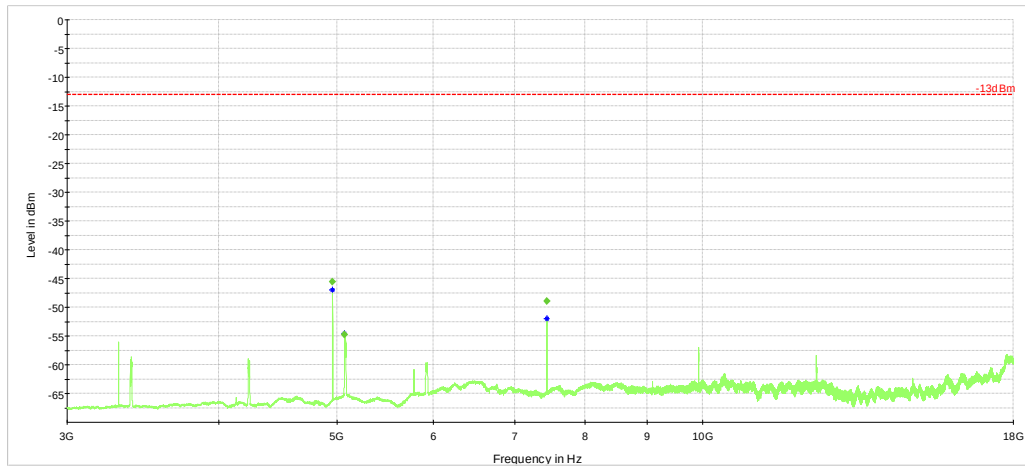


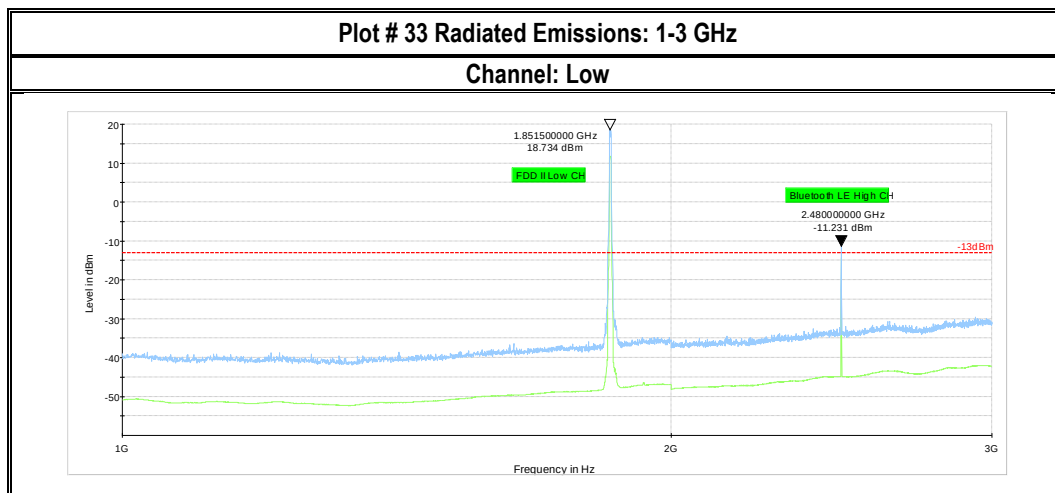
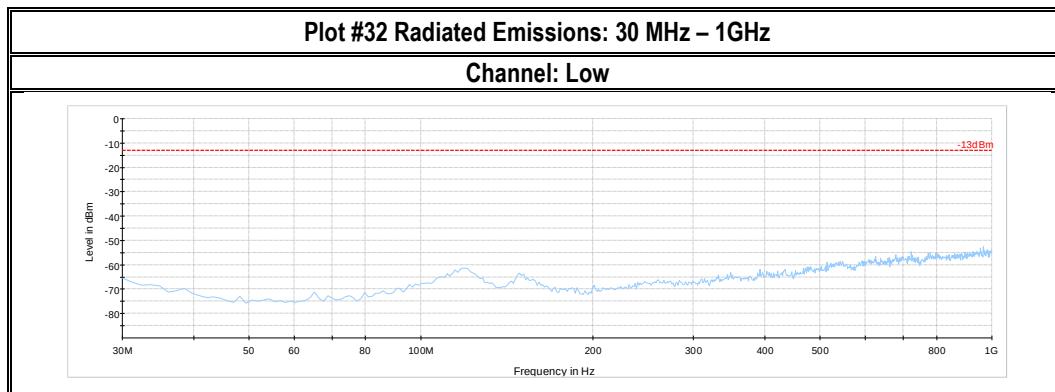
## Plot # 31 Radiated Emissions: 3-18 GHz

Channel: High

## Final Result

| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 4960.000000     | ---           | -45.62    | ---         | ---         | 10.0            | 1000.000        | 266.0       | V   | 95.0          | -100.0     |
| 5074.000000     | ---           | -54.73    | ---         | ---         | 10.0            | 1000.000        | 178.0       | H   | -8.0          | -99.1      |
| 7439.500000     | ---           | -48.99    | ---         | ---         | 10.0            | 1000.000        | 157.0       | H   | 20.0          | -95.4      |



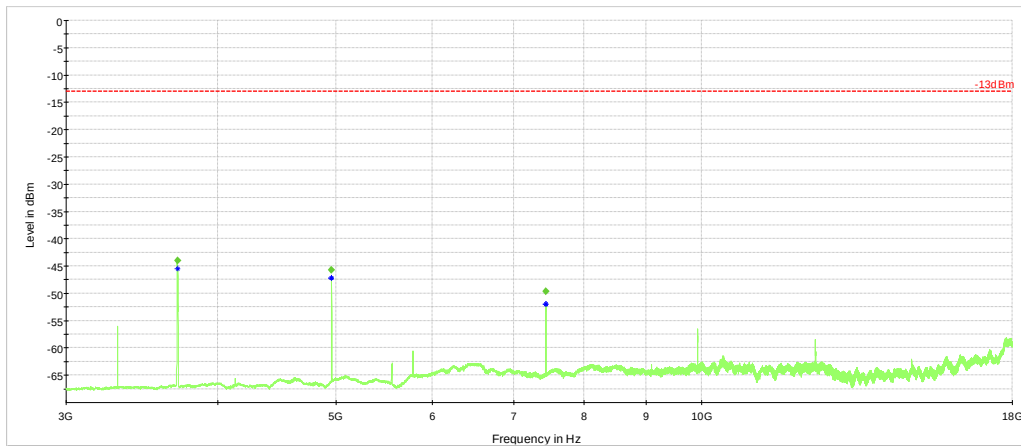
**7.1.9 FDD II**

## Plot # 34 Radiated Emissions: 3-18 GHz

Channel: Low

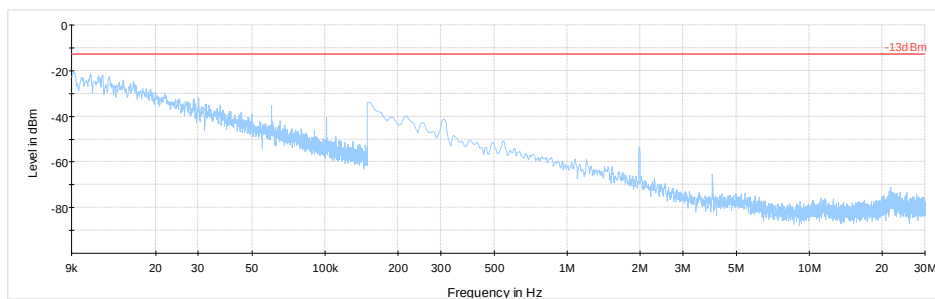
## Final Result

| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 3706.500000     | ---           | -44.05    | ---         | ---         | 10.0            | 1000.000        | 200.0       | H   | 13.0          | -101.8     |
| 4960.000000     | ---           | -45.67    | ---         | ---         | 10.0            | 1000.000        | 265.0       | V   | 94.0          | -100.0     |
| 7439.500000     | ---           | -49.67    | ---         | ---         | 10.0            | 1000.000        | 153.0       | H   | 18.0          | -95.4      |



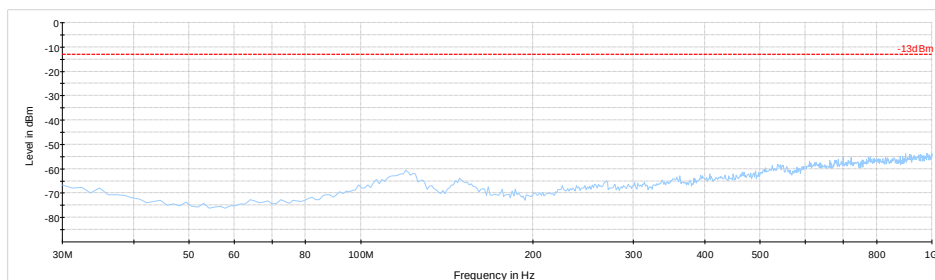
## Plot # 35 Radiated Emissions: 9 kHz-30 MHz

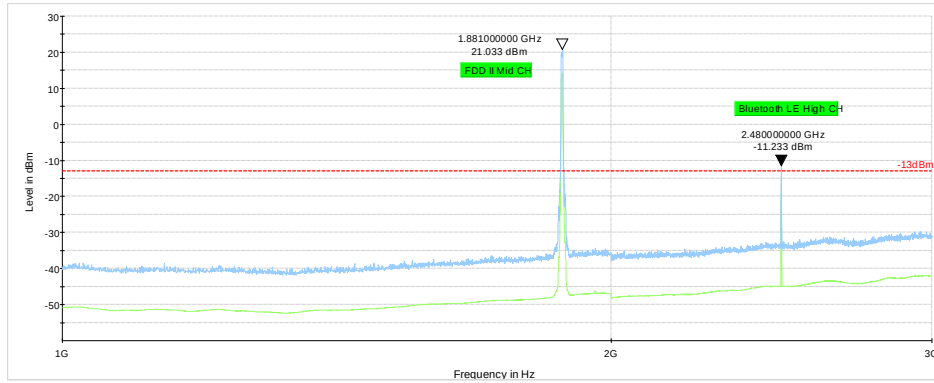
Channel: Mid



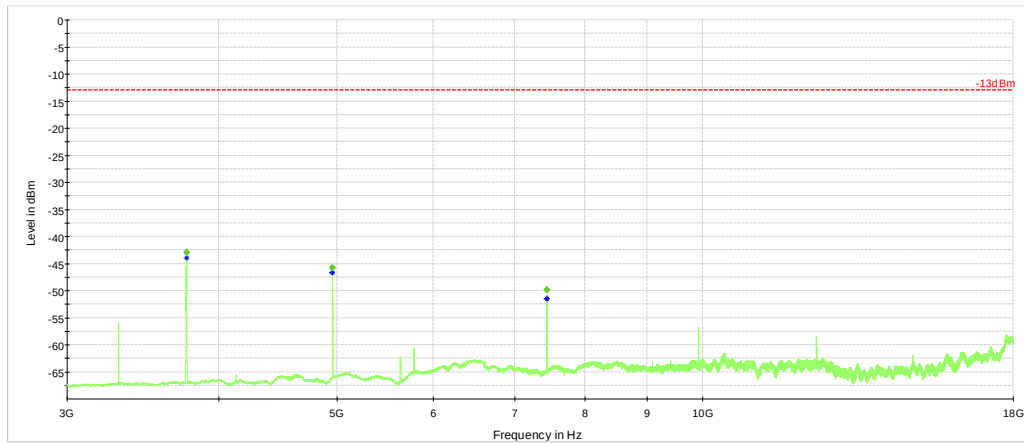
## Plot #36 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid



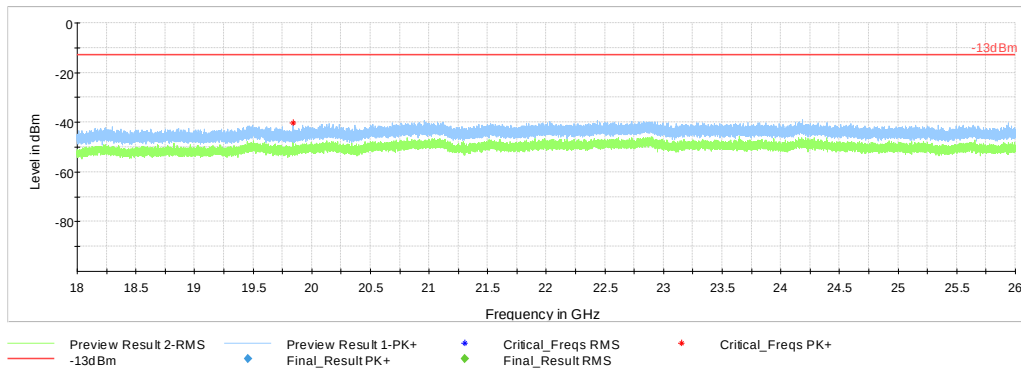
**Plot #37 Radiated Emissions: 1-3 GHz****Channel: Mid****Plot # 38 Radiated Emissions: 3-18 GHz****Channel: Mid****Final Result**

| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 3761.500000     | ---           | -43.00    | ---         | ---         | 10.0            | 1000.000        | 168.0       | H   | 18.0          | -101.6     |
| 4960.000000     | ---           | -45.84    | ---         | ---         | 10.0            | 1000.000        | 160.0       | V   | 93.0          | -100.0     |
| 7439.500000     | ---           | -49.87    | ---         | ---         | 10.0            | 1000.000        | 155.0       | H   | 19.0          | -95.4      |



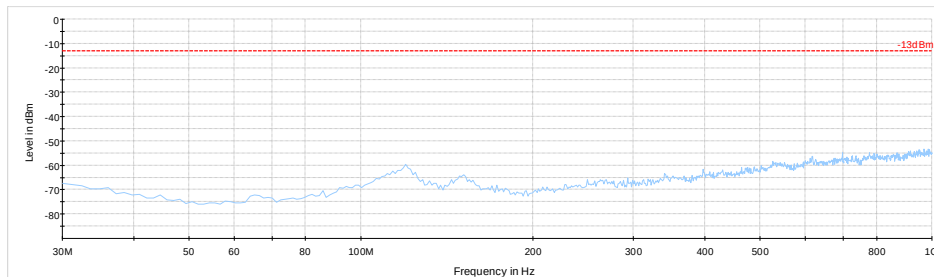
Plot # 39 Radiated Emissions: 18-26 GHz

Channel: Mid



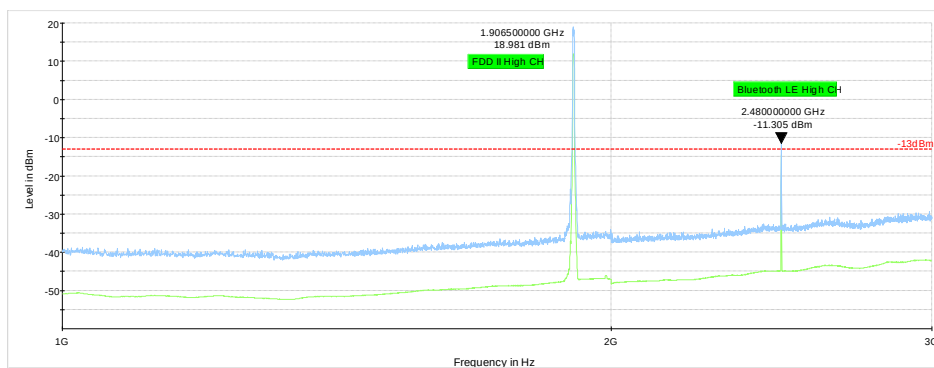
Plot #40 Radiated Emissions: 30 MHz – 1GHz

Channel: High



Plot #41 Radiated Emissions: 1-3 GHz

Channel: High

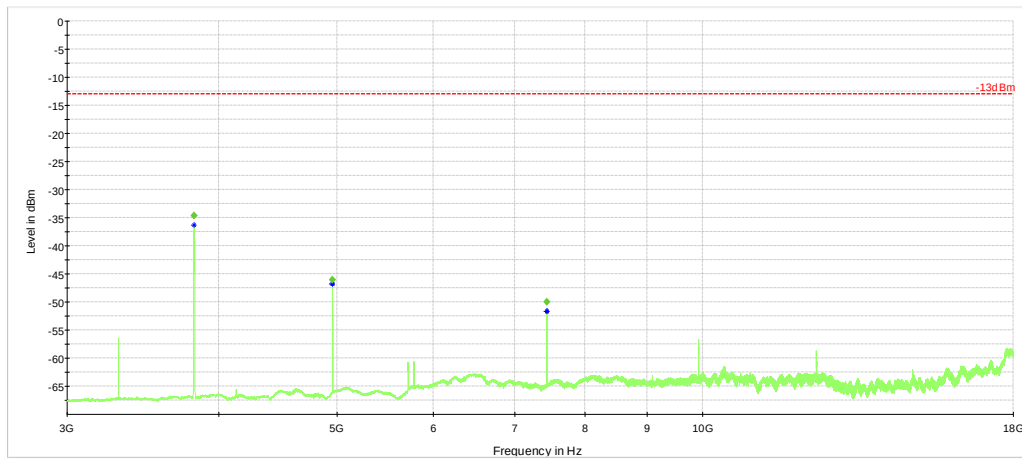


## Plot # 42 Radiated Emissions: 3-18 GHz

Channel: High

## Final Result

| Frequency (MHz) | MaxPeak (dBm) | RMS (dBm) | Limit (dBm) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|---------------|-----------|-------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 3817.000000     | ---           | -34.68    | ---         | ---         | 10.0            | 1000.000        | 171.0       | H   | 7.0           | -101.7     |
| 4960.000000     | ---           | -46.01    | ---         | ---         | 10.0            | 1000.000        | 163.0       | V   | 93.0          | -100.0     |
| 7439.500000     | ---           | -50.04    | ---         | ---         | 10.0            | 1000.000        | 153.0       | H   | 19.0          | -95.4      |



## 8 Test setup photos

Setup photos are included in supporting file name: "EMC\_CALAM\_064\_Setup\_photos.pdf"

## 9 Test Equipment And Ancillaries Used For Testing

| Item Name                  | Equipment Type             | Manufacturer    | Model     | Serial #   | Calibration Cycle | Last Calibration Date |
|----------------------------|----------------------------|-----------------|-----------|------------|-------------------|-----------------------|
| Antenna Loop 6507          | Active Loop Antenna        | ETS Lindgren    | 6507      | 161344     | 3 years           | 10/26/2017            |
| Antenna Biconilog 3142E    | Biconlog Antenna           | EMCO            | 3142E     | 166067     | 3 years           | 06/27/2017            |
| Antenna Horn 3115 SN 35111 | Horn Antenna               | EMCO            | 3115      | 35111      | 3 years           | 07/24/2015            |
| Antenna Horn 3117          | Horn Antenna               | ETS Lindgren    | 3117-PA   | 215984     | 3 years           | 01/26/2018            |
| Antenna Horn 3116          | Horn Antenna               | ETS Lindgren    | 3116      | 70497      | 3 years           | 07/22/2015            |
| EMI Test Receiver          | EMI Test Receiver          | Rohde & Schwarz | ESU40     | 100251     | 3 years           | 01/31/2018            |
| Digital Barometer          | Compact Digital Barometer  | Control Company | 35519-055 | 91119547   | 3 Years           | 06/08/2017            |
| CMU 200                    | Digital Radio Comm. Tester | R&S             | CMU 200   | 101821     | 2 Years           | 07/06/2017            |
| CBT                        | Bluetooth Tester           | R&S             | CBT       | 100212     | 2 Years           | 07/09/2017            |
| Thermometer Humidity TM325 | Thermometer Humidity       | Dickson         | TM325     | 16253651   | 1 Year            | 11/02/2017            |
| Agilent Signal Generator   | Signal Generator           | Agilent         | E4433B    | GB40050855 | N/A               | N/A                   |
| Turn table                 | Turn table                 | EMCO            | 2075      | N/A        | N/A               | N/A                   |
| MAPS Position Controller   | MAPS Position Controller   | ETS Lindgren    | 2092      | 0004-1510  | N/A               | N/A                   |
| Antenna Mast               | Antenna Mast               | EMCO            | 2075      | N/A        | N/A               | N/A                   |
| Relay Switch Unit          | Relay Switch Unit          | R&S             | RSU       | 338964/001 | N/A               | N/A                   |

Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.

Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.



**10 Revision History**

| Date       | Report Name             | Changes to report | Report prepared by |
|------------|-------------------------|-------------------|--------------------|
| 2018-06-20 | EMC_CALAM_064_FCC_22_24 | Initial Version   | Kevin Wang         |