

# EMC Test Report

**Project Number:** 4274013

**Report Number:** 4274013EMC02

**Revision Level:** 0

**Client:** Integrated M2M Technologies LLC

**Equipment Under Test:** iLocate GPS AutoTracker

**Model:** AT850218

**FCC ID:** 2A07F2733AT

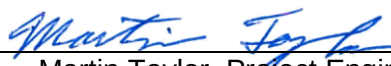
**Applicable Standards:** FCC Part 15 Subpart C, § 15.247

**ANSI C63.10: 2013**

**Report issued on:** 17 April 2018

**Test Result:** Compliant

Tested by:

A handwritten signature in blue ink, appearing to read 'Martin Taylor'.

Martin Taylor, Project Engineer

Reviewed by:

A handwritten signature in blue ink, appearing to read 'David Schramm'.

David Schramm, Operations Manager

*Remarks: This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.*

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## 1 Summary of Test Results

| Test Description                               | Test Specification | Test Result   |
|------------------------------------------------|--------------------|---------------|
| Bandwidth                                      | 15.247(d)          | Compliant     |
| Transmitter Output Power                       | 15.247(b)(3)       | Compliant     |
| Power Spectral Density                         | 15.247(e)          | Compliant     |
| Conducted Spurious Emissions / Band Edge       | 15.247(d)          | Compliant     |
| Radiated Spurious Emissions / Restricted Bands | 15.35(b),15.209    | Compliant     |
| Antenna Requirement                            | 15.203             | Compliant (1) |
| AC Powerline Conducted Emissions, Class A      | 15.107, 15.207     | N/A (2)       |

(1) The device uses an internal PCB trace antenna. It is not replaceable by the end user.

(2) Not Applicable. The EUT does not connect to the AC mains.

### 1.1 Modifications Required for Compliance

None

## 2 General Information

### 2.1 Client Information

Name: Integrated M2M Technologies LLC  
Address: 3773 Howard Hughes Pwky, Suite 500S  
City, State, Zip, Country: Las Vegas, NV 89169, USA

### 2.2 Test Laboratory

Name: SGS North America, Inc.  
Address: 620 Old Peachtree Road NW, Suite 100  
City, State, Zip, Country: Suwanee, GA 30024, USA

Accrediting Body: A2LA  
Type of lab: Testing Laboratory  
Certificate Number: 3212.01

### 2.3 General Information of EUT

Type of Product: iLocate GPS AutoTracker  
Model Number: AT850218  
Serial Number: Not labeled  
FCC ID: 2AO7F2733AT

Frequency Range: 2402 – 2480 MHz  
Data Modes: Bluetooth Low Energy  
Antenna: PCB Trace Antenna (1.2dB)

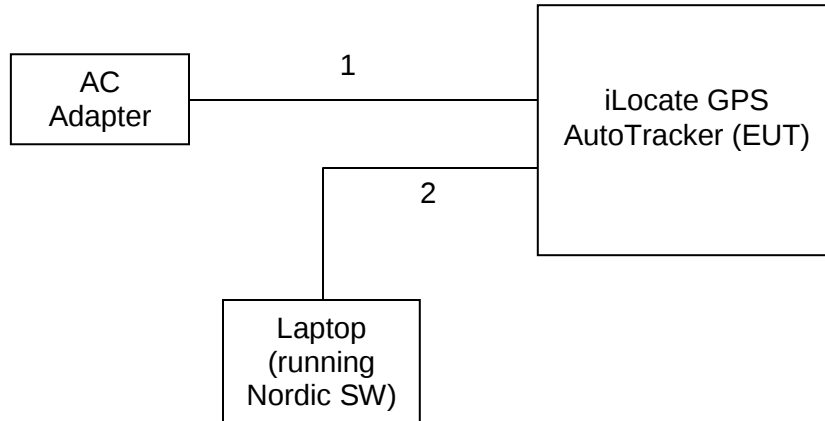
Rated Voltage: 8 – 20 Vdc  
Test Voltage: 12 Vdc

Sample Received Date: 19 March 2018  
Dates of testing: 05-16 April 2018

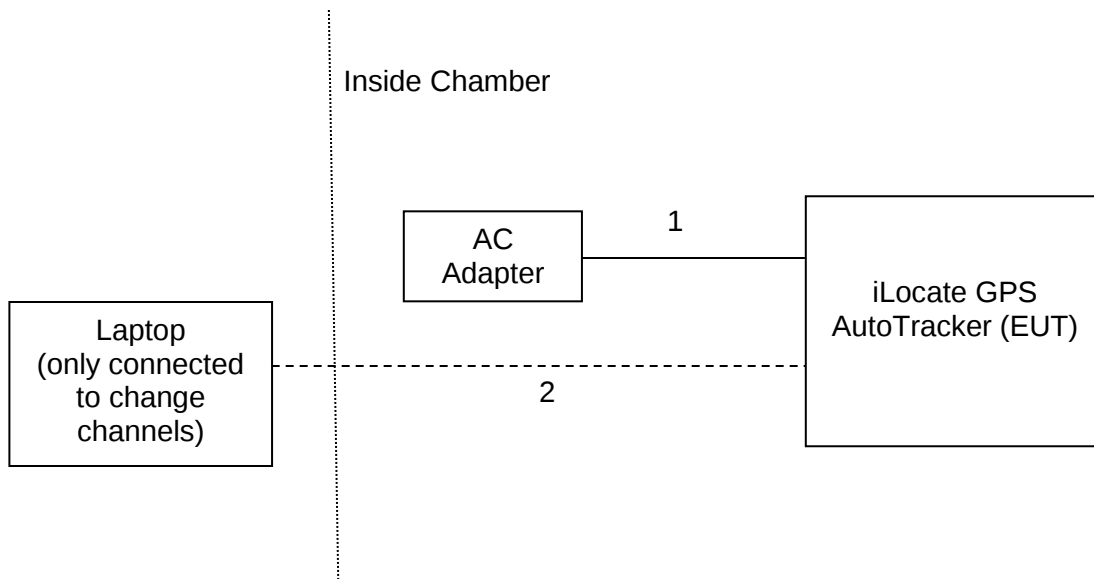
### 2.4 Operating Modes and Conditions

Continuous traffic was generated using test commands. Where the duty cycle measured below 99% and an RMS detector was employed, corrections of  $10 \cdot \log(1/D)$  were applied according to KDB publication 558074 D01 DTS Meas Guidance v04.

## 2.5 EUT Connection Block Diagram – Conducted Measurements



## 2.6 EUT Connection Block Diagram – Radiated Measurements



## 2.7 System Configurations

| Manufacturer                    | Description             | Model Number | Serial Number |
|---------------------------------|-------------------------|--------------|---------------|
| Integrated M2M Technologies LLC | iLocate GPS AutoTracker | AT850218     | Not labeled   |
| V-Infinity                      | AC Adapter              | EPS120050    | Not labeled   |

## 2.8 Cable List

| Cable reference | Port Name | Start           | End                      | Cable Length (m) | Ferrite installed? | Shielded? |
|-----------------|-----------|-----------------|--------------------------|------------------|--------------------|-----------|
| 1               | DC Power  | AC Adapter      | DC Power Jack (EUT)      | 1.8              | No                 | No        |
| 2               | Serial    | Laptop USB Port | Serial Port Header (EUT) | 1.8              | No                 | No        |

### 3 Bandwidth

#### 3.1 Test Result

| Test Description         | Test Specification |                                  | Test Result |
|--------------------------|--------------------|----------------------------------|-------------|
| 6 dB bandwidth / 99% OBW | 15.247(d)          | RSS-247 S5.2 (1)<br>RSS-GEN S6.6 | Compliant   |

#### 3.2 Test Method

The procedures from ANSI C63.10: 2013 clause 11.8 and 558074 D01 DTS Meas Guidance v04 were used to determine the 6 dB bandwidth and 99% OBW.

#### 3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.6 °C  
Relative Humidity: 26.8 %  
Atmospheric Pressure: 98.1 kPa

#### 3.4 Test Equipment

Test End Date: 5-Apr-2018

Tester: MT

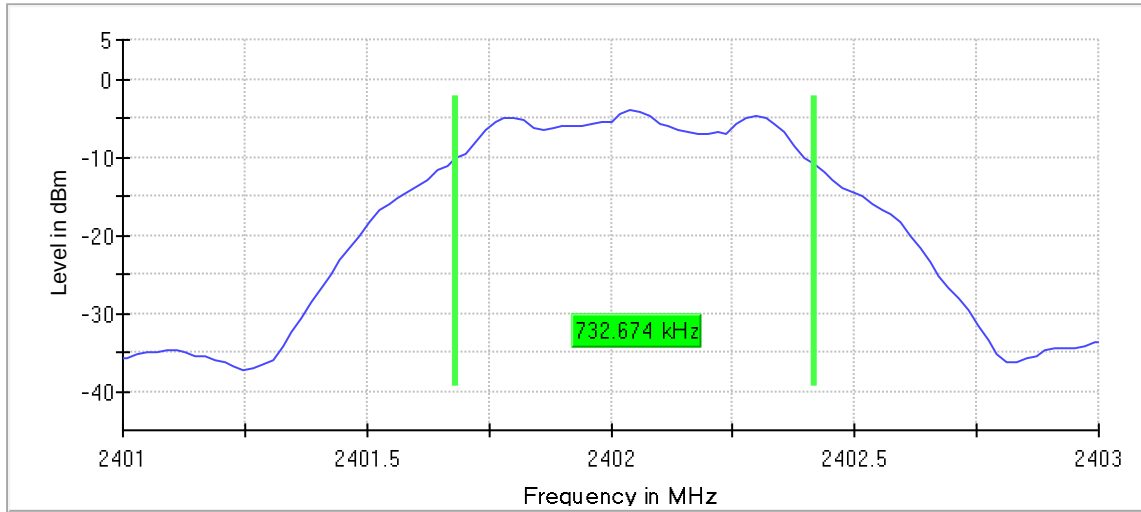
| Equipment                    | Model   | Manufacturer    | Asset Number | Cal Due Date |
|------------------------------|---------|-----------------|--------------|--------------|
| SIGNAL ANALYZER              | FSV30   | ROHDE & SCHWARZ | B085749      | 1-Nov-2019   |
| OPEN SWITCH AND CONTROL UNIT | OSP 120 | ROHDE & SCHWARZ | S/N: 101182  | CNR          |
| ATTENUATOR, 10DB             | 10DB    | ROHDE & SCHWARZ | B095591      | 28-Jul-2018  |
| RF CABLE                     | 141     | HUBER & SUHNER  | B095587      | 26-Jul-2018  |

Note: The equipment calibration period is 1 year except for the FSV which is on a 2 year cycle.

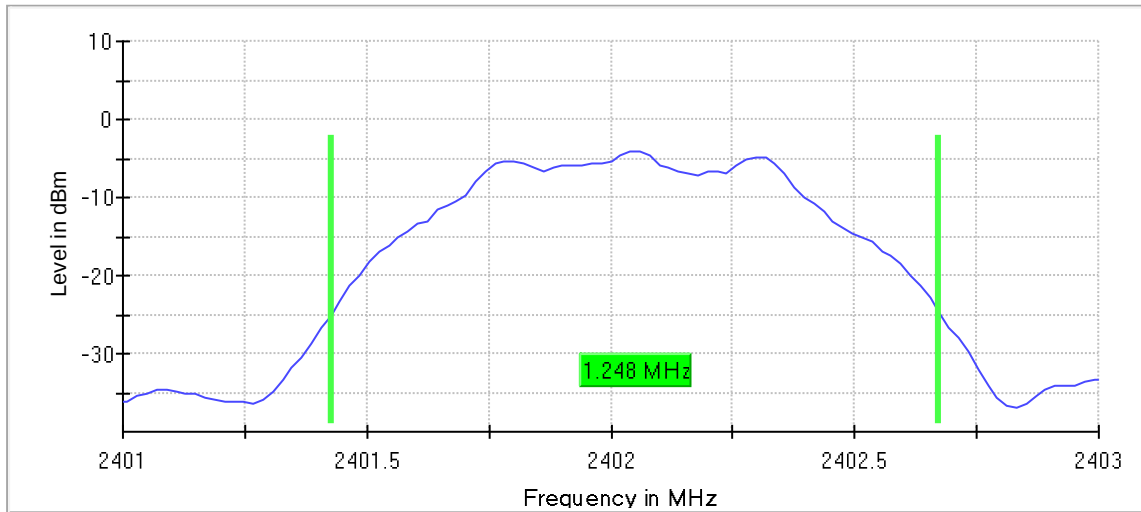
#### 3.5 Test Data

| Protocol | Channel | 6dB Bandwidth (MHz) | Occupied Bandwidth (99%) (MHz) |
|----------|---------|---------------------|--------------------------------|
| BLE      | 0       | 0.733               | 1.248                          |
| BLE      | 19      | 0.733               | 1.248                          |
| BLE      | 39      | 0.713               | 1.248                          |

### 6dB Bandwidth



### 99% Occupied Bandwidth



Plots at the low channel are representative of the mid and high channels.

## 4 Output Power

### 4.1 Test Result

| Test Description  | Test Specification |                  | Test Result |
|-------------------|--------------------|------------------|-------------|
| Peak Output Power | 15.247(b)(3)       | RSS-247 S5.4 (4) | Compliant   |

### 4.2 Test Method

Fundamental peak power measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.9 and KDB 558074 D01 Meas Guidance v04.

#### Limit

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. For using antennas with greater than 6dBi of gain, the limit is reduced in dB by the amount the gain exceeds 6dBi (e.g. for a 7.4dBi antenna, the limit is reduced from 30dBm to 28.6dBm)

### 4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

#### Environmental Conditions

Temperature: 24.6 °C  
Relative Humidity: 26.8 %  
Atmospheric Pressure: 98.1 kPa

### 4.4 Test Equipment

Test End Date: 5-Apr-2018

Tester: MT

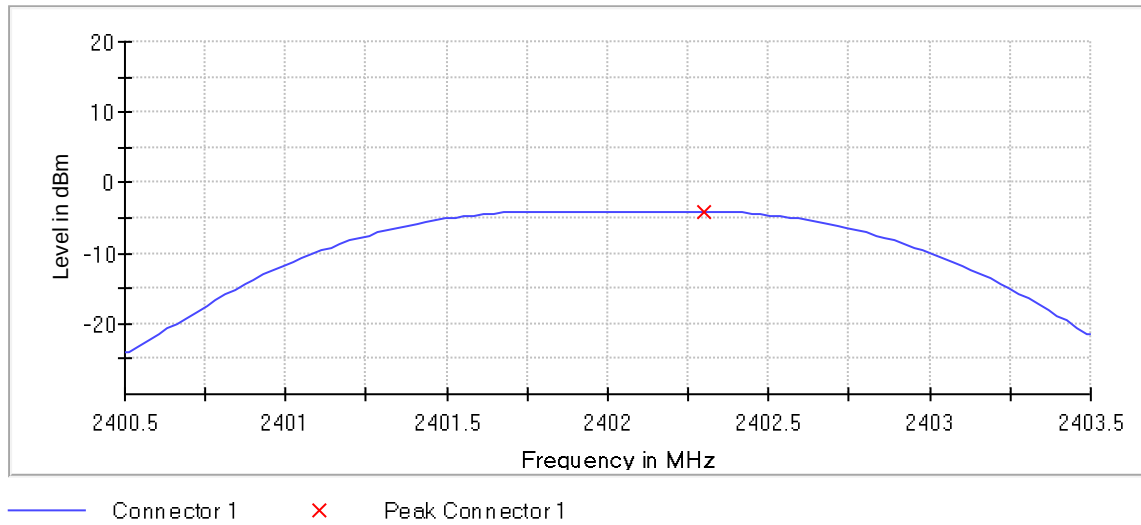
| Equipment                    | Model   | Manufacturer    | Asset Number | Cal Due Date |
|------------------------------|---------|-----------------|--------------|--------------|
| SIGNAL ANALYZER              | FSV30   | ROHDE & SCHWARZ | B085749      | 1-Nov-2019   |
| OPEN SWITCH AND CONTROL UNIT | OSP 120 | ROHDE & SCHWARZ | S/N: 101182  | CNR          |
| ATTENUATOR, 10DB             | 10DB    | ROHDE & SCHWARZ | B095591      | 28-Jul-2018  |
| RF CABLE                     | 141     | HUBER & SUHNER  | B095587      | 26-Jul-2018  |

Note: The equipment calibration period is 1 year except for the FSV which is on a 2 year cycle.

#### 4.5 Test Data

| Protocol | Channel | Peak Power (dBm) | Limit (dBm) | Margin (dB) |
|----------|---------|------------------|-------------|-------------|
| BLE      | 0       | -3.6             | 30          | -34.1       |
| BLE      | 19      | -3.8             | 30          | -34.3       |
| BLE      | 39      | -4.2             | 30          | -34.7       |

Sample Plot:



## 5 Power Spectral Density

### 5.1 Test Result

| Test Description       | Test Specification |                  | Test Result |
|------------------------|--------------------|------------------|-------------|
| Power Spectral Density | 15.247(e)          | RSS-247 S5.2 (2) | Compliant   |

### 5.2 Test Method

Power spectral density measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.10 and KDB 558074 D01 Meas Guidance v04.

#### Limit

The limit is 8 dBm / 3 kHz.

### 5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

#### Environmental Conditions

Temperature: 24.6 °C  
Relative Humidity: 26.8 %  
Atmospheric Pressure: 98.1 kPa

### 5.4 Test Equipment

Test End Date: 5-Apr-2018

Tester: MT

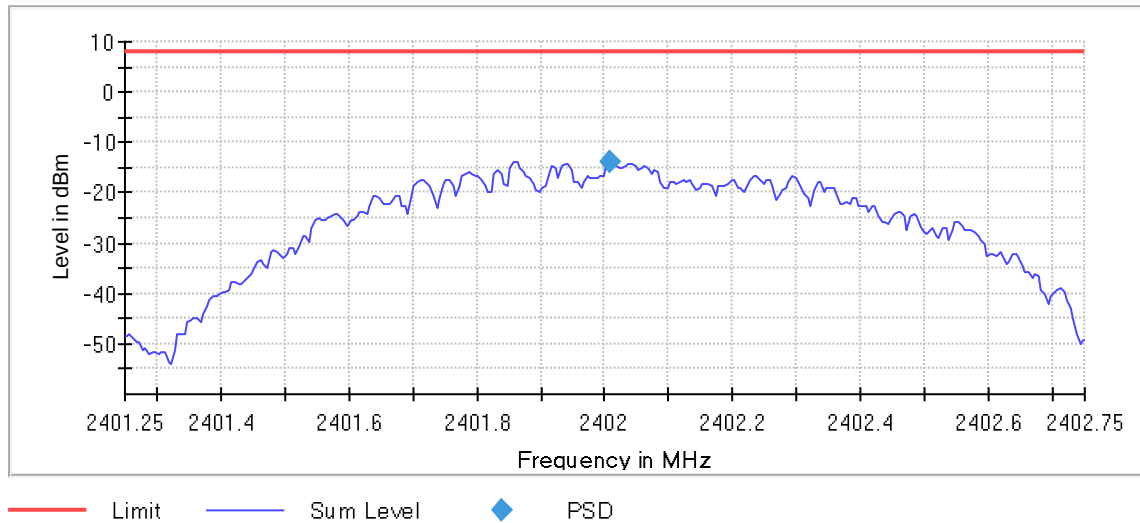
| Equipment                    | Model   | Manufacturer    | Asset Number | Cal Due Date |
|------------------------------|---------|-----------------|--------------|--------------|
| SIGNAL ANALYZER              | FSV30   | ROHDE & SCHWARZ | B085749      | 1-Nov-2019   |
| OPEN SWITCH AND CONTROL UNIT | OSP 120 | ROHDE & SCHWARZ | S/N: 101182  | CNR          |
| ATTENUATOR, 10DB             | 10DB    | ROHDE & SCHWARZ | B095591      | 28-Jul-2018  |
| RF CABLE                     | 141     | HUBER & SUHNER  | B095587      | 26-Jul-2018  |

Note: The equipment calibration period is 1 year except for the FSV which is on a 2 year cycle.

## 5.5 Test Data

| Protocol | Channel | Peak PSD (dBm/3kHz) | Limit (dBm/3kHz) | Margin (dB) |
|----------|---------|---------------------|------------------|-------------|
| BLE      | 0       | -13.77              | 8                | -21.77      |
| BLE      | 19      | -14.10              | 8                | -22.10      |
| BLE      | 39      | -14.39              | 8                | -22.39      |

Sample Plot:



## 6 Conducted Spurious Emissions / Band Edge

### 6.1 Test Result

| Test Description             | Test Specification |              | Test Result |
|------------------------------|--------------------|--------------|-------------|
| Conducted Spurious Emissions | 15.247(d)          | RSS-247 S5.5 | Compliant   |

### 6.2 Test Method

Spurious emissions in non-restricted frequency bands were recorded using the methods defined in ANSI C63.10: 2013 clause 11.11 and KDB 558074 D01 Meas Guidance v04.

Lowest, middle, and highest channels were investigated.

Because the maximum conducted peak output power was used to determine compliance with the output power limits, the limit in any 100 kHz band outside of the authorized band is 20 dB below the maximum in-band peak level.

### 6.3 Test Site

SGS EMC Laboratory, Suwanee, GA

|                          |           |                              |
|--------------------------|-----------|------------------------------|
| Environmental Conditions | Band Edge | Conducted Spurious Emissions |
| Temperature:             | 24.6 °C   | 25.1 °C                      |
| Relative Humidity:       | 26.8 %    | 35.3 %                       |
| Atmospheric Pressure:    | 98.1 kPa  | 97.9 kPa                     |

### 6.4 Test Equipment

Band Edge:

Test End Date: 5-Apr-2018

Tester: MT

| Equipment                    | Model   | Manufacturer    | Asset Number | Cal Due Date |
|------------------------------|---------|-----------------|--------------|--------------|
| SIGNAL ANALYZER              | FSV30   | ROHDE & SCHWARZ | B085749      | 1-Nov-2019   |
| OPEN SWITCH AND CONTROL UNIT | OSP 120 | ROHDE & SCHWARZ | S/N: 101182  | CNR          |
| ATTENUATOR, 10DB             | 10DB    | ROHDE & SCHWARZ | B095591      | 28-Jul-2018  |
| RF CABLE                     | 141     | HUBER & SUHNER  | B095587      | 26-Jul-2018  |

Note: The equipment calibration period is 1 year except for the FSV which is on a 2 year cycle.

Conducted Spurious Emissions:

Test End Date: 13-Apr-2018

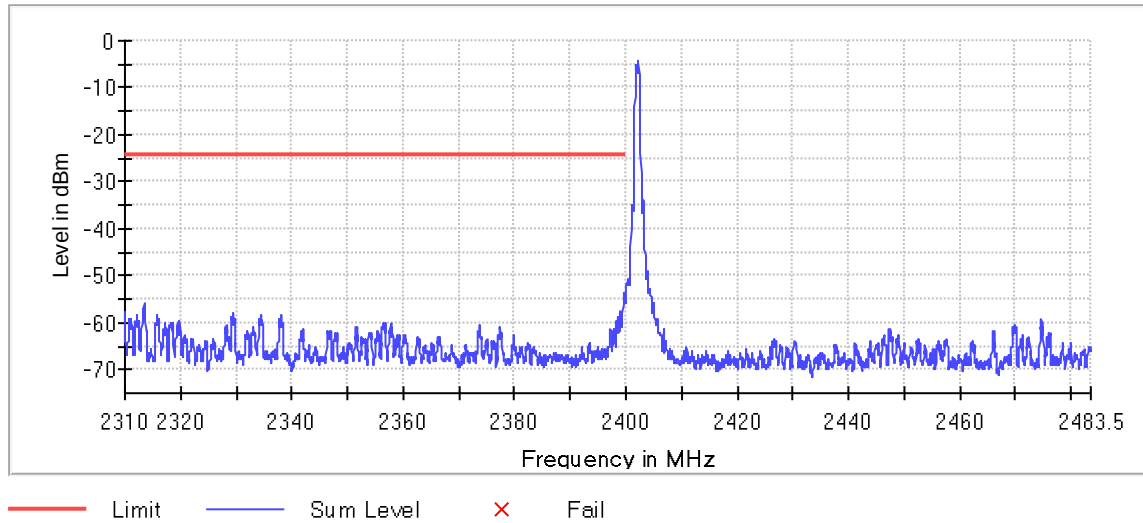
Tester: MT

| Equipment       | Model | Manufacturer    | Asset Number  | Cal Due Date |
|-----------------|-------|-----------------|---------------|--------------|
| SIGNAL ANALYZER | FSV30 | ROHDE & SCHWARZ | S/N: 1608522I | 24-Jul-2018  |

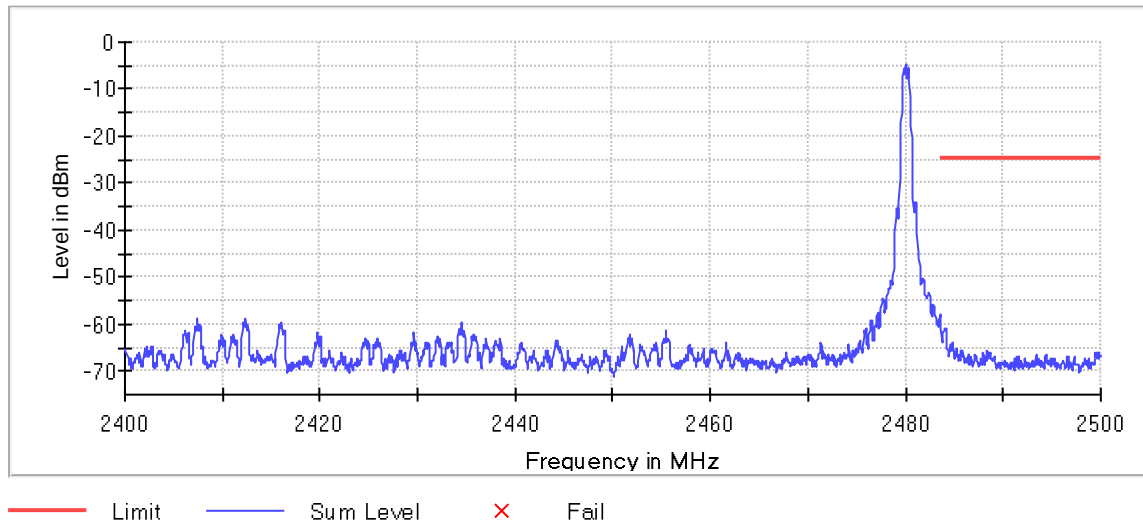
Note: The equipment calibration period is 1 year.

## 6.5 Test Data – DTS Band Edge

BLE - Lower band edge:

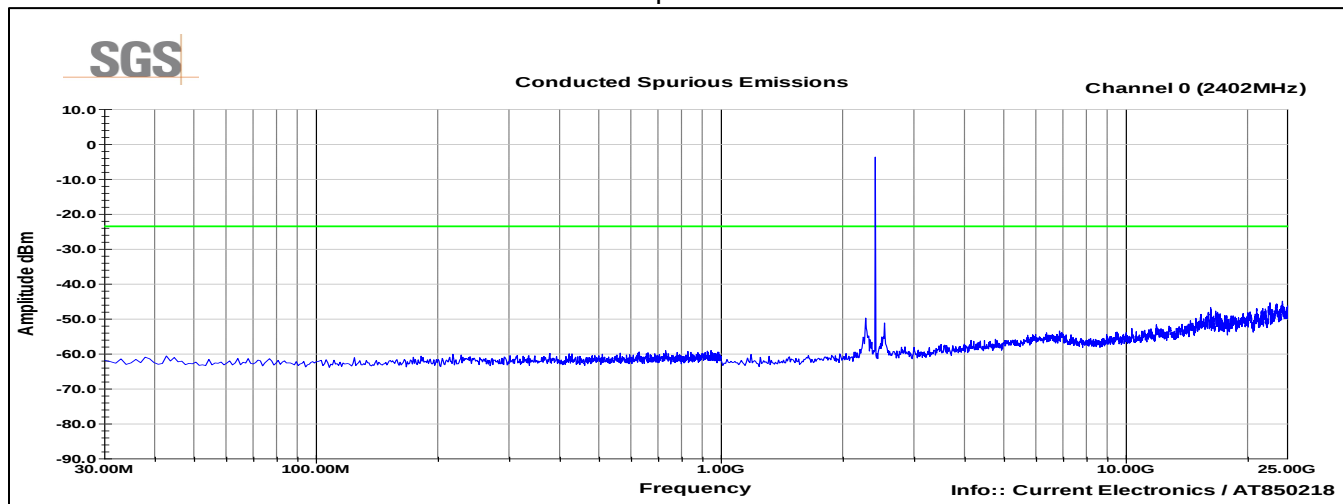


BLE - Upper band edge:

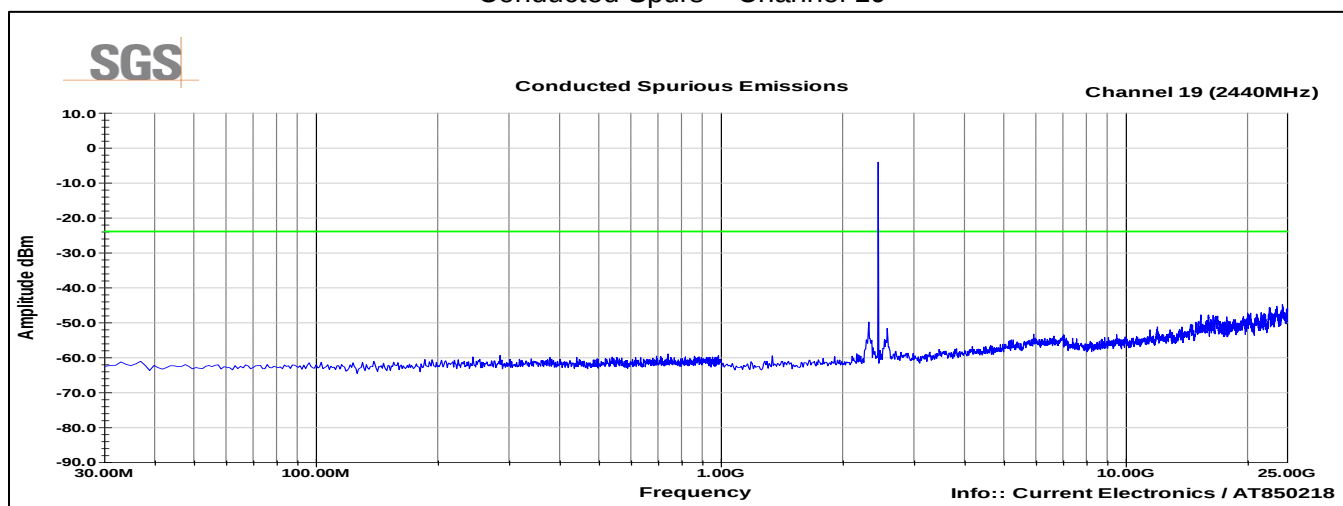


## 6.6 Test Data – Conducted Spurious Emissions

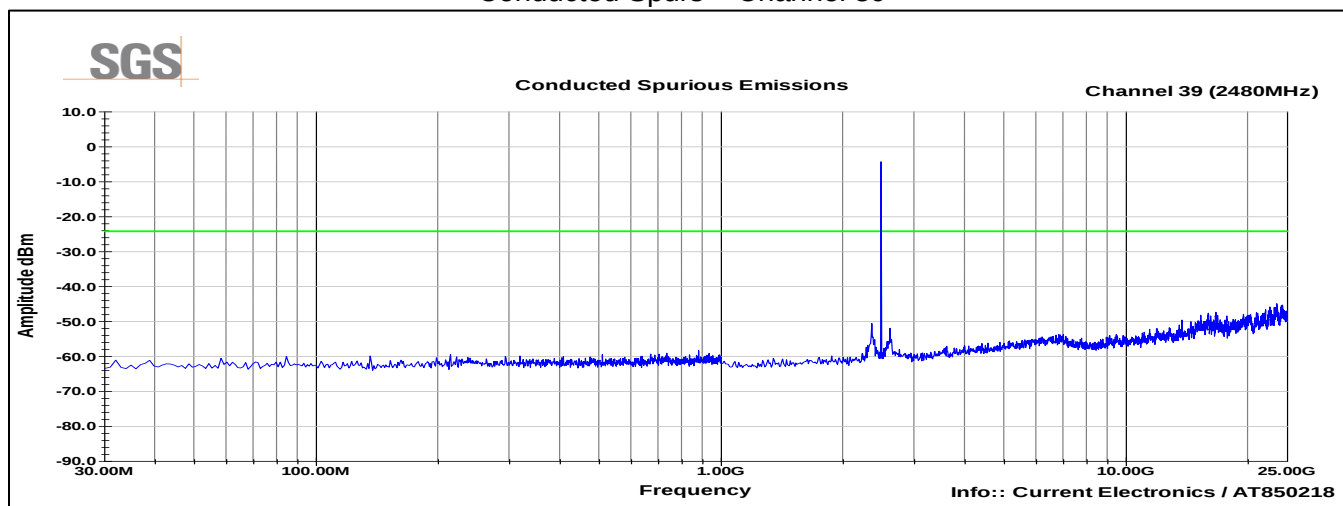
### Conducted Spurs – Channel 0



### Conducted Spurs – Channel 19



### Conducted Spurs – Channel 39



## 7 Field Strength of Spurious Radiation

### 7.1 Test Result

| Test Description   | Test Specification    |              | Test Result |
|--------------------|-----------------------|--------------|-------------|
| Spurious Emissions | 15.247 (d) and 15.209 | RSS-247 S5.5 | Compliant   |

### 7.2 Test Method

The measurement methods defined in ANSI C63.10: 2013 and KDB 558074 D01 Meas Guidance v04 were used.

Lowest, middle, and highest channels were investigated – the device was commanded to continuously transmit on channels 0, 19 and 39.

Test distance:

- 9k to 30 MHz – Near field prescan to determine if there were any emissions
- 30 to 1000 MHz - The EUT to measurement antenna distance was 3 meters
- 1 to 18 GHz - The EUT to measurement antenna distance was 3 meters
- 18 to 26 GHz - The EUT to measurement antenna distance was 1.5 meter

Limits within restricted bands of operation:

| Frequency      | Limits <sup>(1)</sup> |                     | Peak Limits<br>dBuV/m |
|----------------|-----------------------|---------------------|-----------------------|
|                | Microvolts/m          | dBuV/m              |                       |
| 30 - 88 MHz    | 100                   | 40 <sup>(2)</sup>   | --                    |
| 88 - 216 MHz   | 150                   | 43.5 <sup>(2)</sup> | --                    |
| 216 - 960 MHz  | 200                   | 46 <sup>(2)</sup>   | --                    |
| 960 - 1000 MHz | 500                   | 54 <sup>(2)</sup>   | --                    |
| 1 - 40 GHz     | 500                   | 54 <sup>(3)</sup>   | 74                    |

(1) These limits are applicable to emissions outside of the intentional transmit frequency band.

(2) Quasi-peak limit

(3) Average limit

### 7.3 Test Site

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

| Environmental Conditions | 30MHz to 1GHz | 1 to 18GHz      | 18 to 26GHz |
|--------------------------|---------------|-----------------|-------------|
| Temperature:             | 24.9 °C       | 23.4 – 24.2 °C  | 24.9 °C     |
| Relative Humidity:       | 35.9 %        | 25.8 – 31.3 %   | 26.8 %      |
| Atmospheric Pressure:    | 97.8 kPa      | 98.2 – 98.4 kPa | 98.2 kPa    |

## 7.4 Test Equipment

30MHz to 1GHz

Test End Date: 13-Apr-2018

Tester: MT

| Equipment           | Model            | Manufacturer    | Asset Number | Cal Due Date |
|---------------------|------------------|-----------------|--------------|--------------|
| ANTENNA, BILOG      | JB6              | SUNOL           | B079689      | 16-Oct-2018  |
| RF CABLE            | SF106            | HUBER & SUHNER  | B079712      | 24-Jul-2018  |
| RF CABLE            | NFS-290-78.7-NFS | FLORIDA RF LABS | B095019      | 24-Jul-2018  |
| RF CABLE            | UC-N-MM-275      | MAURY MICROWAVE | 17015        | 25-Jul-2018  |
| RF CABLE            | 104PE            | HUBER & SUHNER  | B079793      | 24-Jul-2018  |
| LOW NOISE AMPLIFIER | TS-PR18          | ROHDE & SCHWARZ | B094463      | 6-Mar-2019   |
| EMI TEST RECEIVER   | ESU8             | ROHDE & SCHWARZ | B085759      | 25-Jul-2018  |

Note: The equipment calibration period is 1 year.

1 to 18GHz

Test End Date: 11-Apr-2018

Tester: MT

| Equipment                  | Model        | Manufacturer    | Asset Number | Cal Due Date |
|----------------------------|--------------|-----------------|--------------|--------------|
| ANTENNA, DRG HORN (MEDIUM) | 3117         | ETS LINDGREN    | B079691      | 27-Jul-2018  |
| RF CABLE                   | SF106        | HUBER & SUHNER  | B079712      | 24-Jul-2018  |
| RF CABLE                   | SUCOFLEX 100 | HUBER & SUHNER  | B108523      | 24-Jul-2018  |
| LOW NOISE AMPLIFIER        | TS-PR18      | ROHDE & SCHWARZ | 15003        | 28-Jul-2018  |
| EMI TEST RECEIVER          | ESU40        | ROHDE & SCHWARZ | B079629      | 25-Apr-2018  |

Note: The equipment calibration period is 1 year.

18 to 26GHz

Test End Date: 11-Apr-2018

Tester: MT

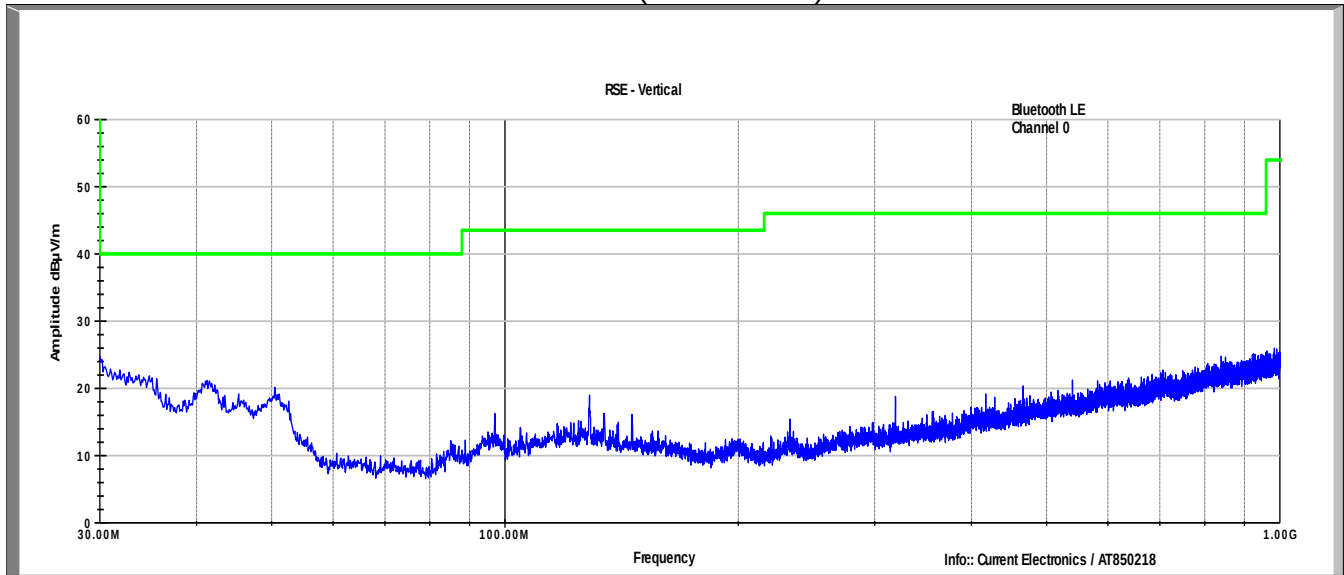
| Equipment                 | Model      | Manufacturer    | Asset Number | Cal Due Date |
|---------------------------|------------|-----------------|--------------|--------------|
| ANTENNA, DRG HORN (SMALL) | 3116B      | ETS LINDGREN    | B079695      | 27-Jul-2018  |
| RF CABLE                  | SF102      | HUBER & SUHNER  | B079823      | 26-Jul-2018  |
| RF CABLE                  | SF102      | HUBER & SUHNER  | B079824      | 26-Jul-2018  |
| LOW NOISE AMPLIFIER       | NSP1840-HG | MITEQ           | B087572      | 28-Jul-2018  |
| EMI TEST RECEIVER         | ESU40      | ROHDE & SCHWARZ | B079629      | 25-Apr-2018  |

Note: The equipment calibration period is 1 year.

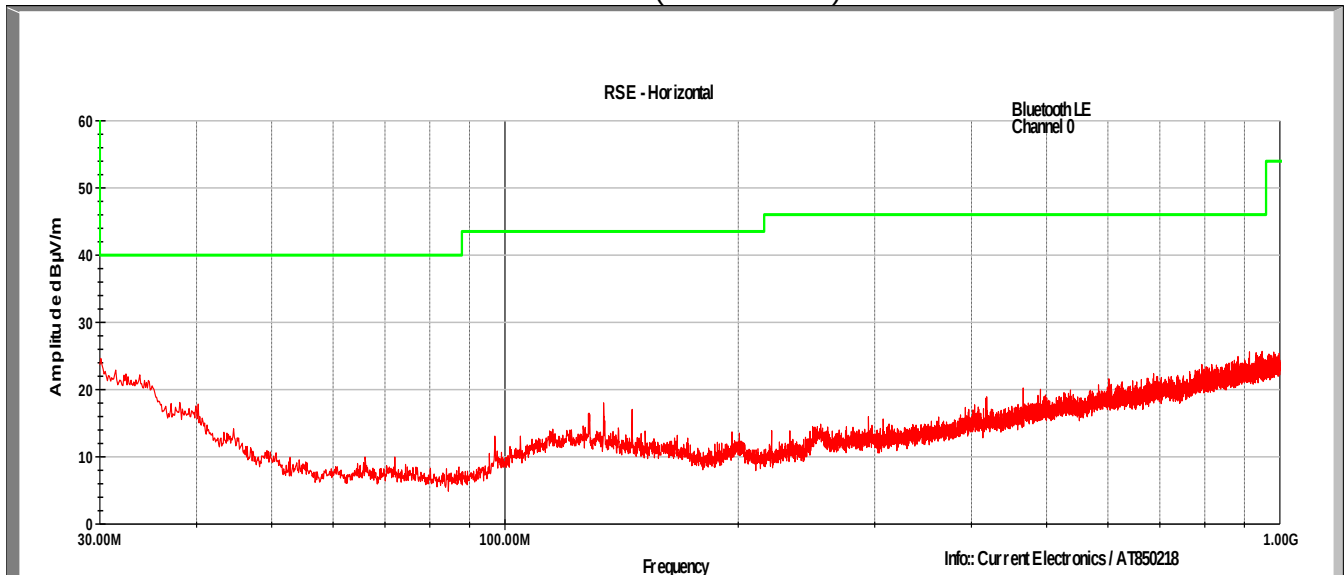
## 7.5 Test Data – Peak Plots

No emissions were detected in the range 9kHz to 30MHz.

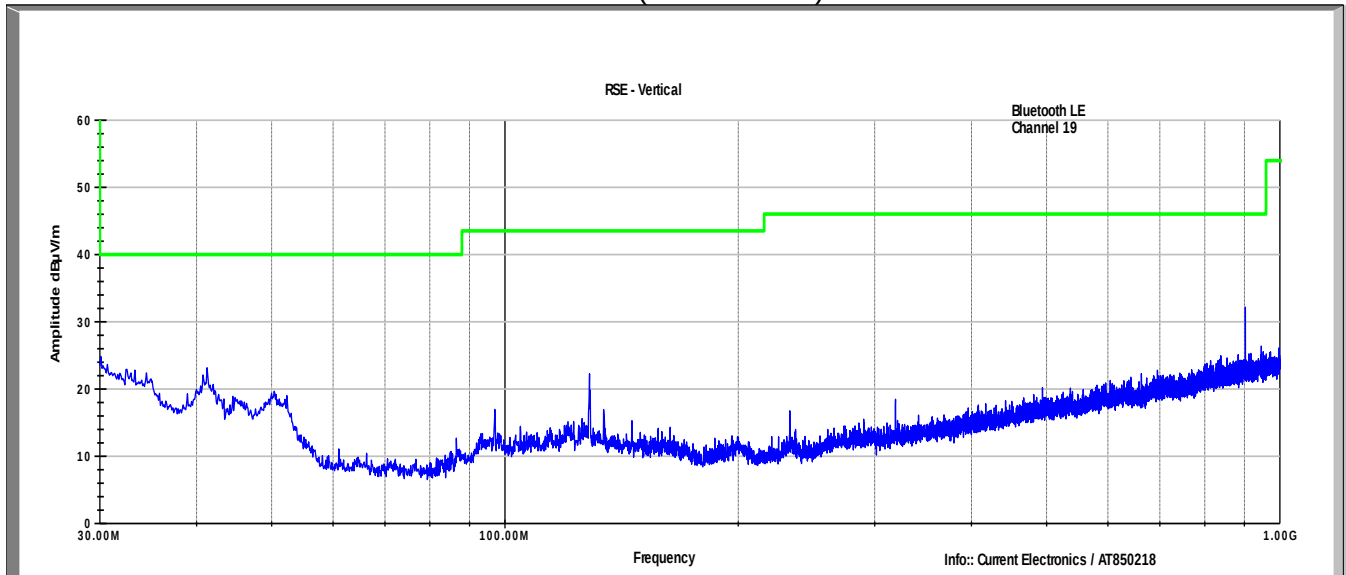
BLE Channel 0  
Vertical (30-1000MHz)



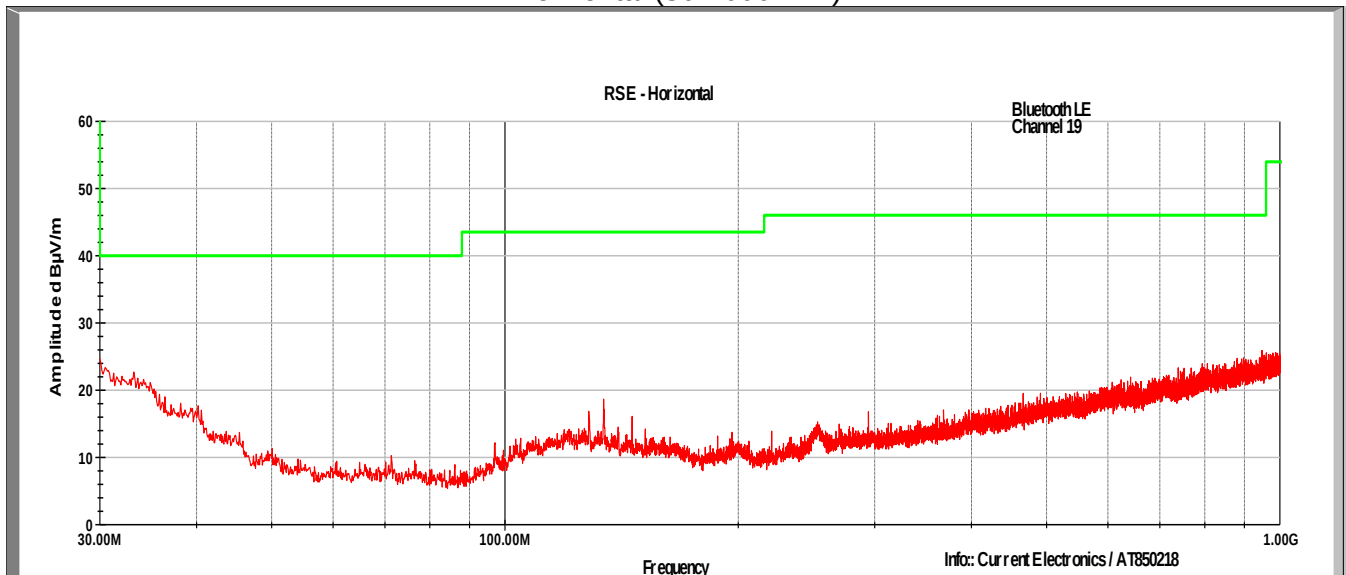
BLE Channel 0  
Horizontal (30-1000MHz)



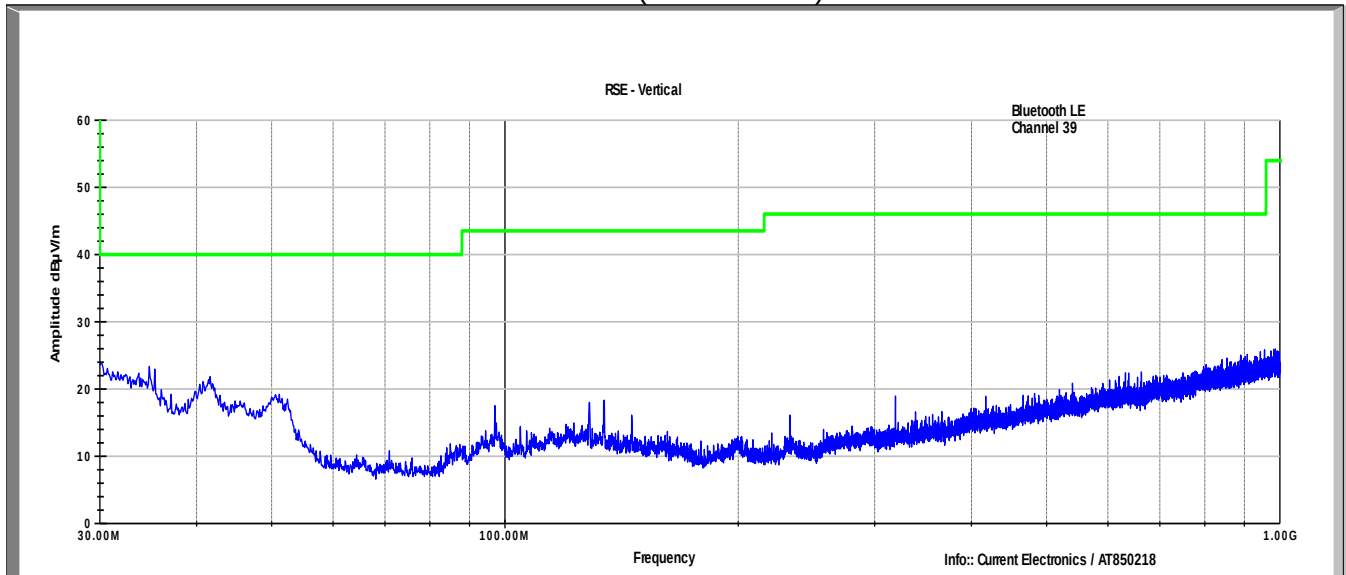
## BLE Channel 19 Vertical (30-1000MHz)



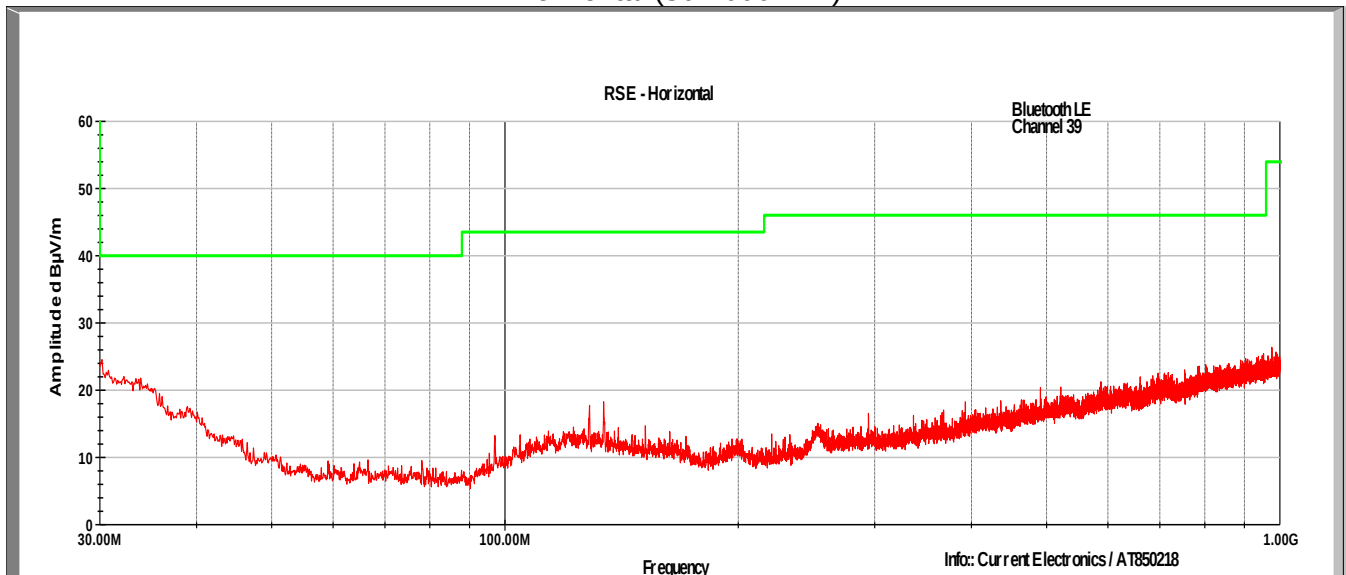
## BLE Channel 19 Horizontal (30-1000MHz)



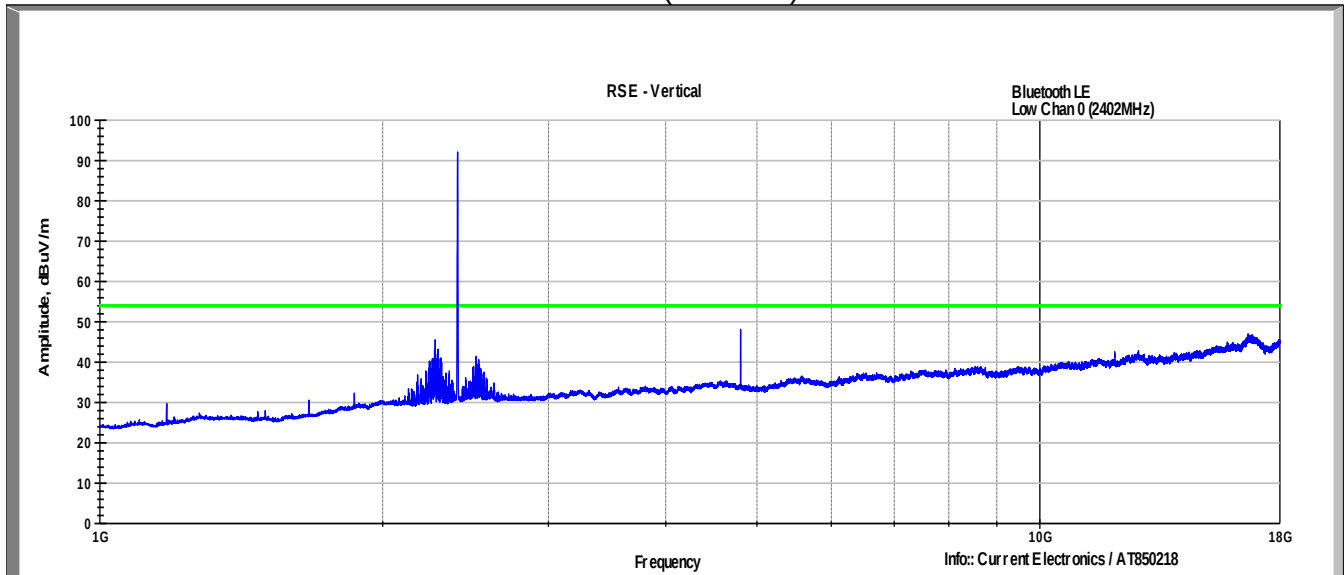
## BLE Channel 39 Vertical (30-1000MHz)



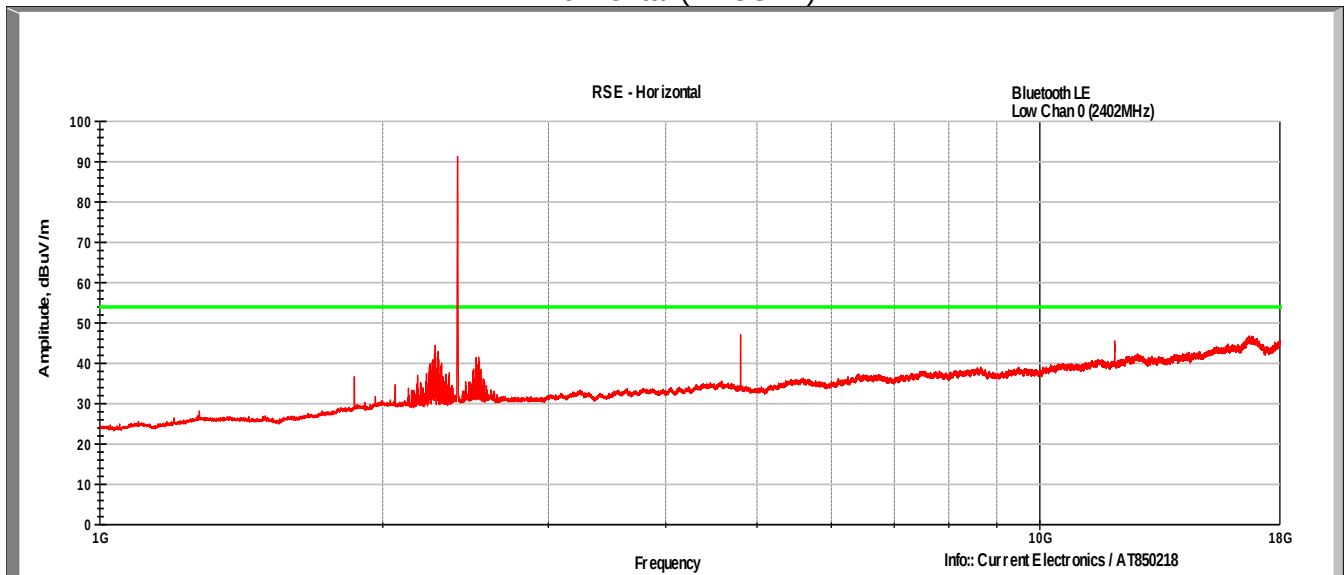
## BLE Channel 39 Horizontal (30-1000MHz)



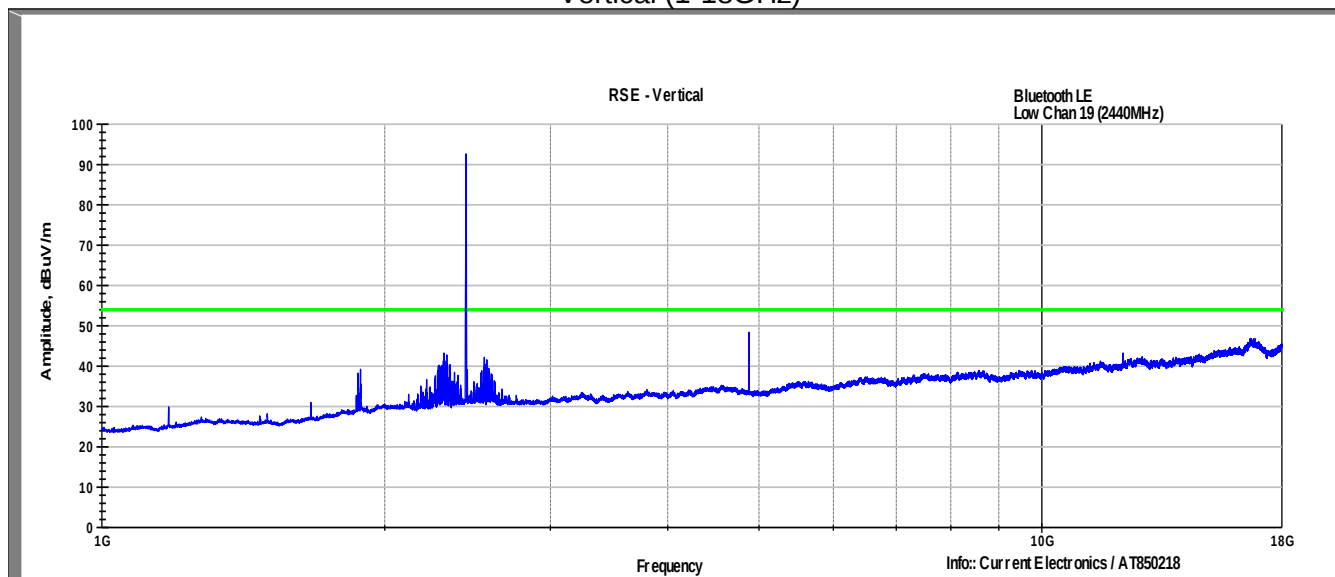
### BLE Channel 0 Vertical (1-18GHz)



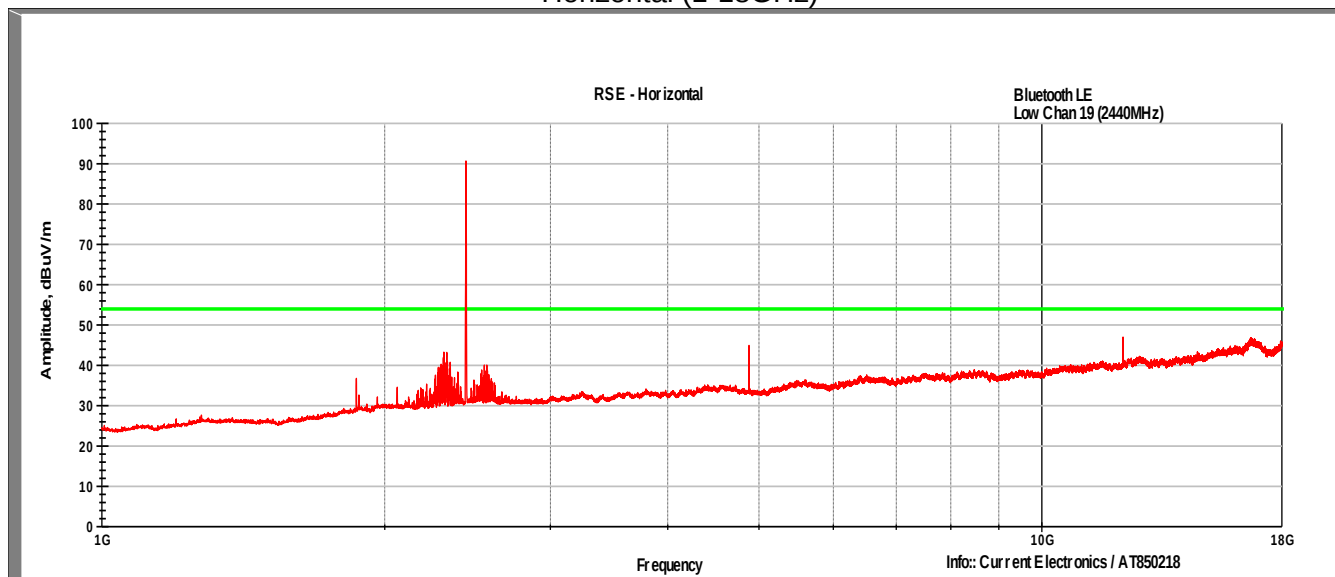
### BLE Channel 0 Horizontal (1-18GHz)



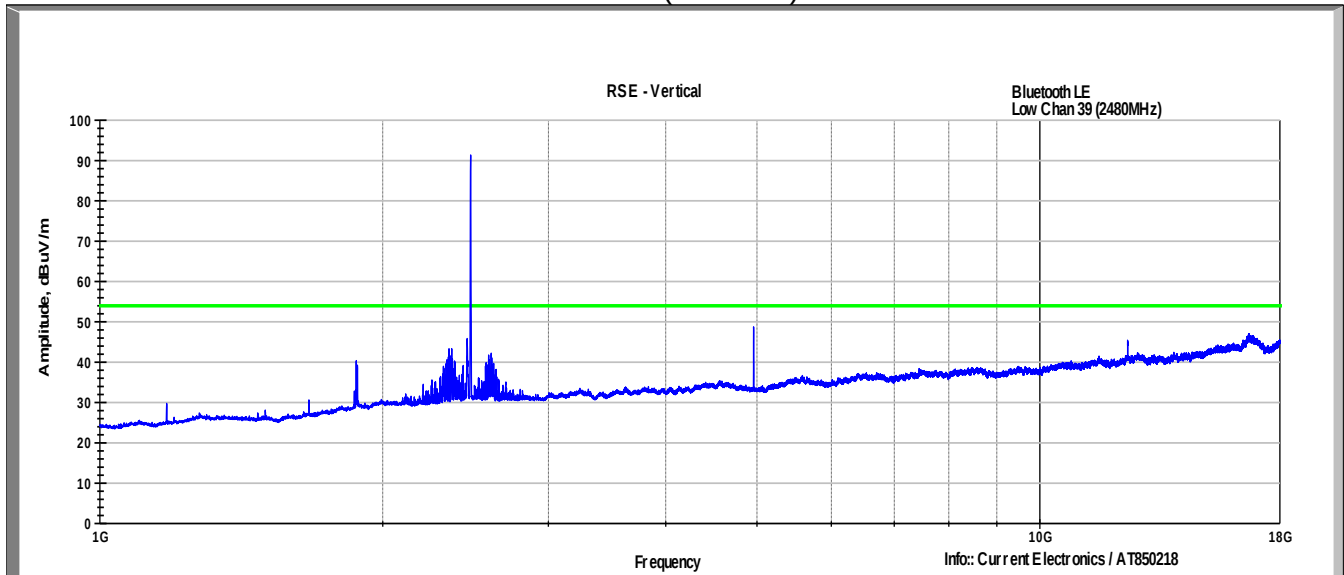
### BLE Channel 19 Vertical (1-18GHz)



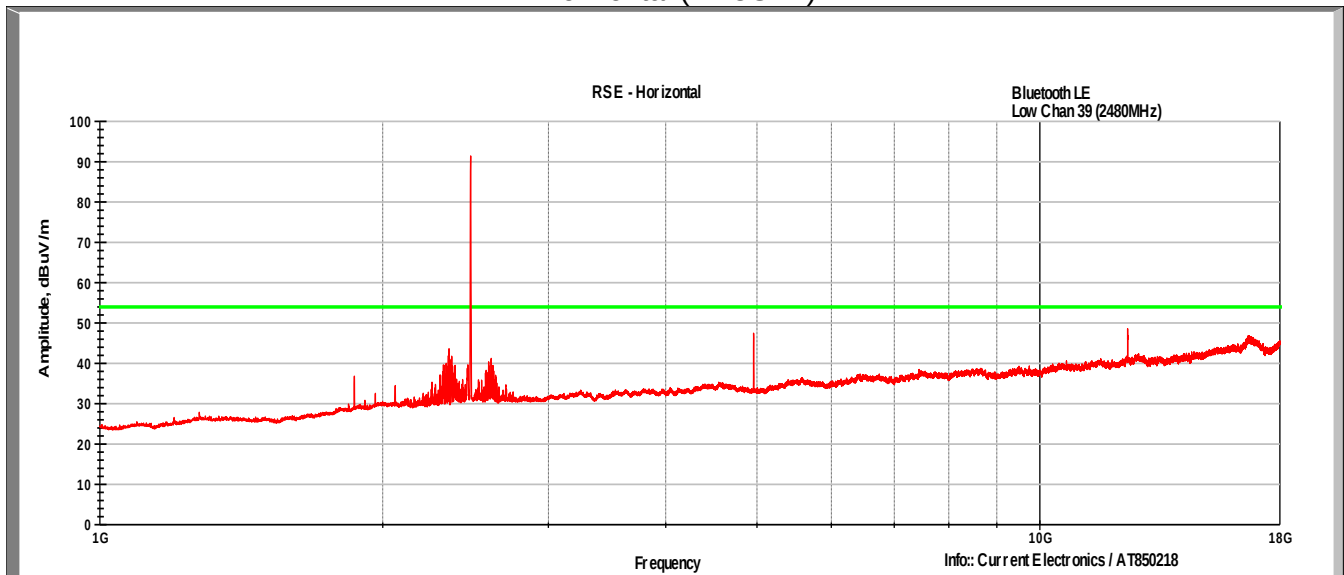
### BLE Channel 19 Horizontal (1-18GHz)



BLE Channel 39  
Vertical (1-18GHz)



BLE Channel 39  
Horizontal (1-18GHz)



Manual scans were performed in the 18 to 26 GHz frequency range and no emissions were detected.

## 7.6 Test Data – Tabular Data

| Frequency<br>MHz     | Raw Meas<br>(dBuV/m) | Polarity<br>(V/H) | Correction<br>(dB) | Corr Value<br>dBuV/m | Limit<br>(dBuV/m) | Margin<br>(dB) |
|----------------------|----------------------|-------------------|--------------------|----------------------|-------------------|----------------|
| Channel 0 (2402MHz)  |                      |                   |                    |                      |                   |                |
| 4804.0               | 48.1                 | V                 | 0.00               | 48.10                | 54.0              | -5.90          |
| 4804.0               | 47.0                 | H                 | 0.00               | 47.00                | 54.0              | -7.00          |
| Channel 19 (2440MHz) |                      |                   |                    |                      |                   |                |
| 4880.0               | 48.3                 | V                 | 0.00               | 48.30                | 54.0              | -5.70          |
| 12200.0              | 46.9                 | H                 | 0.00               | 46.90                | 54.0              | -7.10          |
| Channel 39 (2480MHz) |                      |                   |                    |                      |                   |                |
| 4960.0               | 48.7                 | V                 | 0.00               | 48.70                | 54.0              | -5.30          |
| 12400.0              | 48.5                 | H                 | 0.00               | 48.50                | 54.0              | -5.50          |

## 8 Radiated Emissions at Band Edge / Restricted Band

### 8.1 Test Result

| Test Description   | Test Specification |                     | Test Result |
|--------------------|--------------------|---------------------|-------------|
| Spurious Emissions | 15.205 / 15.209    | RSS-GEN S8.9 / 8.10 | Compliant   |

### 8.2 Test Method

Field strength measurements were performed at the restricted band edges of 2390MHz and 2483.5MHz for each modulation. Measurements were made using the conducted methods defined in Section 12 of FCC publication KDB 558074 D01 DTS Meas Guidance v04.

#### Offset Calculations:

Offset calculations so that conducted measurements on the spectrum analyzer in dBμV represent field strength measurements in dBμV/m.

$$\text{Offset} = -20\log(D) + 104.8 - 107 + \text{CL} + \text{DC} + \text{AG}$$

$$\text{Offset}_{3m} = -11.7 + \text{CL} + \text{DC} + \text{AG}$$

|                       |                              |
|-----------------------|------------------------------|
| D = 3m                | Distance                     |
| CL = 0.5 dB           | Cable Loss                   |
| DC = 1.89 dB (64.76%) | Duty Cycle Correction Factor |
| AG = 2 dB*            | Antenna Gain                 |

$$\text{Offset} = -7.35 \text{ dB}$$

\* The actual antenna gain was calculated to be 1.2dBi. 2 dB correction is the minimum allowed by the test method.

### 8.3 Test Site

SGS EMC Laboratory, Suwanee, GA

#### Environmental Conditions

|                       |          |
|-----------------------|----------|
| Temperature:          | 22.3 °C  |
| Relative Humidity:    | 29.4 %   |
| Atmospheric Pressure: | 97.6 kPa |

### 8.4 Test Equipment

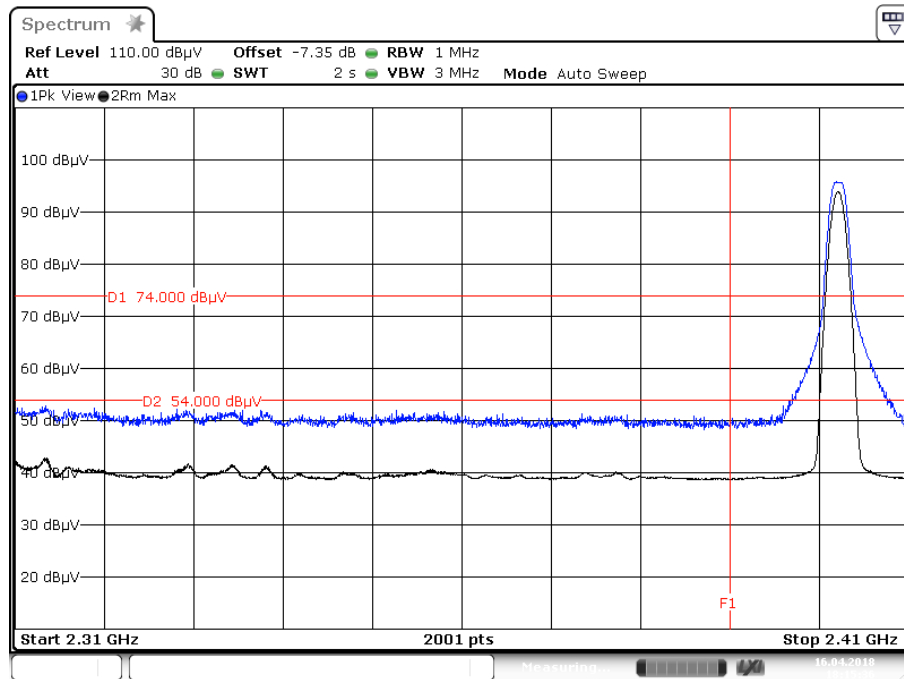
Test End Date: 16-Apr-2018

Tester: MT

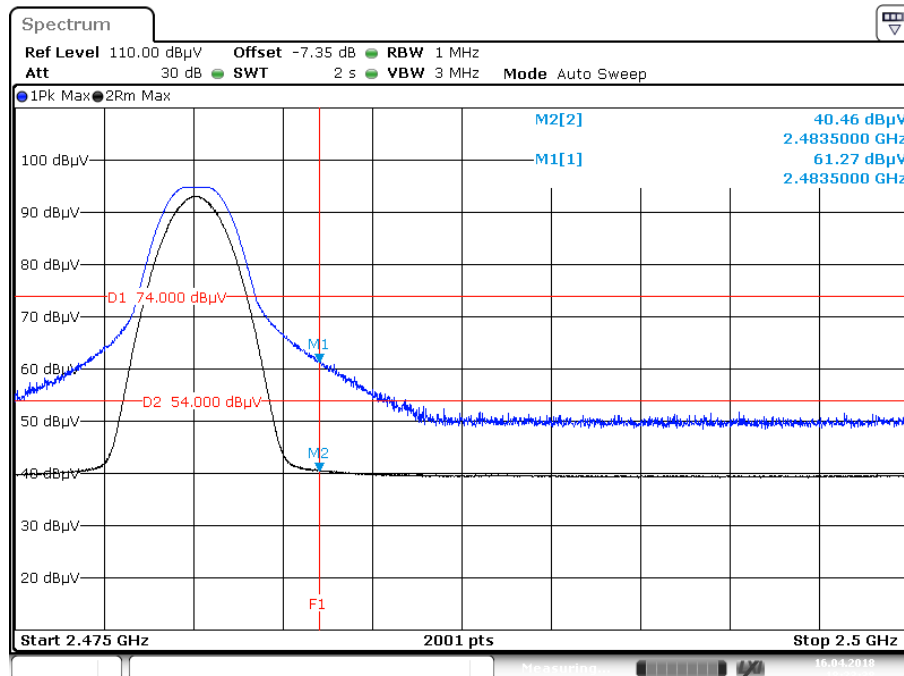
| Equipment       | Model | Manufacturer    | Asset Number  | Cal Due Date |
|-----------------|-------|-----------------|---------------|--------------|
| SIGNAL ANALYZER | FSV30 | ROHDE & SCHWARZ | S/N: 1608522I | 24-Jul-2018  |

Note: The equipment calibration period is 1 year.

## 8.5 Test Data – Restricted Band Edge



Date: 16 APR 2018 18:15:36



Date: 16 APR 2018 18:23:39

## 9 Revision History

| Revision Level | Description of changes | Revision Date |
|----------------|------------------------|---------------|
| 0              | Initial release        | 17 April 2018 |
|                |                        |               |
|                |                        |               |
|                |                        |               |
|                |                        |               |
|                |                        |               |
|                |                        |               |
|                |                        |               |
|                |                        |               |
|                |                        |               |