



## FCC / ISED Test Report

**FOR:** Compology

**Model Number:** R13 & R13L (Variant)

**Product Description:**

Wireless device captures still images, GPS location and accelerometer information and transmits via the CAT-M1 network. Also includes BLE and NFC.

**FCC ID:** 2AO44-R13

**IC ID:** 23661-R13

**Applied Rules and Standards:**

47 CFR Part 15.247 (DTS)

RSS-247 Issue 2 (DTSS) & RSS-Gen Issue 5

**REPORT #:** EMC\_COMPO\_012\_18001\_FCC\_15.247\_ISED\_BLE\_DTS\_rev3

**DATE:** 5/17/2019



**A2LA Accredited**

**IC recognized #**  
**3462B-2**

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## 1 Assessment

The following device as further described in section 3 of this report was evaluated for radiated and conducted spurious emissions for unlicensed radio according to criteria specified in FCC rules 15.247 of Title 47 of the Code of Federal Regulations and the relevant ISED Canada standard RSS-GEN and RSS-247.

No deviations were ascertained.

According to section 5 of this report, the overall result is PASS.

| Company   | Description                                                                                                                                        | Model #      |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Compology | Wireless device captures still images, GPS location and accelerometer information and transmits via the CAT-M1 network. Also includes BLE and NFC. | R13, R13L *1 |

\*1: R13L is a Variant of R13. Check section 3 for more details.

### Responsible for Testing Laboratory:

| 5/17/2019 | Compliance | Li, Cindy<br>(Lab Manager) |           |
|-----------|------------|----------------------------|-----------|
| Date      | Section    | Name                       | Signature |

### Responsible for the Report:

| 5/17/2019 | Compliance | Ghanma, Issa<br>(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>Lab Manager:</b>                | Cindy Li               |
| <b>Responsible Project Leader:</b> | Trina Noor             |

### 2.2 Identification of the Client

|                          |                            |
|--------------------------|----------------------------|
| <b>Applicant's Name:</b> | Compology                  |
| <b>Street Address:</b>   | 1045 Brayent St. Suite 101 |
| <b>City/Zip Code</b>     | San Francisco , CA 94103   |
| <b>Country</b>           | USA                        |

### 2.3 Identification of the Manufacturer

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

### 3 Equipment Under Test (EUT)

#### 3.1 EUT Specifications

|                                                              |                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Marketing name:</b>                                       | Oscar R13                                                                                                                                                                                                                                                                                                                                                                |
| <b>Hardware Version Identification Number (HVIN):</b>        | R13, R13L                                                                                                                                                                                                                                                                                                                                                                |
| <b>Product Marketing Name (PMN):</b>                         | Oscar R13                                                                                                                                                                                                                                                                                                                                                                |
| <b>Chipset manufacturer number:</b>                          | BLUENRG-232                                                                                                                                                                                                                                                                                                                                                              |
| <b>Frequency range / number of channels:</b>                 | Nominal band: 2400 MHz – 2483.5 MHz;<br>Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 39), 40 channels                                                                                                                                                                                                                                                                |
| <b>Type(s) of Modulation:</b>                                | Bluetooth low energy 4.0 GFSK modulation.                                                                                                                                                                                                                                                                                                                                |
| <b>Modes of Operation:</b>                                   | Bluetooth LE in both advertising and connected mode of operation                                                                                                                                                                                                                                                                                                         |
| <b>Max. measured output Powers [ dBm ]:</b>                  | 8.49                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Antenna Information as declared:</b>                      | Internal; 2450AT43B100E, 1.3dBi Peak                                                                                                                                                                                                                                                                                                                                     |
| <b>Power Supply/ Rated Operating Voltage Range [ V DC ]:</b> | Low: 2.5, Nominal: 3.67, High: 3.9                                                                                                                                                                                                                                                                                                                                       |
| <b>Operating Temperature Range [ °C ]:</b>                   | Low: -20, Nominal: 20, High: 85                                                                                                                                                                                                                                                                                                                                          |
| <b>Other Radios included in the device:</b>                  | <ol style="list-style-type: none"> <li>1. Cellular: <ol style="list-style-type: none"> <li>a. Module name: U-blox SARA-R410M-02B</li> <li>b. Model number: SARA-R410M-02B</li> <li>c. FCC ID: XPY2AGQN4NNN</li> </ol> </li> <li>2. GPS: <ol style="list-style-type: none"> <li>a. Module name: U-blox EVA-M8M</li> <li>b. Model number: EVA-M8M-0</li> </ol> </li> </ol> |
| <b>Sample Revision:</b>                                      | <input type="checkbox"/> Prototype Unit; <input type="checkbox"/> Production Unit; <input checked="" type="checkbox"/> Pre-Production                                                                                                                                                                                                                                    |
| <b>EUT Dimensions [ inch ]:</b>                              | 5" X 4" X 4"                                                                                                                                                                                                                                                                                                                                                             |
| <b>Weight [lbs]:</b>                                         | 1.5                                                                                                                                                                                                                                                                                                                                                                      |
| <b>EUT Diameter:</b>                                         | <input checked="" type="checkbox"/> < 60 cm <input type="checkbox"/> Other _____                                                                                                                                                                                                                                                                                         |

### 3.2 EUT Sample details

| EUT # | IMEI            | HW Version | SW Version | Notes / Comments                                                                                                                                                                                                                                                                                                                                                                                          |
|-------|-----------------|------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | 357812090508802 | rev_D      | Oscar-0300 | Used for conducted measurements.                                                                                                                                                                                                                                                                                                                                                                          |
| EUT # | Serial Number   | HW Version | SW Version | Notes / Comments                                                                                                                                                                                                                                                                                                                                                                                          |
| 2     | 0286002653BC5D  | rev_D      | Oscar-0300 | R13 / Primary device                                                                                                                                                                                                                                                                                                                                                                                      |
| 3     | 0286002658C9BE  | rev_D      | Oscar-0300 | <ul style="list-style-type: none"> <li>R13L / The "long turret" version of R13 that will be used in thick-walled containers.</li> <li>The only difference in the electronics is a longer camera flex PCB and longer flash flex PCB; the main board with all RF systems is exactly the same as R13.</li> <li>2 of the 3 mechanical parts are different to accommodate the longer turret design.</li> </ul> |

### 3.3 Accessory Equipment (AE) details

| AE # | Comments |
|------|----------|
| -    | -        |

### 3.4 Mode of Operation details

| Mode of Operation | Description of Operating modes | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Op. 1             | BLE GFSK                       | <p>Putty terminal tool and special commands provided by the customer used to configure the EUT to:</p> <ul style="list-style-type: none"> <li>Modulated TX</li> <li>Low, Mid, High channel.</li> <li>Maximum output power.</li> </ul> <p>Note: The commands will not be available to the end user.</p> <p>For Radiated measurements: The internal antenna was connected.</p> <p>For Conducted measurements: The measurements equipment was connected to 50 ohm RF port of the EUT.</p> |

### **3.5 Justification for Worst Case Mode of Operation**

The worst case mode of operation has been determined by evaluating the conducted results.

During the testing process the EUT was tested with transmitter sets on low, mid and high channels, and the highest duty cycle and output power.

For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

#### 4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules 15.247 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-247 Issue 2 and RSS-GEN Issue 5 of ISED Canada.

This test report is to support a request for new equipment authorization under the:

- FCC ID: 2A044-R13
- IC ID: 23661-R13

Testing procedures are based on 558074 D01 DTS Meas Guidance v05 – “GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER SECTION 15.247” - April 5, 2017, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.

#### 5 Measurement Results Summary

| Test Specification                                    | Test Case                                    | Temperature and Voltage Conditions | Mode  | Pas<br>s | NA | NP | Result                       |
|-------------------------------------------------------|----------------------------------------------|------------------------------------|-------|----------|----|----|------------------------------|
| §15.247(a)(2)<br>RSS-247 5.2(a)                       | Emission Bandwidth                           | Nominal                            | BT LE | ■        | □  | □  | Complies                     |
| §15.247(e)<br>RSS-247 5.2(b)                          | Power Spectral Density                       | Nominal                            | BT LE | ■        | □  | □  | Complies                     |
| §15.247(b)(3)<br>RSS-247 5.4(d)                       | Maximum Conducted Output Power and EIRP      | Nominal                            | BT LE | ■        | □  | □  | Complies                     |
| §15.247(d)<br>RSS-247 5.5                             | Band edge compliance Unrestricted Band Edges | Nominal                            | BT LE | ■        | □  | □  | Complies                     |
| §15.247; 15.209; 15.205<br>RSS-247 5.5; Gen 8.9; 8.10 | Band edge compliance Restricted Band Edges   | Nominal                            | BT LE | ■        | □  | □  | Complies                     |
| §15.247(d); §15.209<br>RSS-Gen 6.13                   | TX Spurious emissions- Radiated              | Nominal                            | BT LE | ■        | □  | □  | Complies                     |
| §15.207(a)<br>RSS Gen 8.8                             | AC Conducted Emissions                       | Nominal                            | BT LE | □        | ■  | □  | Complies<br>Note 1<br>Note 2 |

**Note1:** NA= Not Applicable; NP= Not Performed.

**Note2:** Device does not connect to and AC main.

## 6 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 30 MHz    | $\pm 2.5$ dB (Magnetic Loop Antenna) |
| 30 MHz to 1000 MHz | $\pm 2.0$ dB (Biconilog Antenna)     |
| 1 GHz to 40 GHz    | $\pm 2.3$ dB (Horn Antenna)          |

### Conducted measurement

|                   |                     |
|-------------------|---------------------|
| 150 kHz to 30 MHz | $\pm 0.7$ dB (LISN) |
|-------------------|---------------------|

|                          |              |
|--------------------------|--------------|
| RF conducted measurement | $\pm 0.5$ dB |
|--------------------------|--------------|

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: <http://physics.nist.gov/cuu/Uncertainty/typeb.html>. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3 dB to the limit.

### 6.1 Environmental Conditions During Testing:

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

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

### 6.2 Dates of Testing:

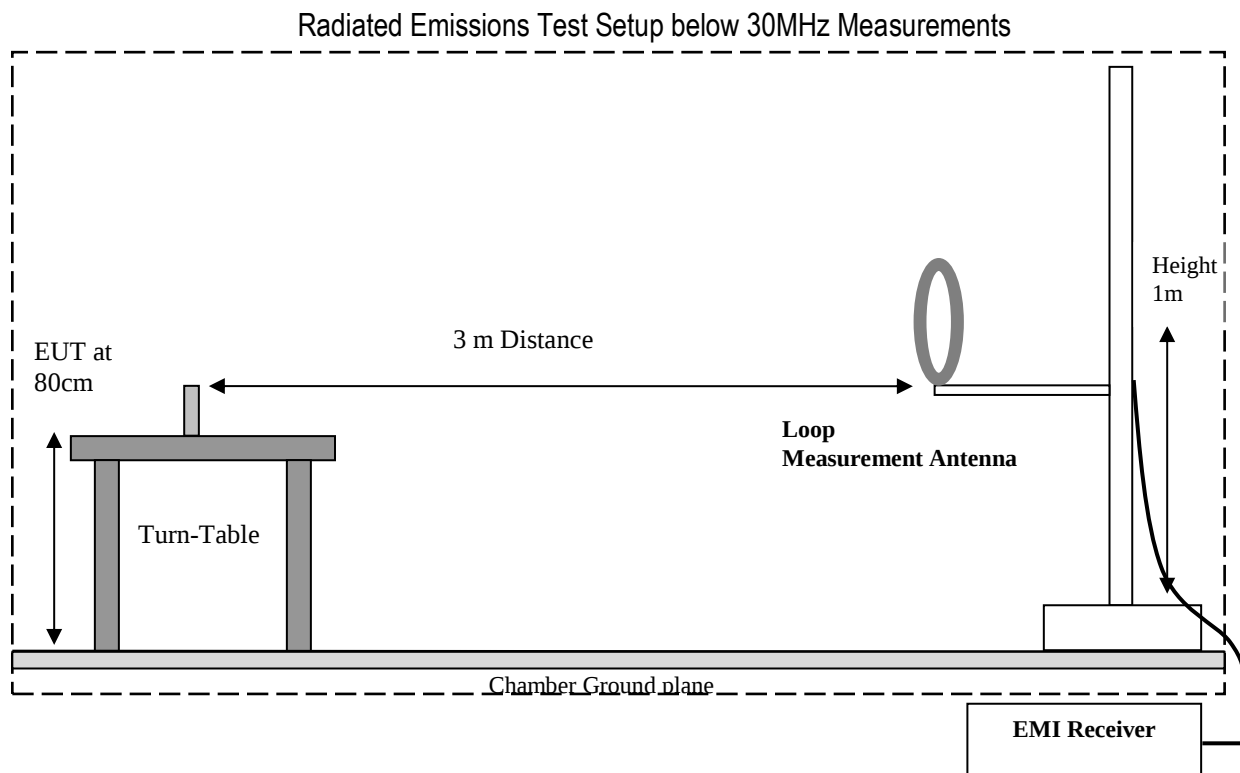
02/25/2019 – 03/01/2019

## 7 Measurement Procedures

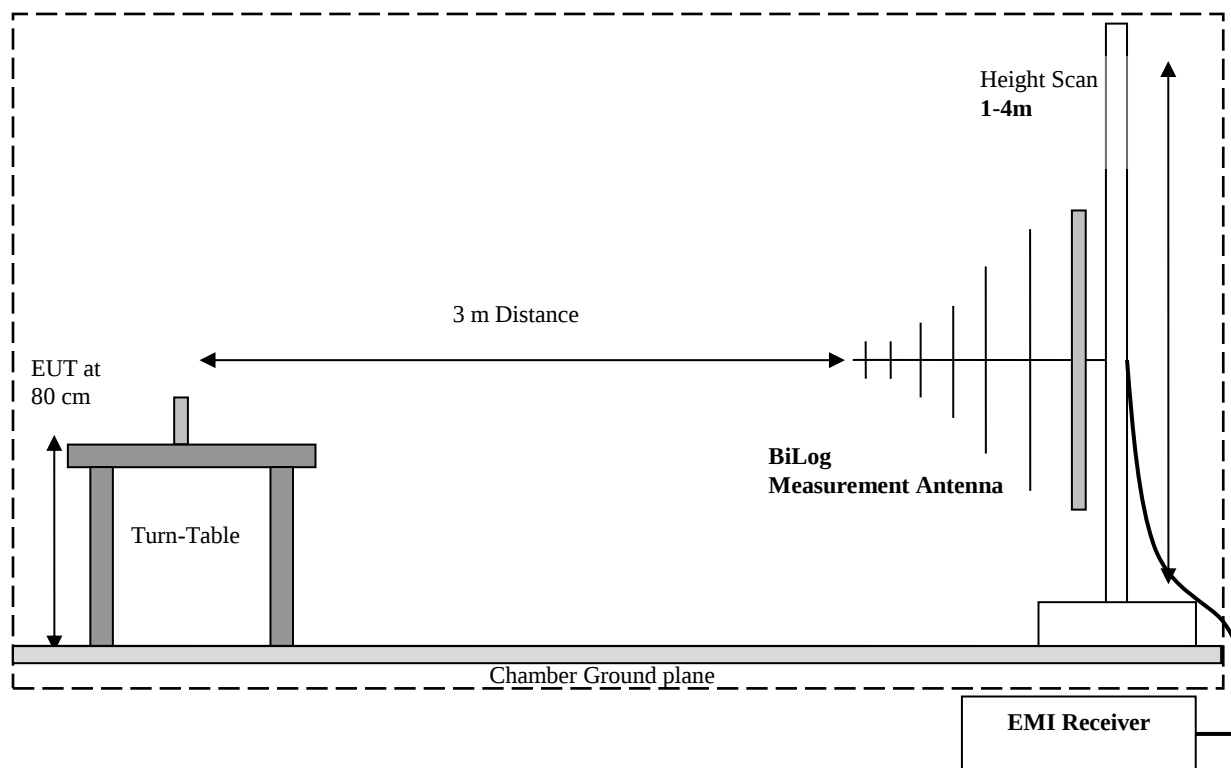
### 7.1 Radiated Measurement

The radiated measurement is performed according to ANSI C63.10 (2013)

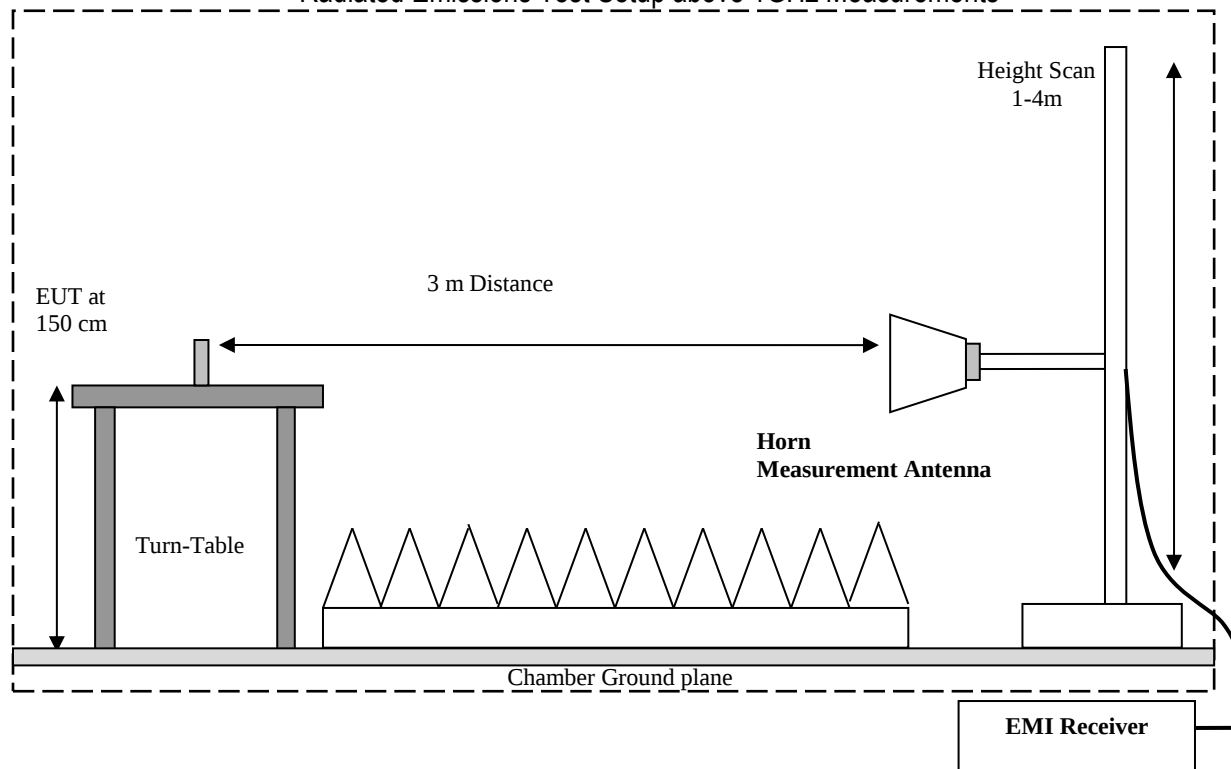
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to 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 30MHz-1GHz Measurements



### Radiated Emissions Test Setup above 1GHz Measurements



### 7.1.1 Sample Calculations for Field Strength Measurements

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

1. Measured reading in dB $\mu$ V
2. Cable Loss between the receiving antenna and SA in dB and
3. 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:

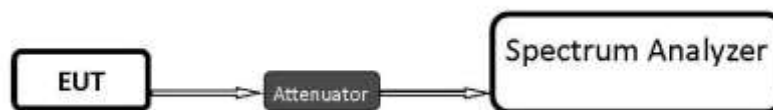
$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} - \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

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                                 |

### 7.2 RF Conducted Measurement Procedure

Testing procedures are based on 558074 D01 DTS Meas Guidance v05 – “GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER SECTION 15.247” - April 5, 2017, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.



- Connect the equipment as shown in the above diagram.
- Adjust the settings of the SA (Rohde-Schwarz Spectrum Analyzer) to connect the EUT at the required mode of test.
- Measurements are to be performed with the EUT set to the low, middle and high channels and for worst case modulation schemes.

## **8 Test Result Data**

### **8.1 Emission Bandwidth 6dB and 99% Occupied Bandwidth**

#### **8.1.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v05**

##### **Spectrum Analyzer settings:**

- Set RBW = 100 kHz
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW
- Detector = Peak
- Trace mode = Max hold
- Sweep = Auto couple
- Allow the trace to stabilize
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

##### **8.1.2 Limits:**

- FCC §15.247(a) (2):
  - Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
- RSS-247 5.2:
  - DTSS include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to the bands 902-928 MHz and 2400-2483.5 MHz:
    - a. The minimum 6 dB bandwidth shall be 500 kHz.

### 8.1.3 Test conditions and setup:

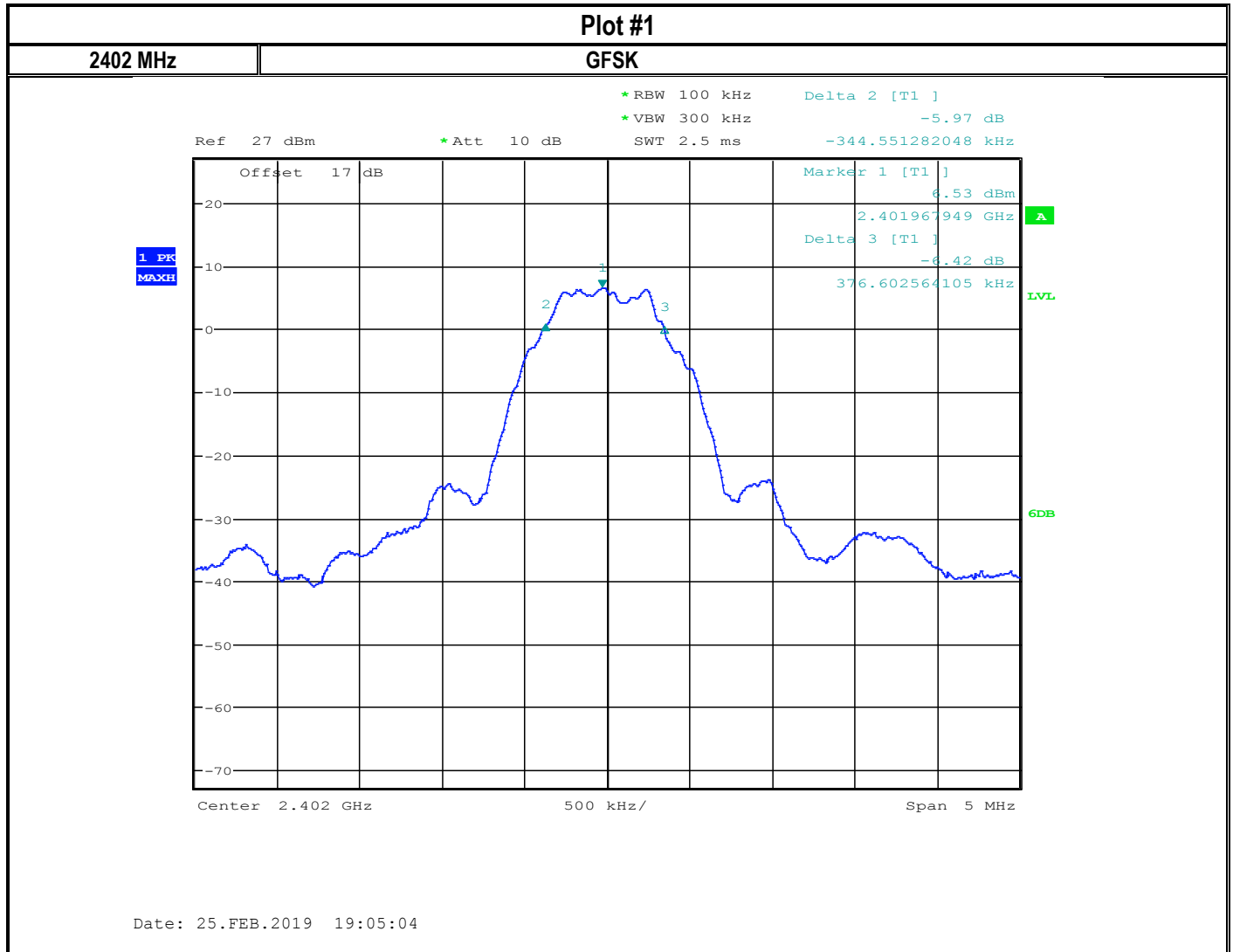
| Ambient Temperature | EUT # | EUT operating mode | Power Input |
|---------------------|-------|--------------------|-------------|
| 22° C               | 1     | Op.1               | 3.67v DC    |

### 8.1.4 Measurement result:

| Plot # | Frequency (MHz) | 6dB Emissions Bandwidth (MHz) | Limit (MHz) | Result |
|--------|-----------------|-------------------------------|-------------|--------|
| 1      | 2402            | 0.721                         | > 0.5       | Pass   |
| 2      | 2440            | 0.721                         | > 0.5       | Pass   |
| 3      | 2480            | 0.713                         | > 0.5       | Pass   |

| Plot # | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | Limit (MHz) | Result |
|--------|-----------------|------------------------------|-------------|--------|
| 4      | 2402            | 1.05                         | > 0.5       | Pass   |
| 5      | 2440            | 1.04                         | > 0.5       | Pass   |
| 6      | 2480            | 1.04                         | > 0.5       | Pass   |

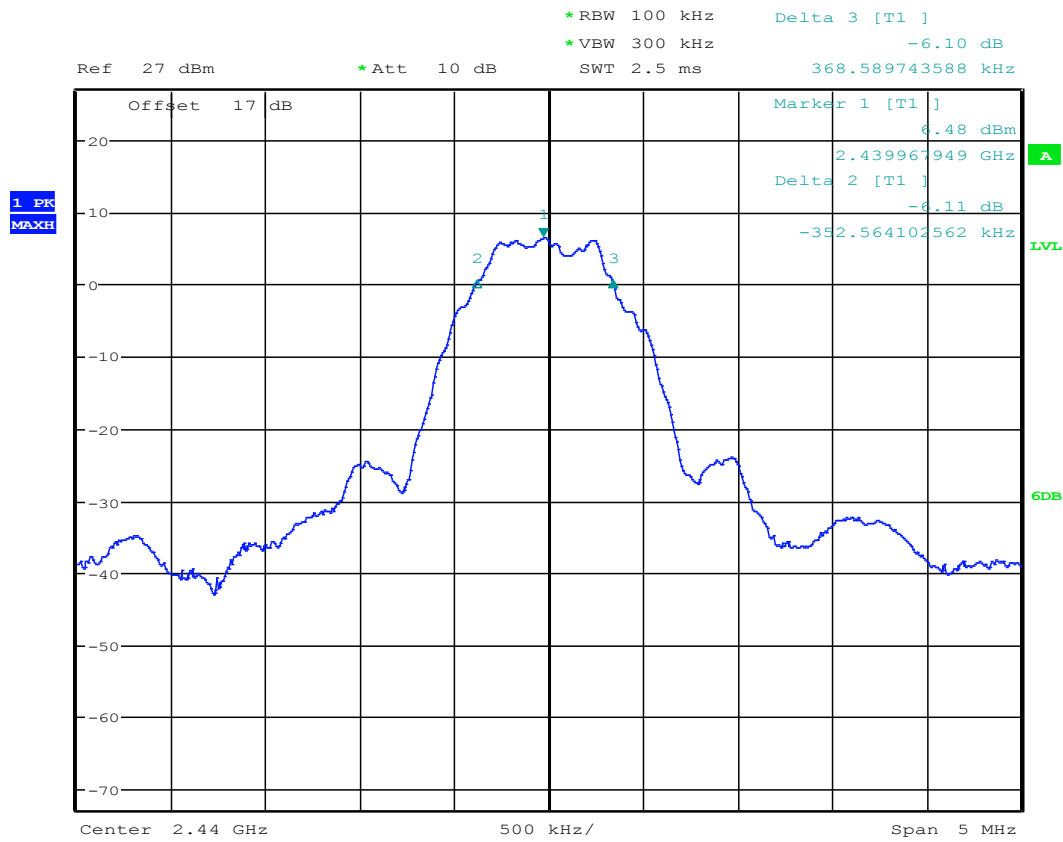
### 8.1.5 Measurement Plots:



## Plot #2

2440 MHz

GFSK

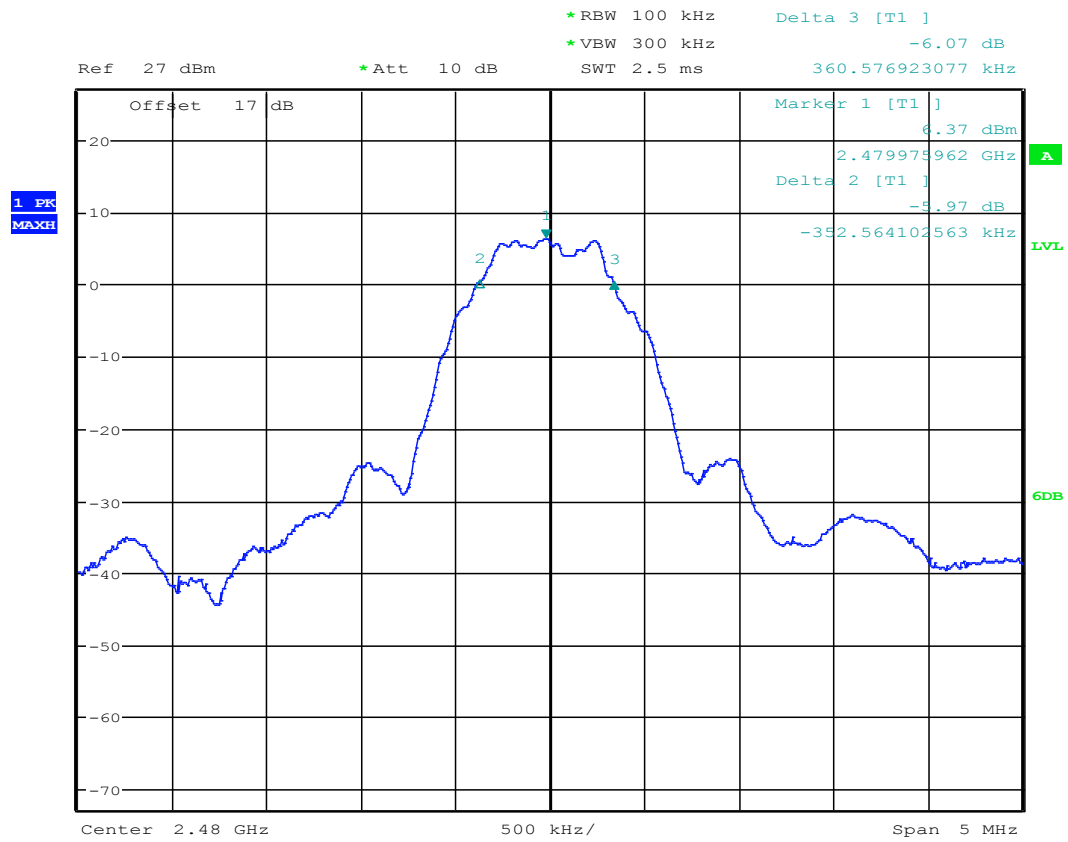


Date: 25.FEB.2019 19:07:23

## Plot #3

2480 MHz

GFSK

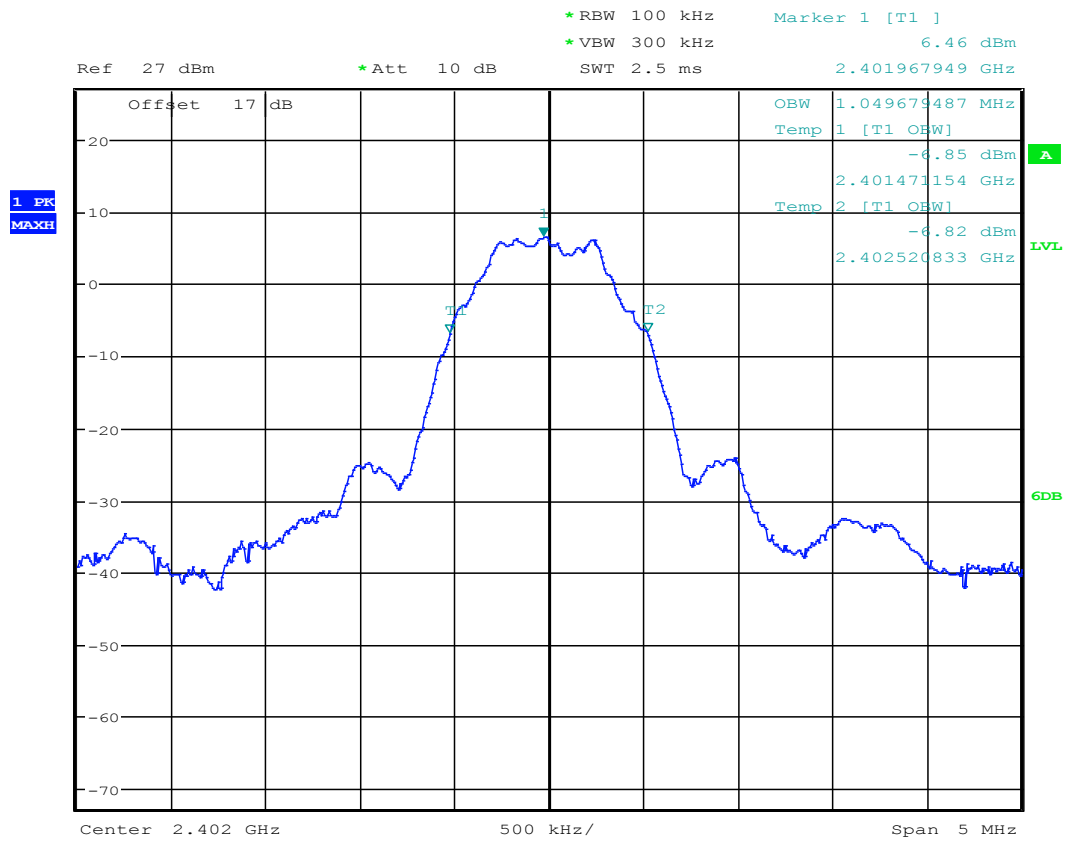


Date: 25.FEB.2019 19:12:09

### Plot #4

2402 MHz

GFSK

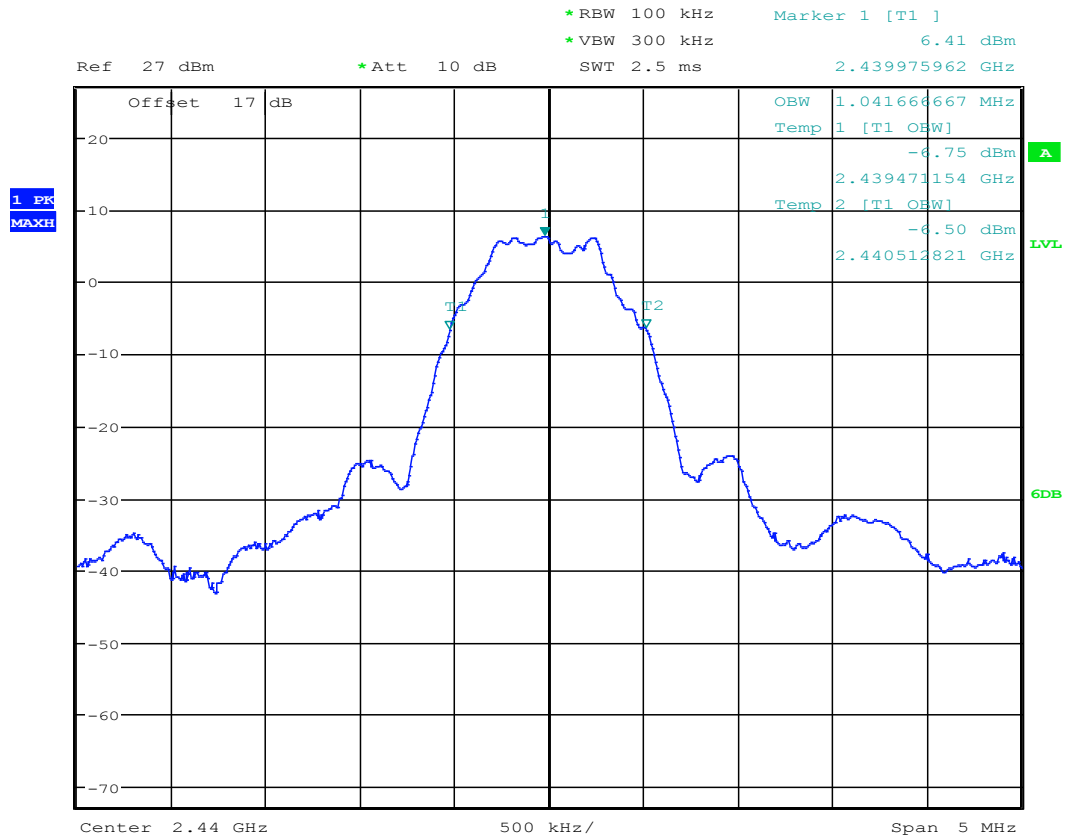


Date: 25.FEB.2019 19:16:42

**Plot #5**

**2440 MHz**

**GFSK**

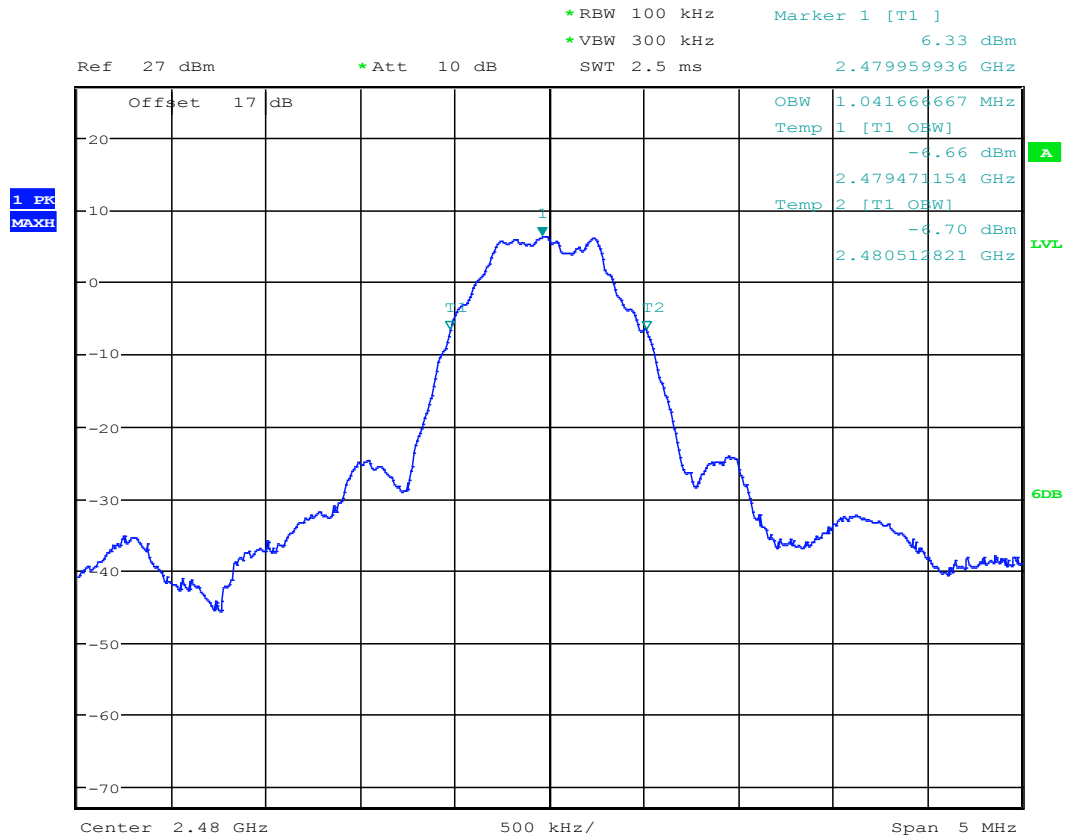


Date: 25.FEB.2019 19:15:36

### Plot #6

2480 MHz

GFSK



Date: 25.FEB.2019 19:14:04

## 8.2 Power Spectral Density

### 8.2.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v05

#### Spectrum Analyzer settings for Peak PSD method:

- Set analyzer center frequency to DTS channel center frequency
- Set the span to 1.5 x DTS bandwidth
- Set RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
- Set the VBW  $\geq 3 \times \text{RBW}$
- Detector = Peak
- Sweep time = Auto couple
- Trace mode = Max hold
- Allow trace to fully stabilize
- Use the peak marker function to determine the maximum amplitude level within the RBW
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat

### 8.2.2 Limits:

- FCC§15.247
  - (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
- RSS-247 5.2
  - b. The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

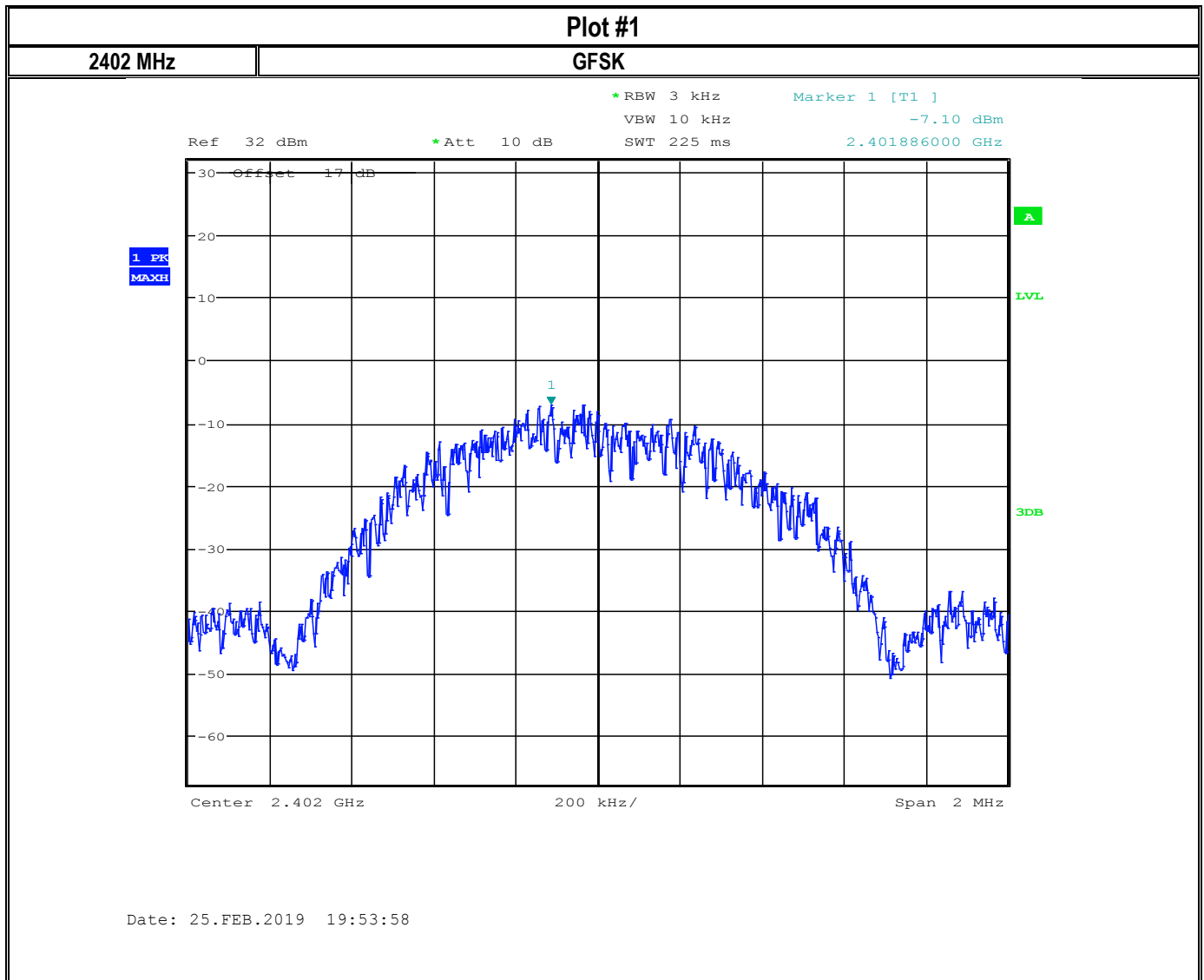
### 8.2.3 Test conditions and setup:

| Ambient Temperature | EUT # | EUT operating mode | Power Input | Antenna Gain |
|---------------------|-------|--------------------|-------------|--------------|
| 22° C               | 1     | Op.1               | 3.67v DC    | 1.3 dBi      |

### 8.2.4 Measurement result:

| Plot # | Frequency<br>[ MHz ] | Peak Power Spectral<br>Density<br>[ dBm/3 kHz ] | PSD Adjusted for<br>Antenna Gain<br>[ dBm/3 kHz ] | Limit<br>[ dBm/3 kHz ] | Result |
|--------|----------------------|-------------------------------------------------|---------------------------------------------------|------------------------|--------|
| 1      | 2402                 | -7.10                                           | -5.8                                              | 8                      | Pass   |
| 2      | 2441                 | -7.24                                           | -5.94                                             | 8                      | Pass   |
| 3      | 2480                 | -7.35                                           | -6.05                                             | 8                      | Pass   |

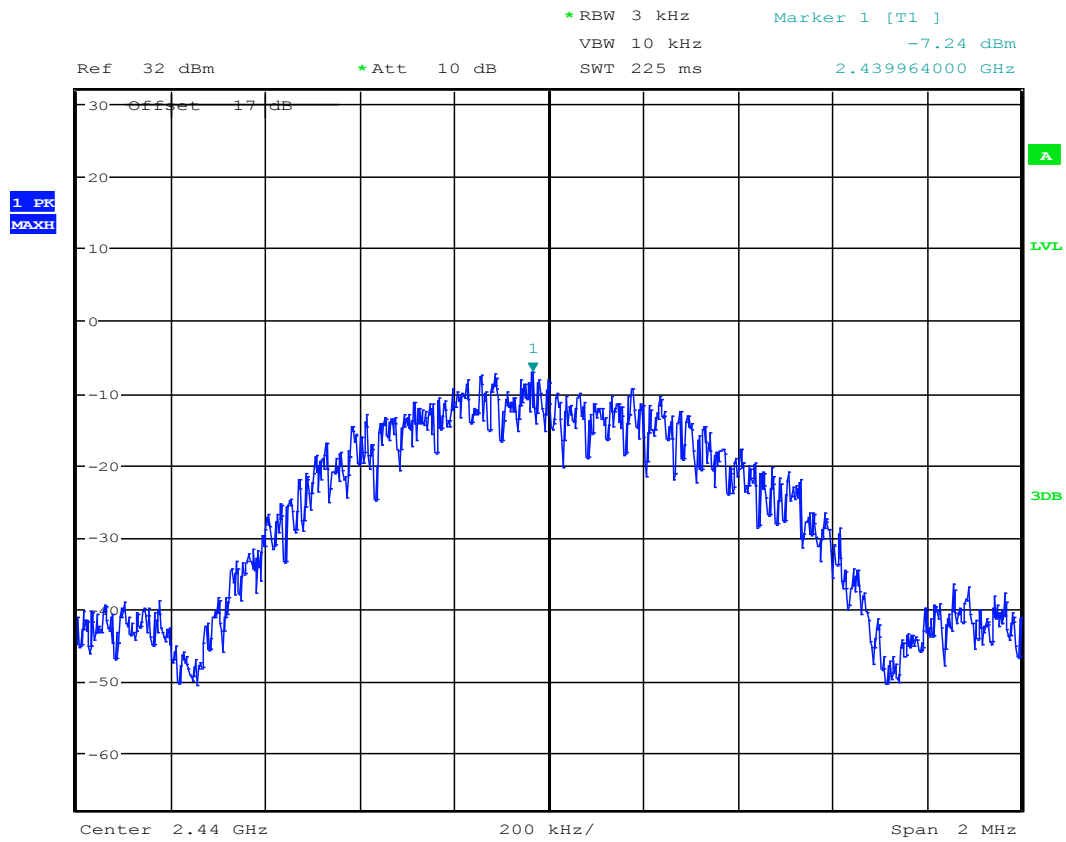
## 8.2.5 Measurement Plots:



**Plot #2**

**2440 MHz**

**GFSK**

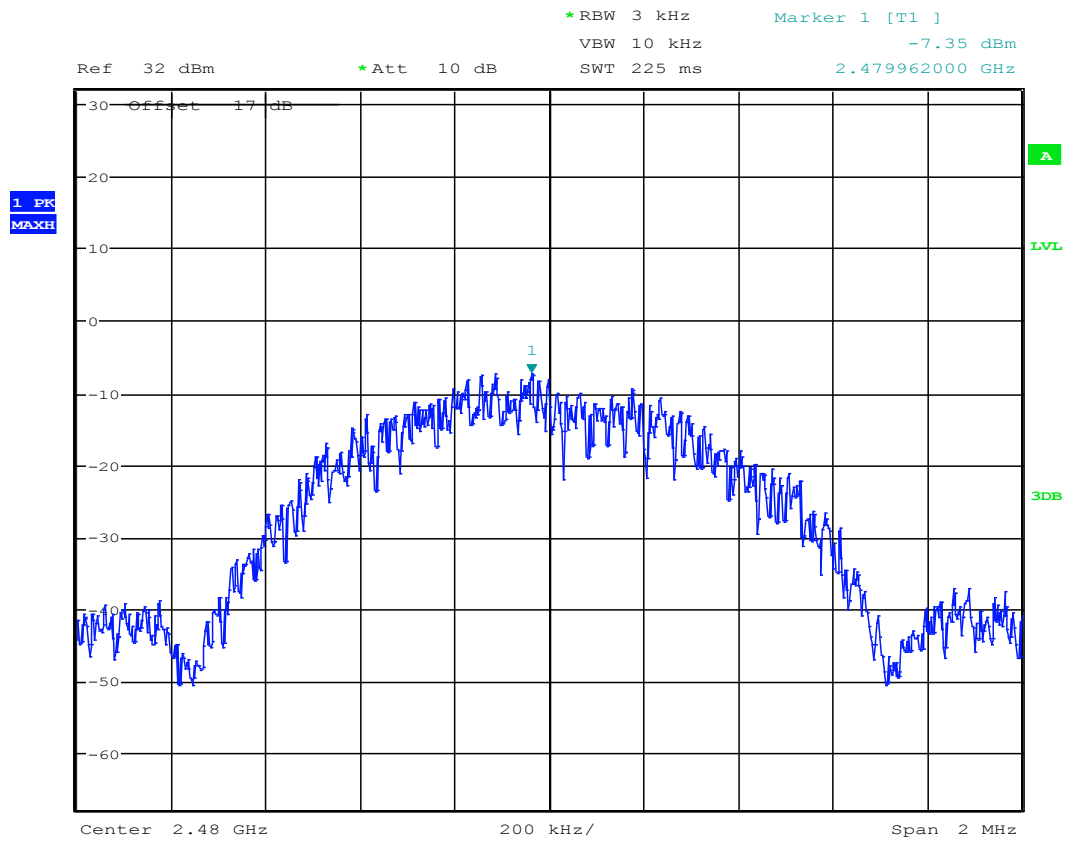


Date: 25.FEB.2019 19:51:47

**Plot #3**

**2480 MHz**

**GFSK**



Date: 25.FEB.2019 19:50:33

### 8.3 Maximum Peak Conducted Output Power

#### 8.3.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v05

##### Spectrum Analyzer settings:

- RBW  $\geq$  DTS bandwidth
- VBW  $\geq 3 \times$  RBW
- Span  $\geq 3 \times$  RBW
- Sweep = Auto couple
- Detector function = Peak
- Trace = Max hold
- Use peak marker function to determine the peak amplitude level

#### 8.3.2 Limits:

##### Maximum Peak Output Power:

- FCC §15.247 (b):
  - (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
- IC RSS-247 5.4:
  - d. For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).
  - As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

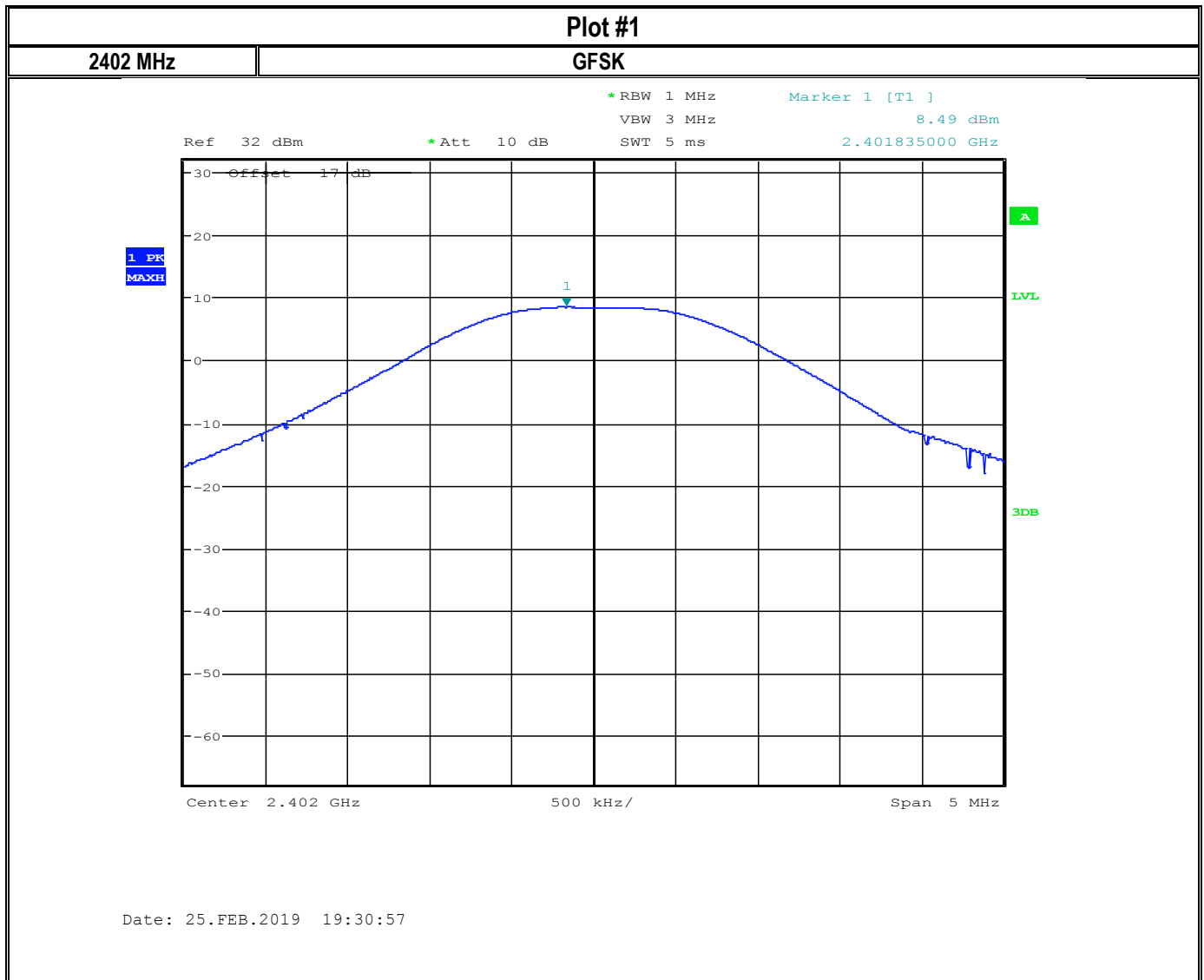
### 8.3.3 Test conditions and setup:

| Ambient Temperature | EUT # | EUT operating mode | Power Input | Antenna Gain |
|---------------------|-------|--------------------|-------------|--------------|
| 22° C               | 1     | Op.1               | 3.67v DC    | 1.3 dBi      |

### 8.3.4 Measurement result:

| Plot # | Frequency (MHz) | Maximum Peak Conducted Output Power (dBm) | EIRP (dBm) | Limit (dBm)         | Result |
|--------|-----------------|-------------------------------------------|------------|---------------------|--------|
| 1      | 2402            | 8.49                                      | 9.79       | 30 (Pk) / 36 (EIRP) | Pass   |
| 2      | 2441            | 8.45                                      | 9.75       | 30 (Pk) / 36 (EIRP) | Pass   |
| 3      | 2480            | 8.33                                      | 9.63       | 30 (Pk) / 36 (EIRP) | Pass   |

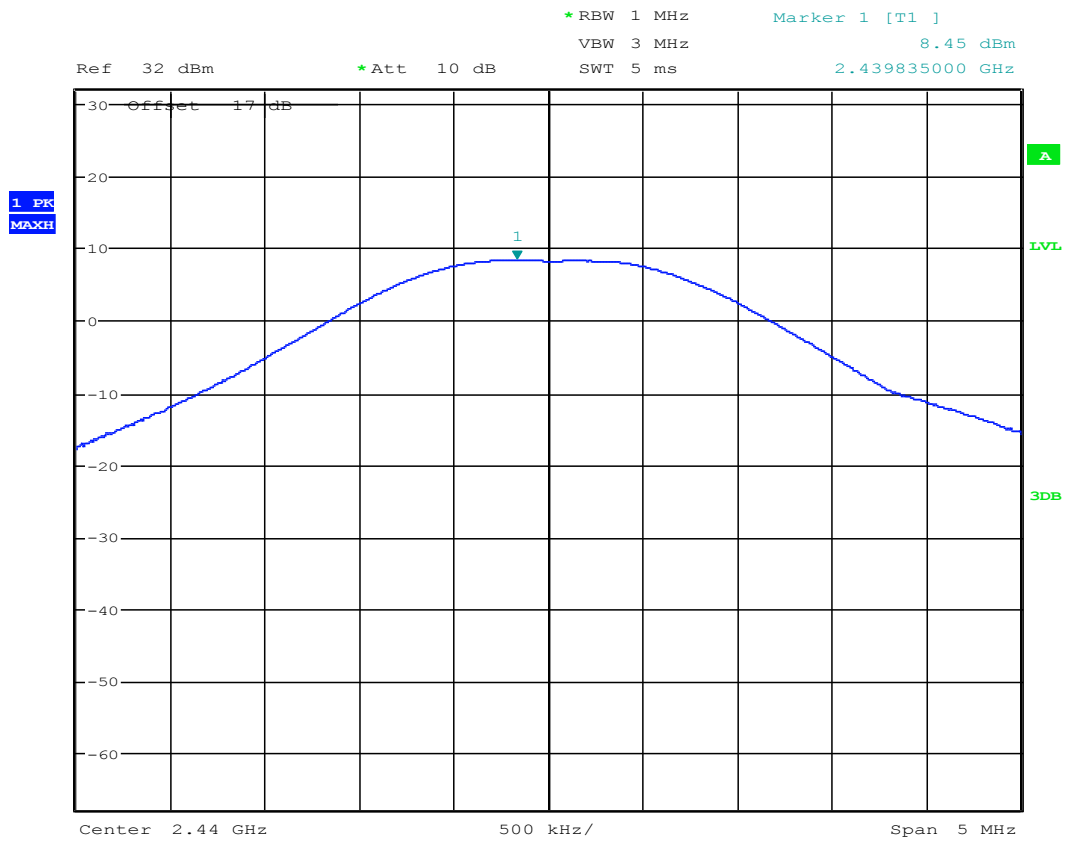
### 8.3.5 Measurement Plots:



**Plot #2**

**2440 MHz**

**GFSK**

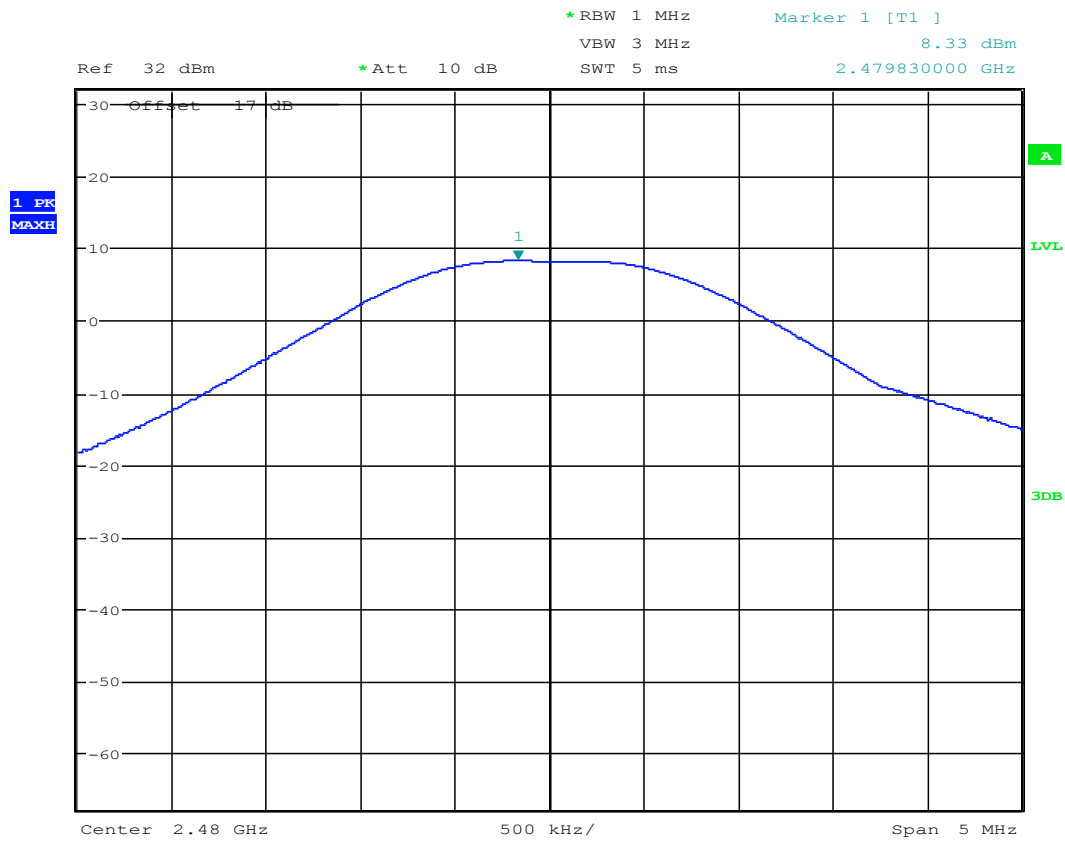


Date: 25.FEB.2019 19:32:33

**Plot #3**

**2480 MHz**

**GFSK**



Date: 25.FEB.2019 19:33:46

## 8.4 Band Edge Compliance

### 8.4.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v05

#### Spectrum Analyzer settings for band edge:

- Set the center frequency and span to encompass frequency range to be measured
- RBW = 100 kHz
- VBW  $\geq 3 \times$  RBW
- Sweep Time: Auto couple
- Detector = Peak
- Trace = Max hold
- Allow trace to fully stabilize
- Use the peak marker function to determine the maximum amplitude level
- Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge

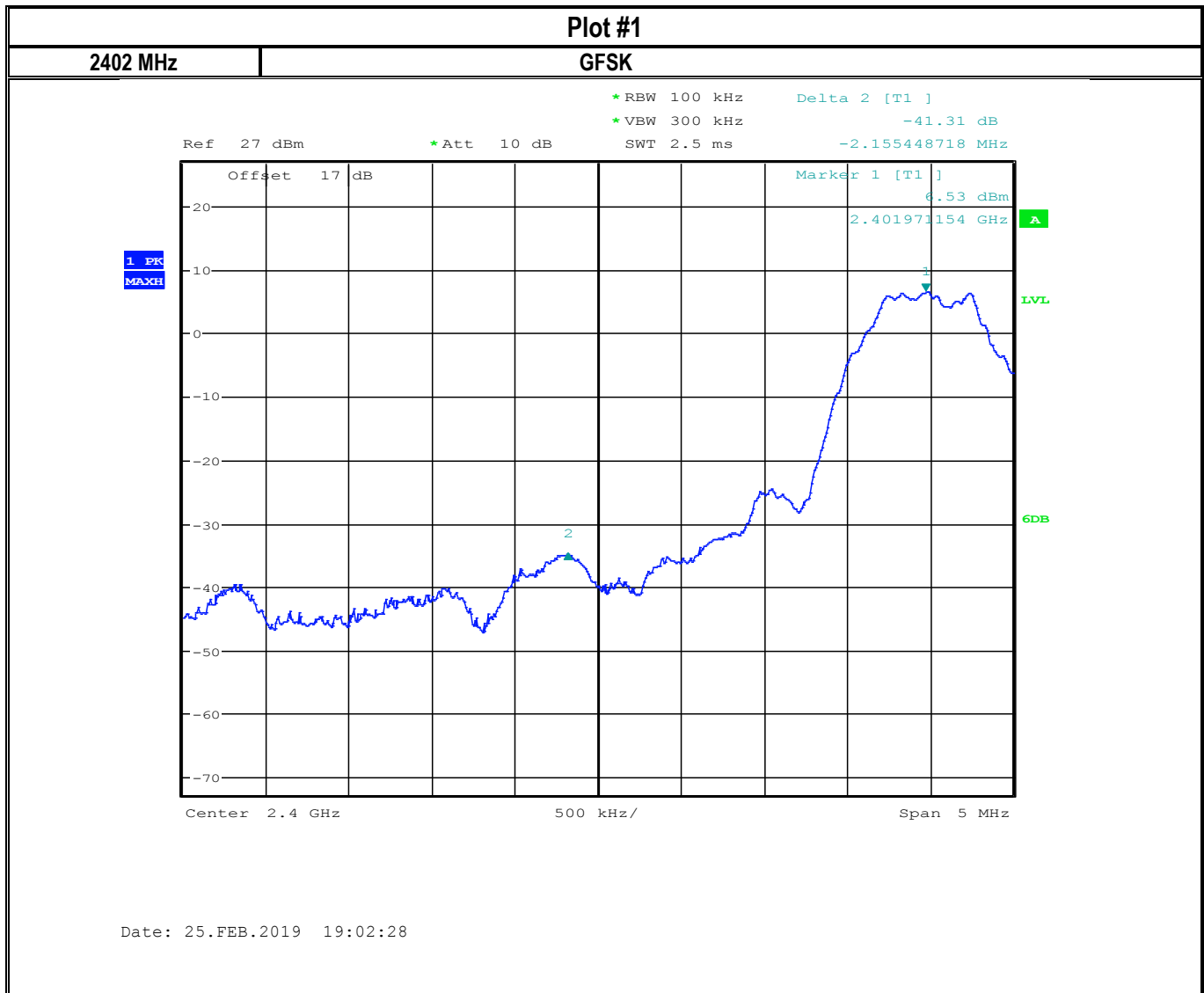
### 8.4.2 Limits non restricted band:

- FCC§15.247
  - (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
- RSS-247 5.5
  - In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB.

### 8.4.3 Measurement result:

| Plot # | EUT # | EUT operating mode | Band Edge             | Band Edge Delta (dBc) | Limit (dBc) |
|--------|-------|--------------------|-----------------------|-----------------------|-------------|
| 1      | 1     | Op.1               | Lower, Non-restricted | 41.31                 | >20         |

#### 8.4.4 Measurement plots



**Spectrum Analyzer settings for restricted band:**

- Peak measurements are made using a peak detector and RBW=1 MHz

**8.4.5 Limits restricted band §15.247/15.209/15.205**

- \*PEAK LIMIT= 74 dB $\mu$ V/m @3m =-21.23 dBm
- \*AVG. LIMIT= 54 dB $\mu$ V/m @3m =-41.23 dBm
- Start frequency & stop frequency according to frequency range specified in the restricted band table in FCC section 15.205 & RSS-Gen 8.10
- Measurements with a peak detector were used to show compliance to average limits, thus showing compliance to both peak and average limits.

- (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.090-0.110       | 16.42-16.423        | 399.9-410     | 4.5-5.15    |
| 10.495-0.505      | 16.69475-16.69525   | 608-614       | 5.35-5.46   |
| 2.1735-2.1905     | 16.80425-16.80475   | 960-1240      | 7.25-7.75   |
| 4.125-4.128       | 25.5-25.67          | 1300-1427     | 8.025-8.5   |
| 4.17725-4.17775   | 37.5-38.25          | 1435-1626.5   | 9.0-9.2     |
| 4.20725-4.20775   | 73-74.6             | 1645.5-1646.5 | 9.3-9.5     |
| 6.215-6.218       | 74.8-75.2           | 1660-1710     | 10.6-12.7   |
| 6.26775-6.26825   | 108-121.94          | 1718.8-1722.2 | 13.25-13.4  |
| 6.31175-6.31225   | 123-138             | 2200-2300     | 14.47-14.5  |
| 8.291-8.294       | 149.9-150.05        | 2310-2390     | 15.35-16.2  |
| 8.362-8.366       | 156.52475-156.52525 | 2483.5-2500   | 17.7-21.4   |
| 8.37625-8.38675   | 156.7-156.9         | 2690-2900     | 22.01-23.12 |
| 8.41425-8.41475   | 162.0125-167.17     | 3260-3267     | 23.6-24.0   |
| 12.29-12.293      | 167.72-173.2        | 3332-3339     | 31.2-31.8   |
| 12.51975-12.52025 | 240-285             | 3345.8-3358   | 36.43-36.5  |
| 12.57675-12.57725 | 322-335.4           | 3600-4400     | Above 38.6  |
| 13.36-13.41       |                     |               |             |

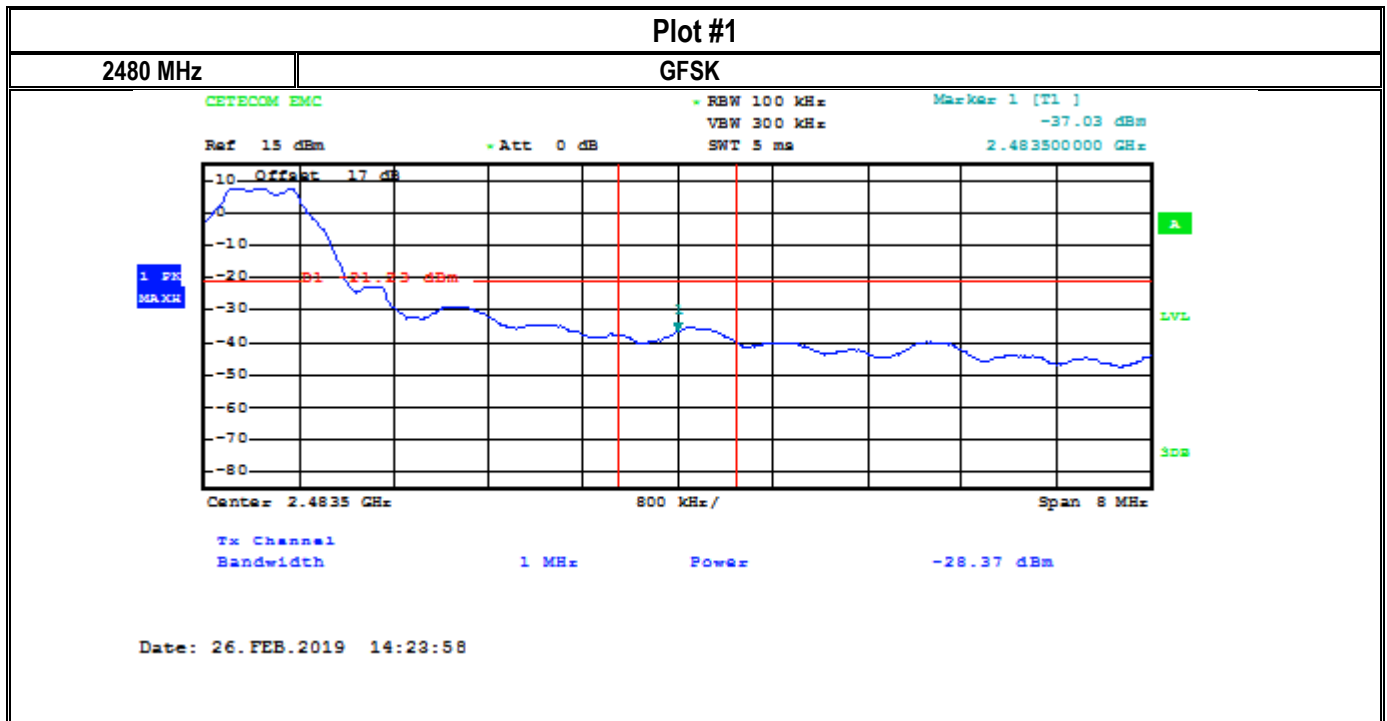
#### 8.4.6 Test conditions and setup:

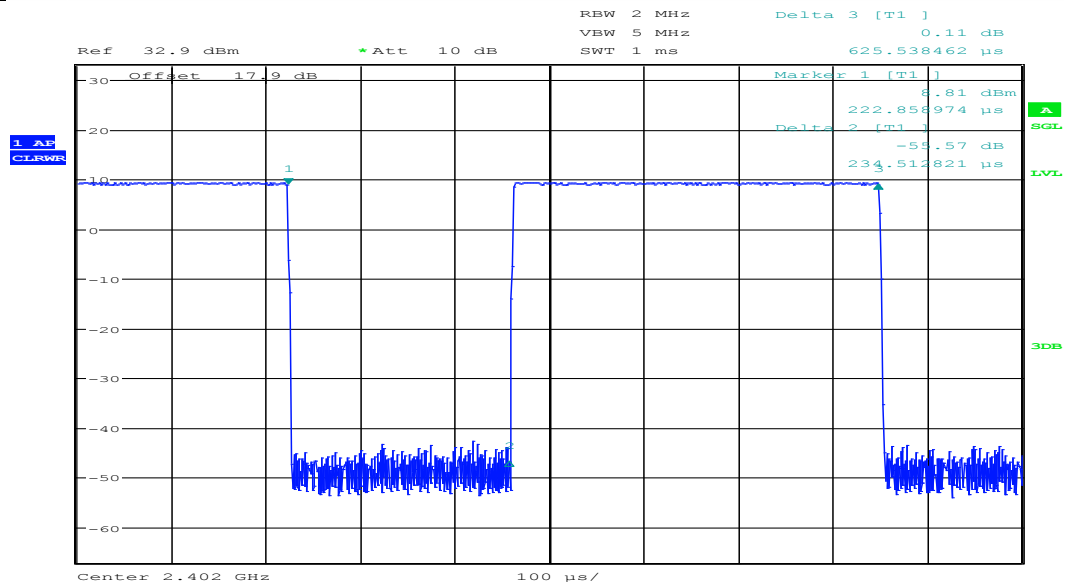
| Ambient Temperature | EUT # | EUT operating mode | Power Input | Antenna Gain |
|---------------------|-------|--------------------|-------------|--------------|
| 22° C               | 1     | Op.1               | 3.67v DC    | 1.3 dBi      |

#### 8.4.7 Measurement result:

| Plot # | Band Edge                | Measured Peak, Average Values (dBm) | Corrected by Antenna Gain (dBm)                  | Limit (dBm) | Result |
|--------|--------------------------|-------------------------------------|--------------------------------------------------|-------------|--------|
| 1      | Upper Restricted Peak    | -28.37                              | -27.07                                           | -21.23 Peak | Pass   |
| 2      | Upper Restricted Average | -45.37                              | -44.07<br>• And corrected for duty cycle= -41.95 | -41.23 AVG  | Pass   |

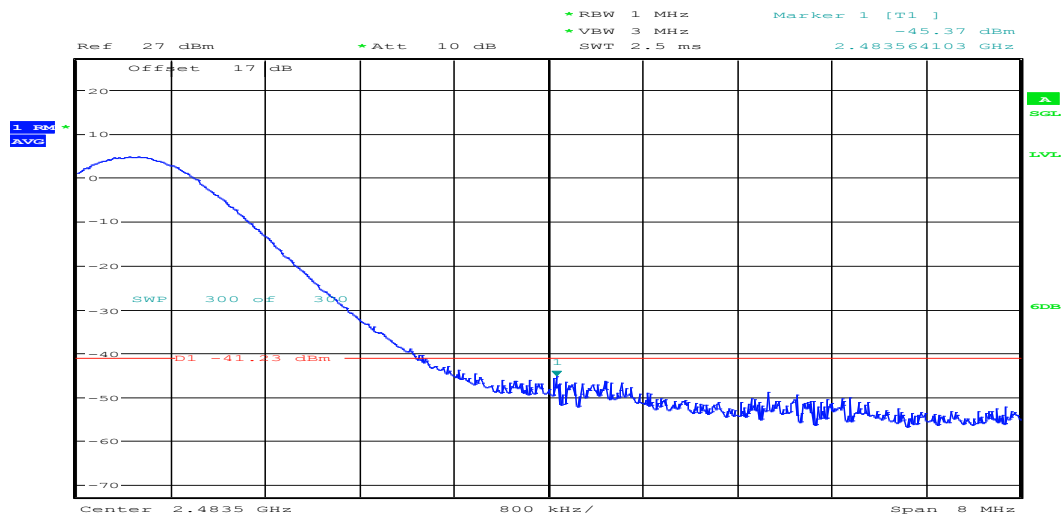
#### 8.4.8 Measurement plot:



**Zero-Span measurement method****RBW & VBW > 50/T****# of sweep points across T > 100****Duty cycle 61.4%**

Date: 25.FEB.2019 13:57:59

- $10 \cdot \log(1/\text{Duty cycle}) = 2.12 \text{ dB}$

**Plot #2****2480 MHz****GFSK**

Date: 25.FEB.2019 18:59:40

## 8.5 Radiated Transmitter Spurious Emissions and Restricted Bands

### 8.5.1 Measurement according to ANSI C63.10 (2013)

#### Spectrum Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector: Peak
  
- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW= 120 KHz (<1GHz)
  
- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1 MHz
  
- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) data rate shall be recorded for each measurement.
- For testing at distance other than the specified in the standard, the limit conversion is calculated by using 40 dB/decade extrapolation factor as follow: Conversion factor (CF) =  $40 \log (D/d) = 40 \log (300\text{m} / 3\text{m}) = 80\text{dB}$

### 8.5.2 Limits:

#### FCC §15.247

- d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

#### FCC §15.209 & RSS-Gen 8.9

- Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency of emission (MHz) | Field strength (μV/m) | Measurement Distance (m) | Field strength @ 3m (dBμV/m) |
|-----------------------------|-----------------------|--------------------------|------------------------------|
| 0.009–0.490                 | 2400/F(kHz) / -----   | 300                      | -                            |
| 0.490–1.705                 | 24000/F(kHz) / -----  | 30                       | -                            |
| 1.705–30.0                  | 30 / (29.5)           | 30                       | -                            |
| 30–88                       | 100                   | 3                        | 40 dBμV/m                    |
| 88–216                      | 150                   | 3                        | 43.5 dBμV/m                  |
| 216–960                     | 200                   | 3                        | 46 dBμV/m                    |
| Above 960                   | 500                   | 3                        | 54 dBμV/m                    |

#### FCC §15.205 & RSS-Gen 8.10

- Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.090-0.110       | 16.42-16.423        | 399.9-410     | 4.5-5.15    |
| 10.495-0.505      | 16.69475-16.69525   | 608-614       | 5.35-5.46   |
| 2.1735-2.1905     | 16.80425-16.80475   | 960-1240      | 7.25-7.75   |
| 4.125-4.128       | 25.5-25.67          | 1300-1427     | 8.025-8.5   |
| 4.17725-4.17775   | 37.5-38.25          | 1435-1626.5   | 9.0-9.2     |
| 4.20725-4.20775   | 73-74.6             | 1645.5-1646.5 | 9.3-9.5     |
| 6.215-6.218       | 74.8-75.2           | 1660-1710     | 10.6-12.7   |
| 6.26775-6.26825   | 108-121.94          | 1718.8-1722.2 | 13.25-13.4  |
| 6.31175-6.31225   | 123-138             | 2200-2300     | 14.47-14.5  |
| 8.291-8.294       | 149.9-150.05        | 2310-2390     | 15.35-16.2  |
| 8.362-8.366       | 156.52475-156.52525 | 2483.5-2500   | 17.7-21.4   |
| 8.37625-8.38675   | 156.7-156.9         | 2690-2900     | 22.01-23.12 |
| 8.41425-8.41475   | 162.0125-167.17     | 3260-3267     | 23.6-24.0   |
| 12.29-12.293      | 167.72-173.2        | 3332-3339     | 31.2-31.8   |
| 12.51975-12.52025 | 240-285             | 3345.8-3358   | 36.43-36.5  |
| 12.57675-12.57725 | 322-335.4           | 3600-4400     | Above 38.6  |
| 13.36-13.41       |                     |               |             |

- Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).  
 \*PEAK LIMIT= 74 dBμV/m  
 \*AVG. LIMIT= 54 dBμV/m

### 8.5.3 Test conditions and setup:

| Ambient Temperature | EUT operating mode | Power Input |
|---------------------|--------------------|-------------|
| 23° C               | Op.1               | 12 VDC      |

### 8.5.4 Measurement result:

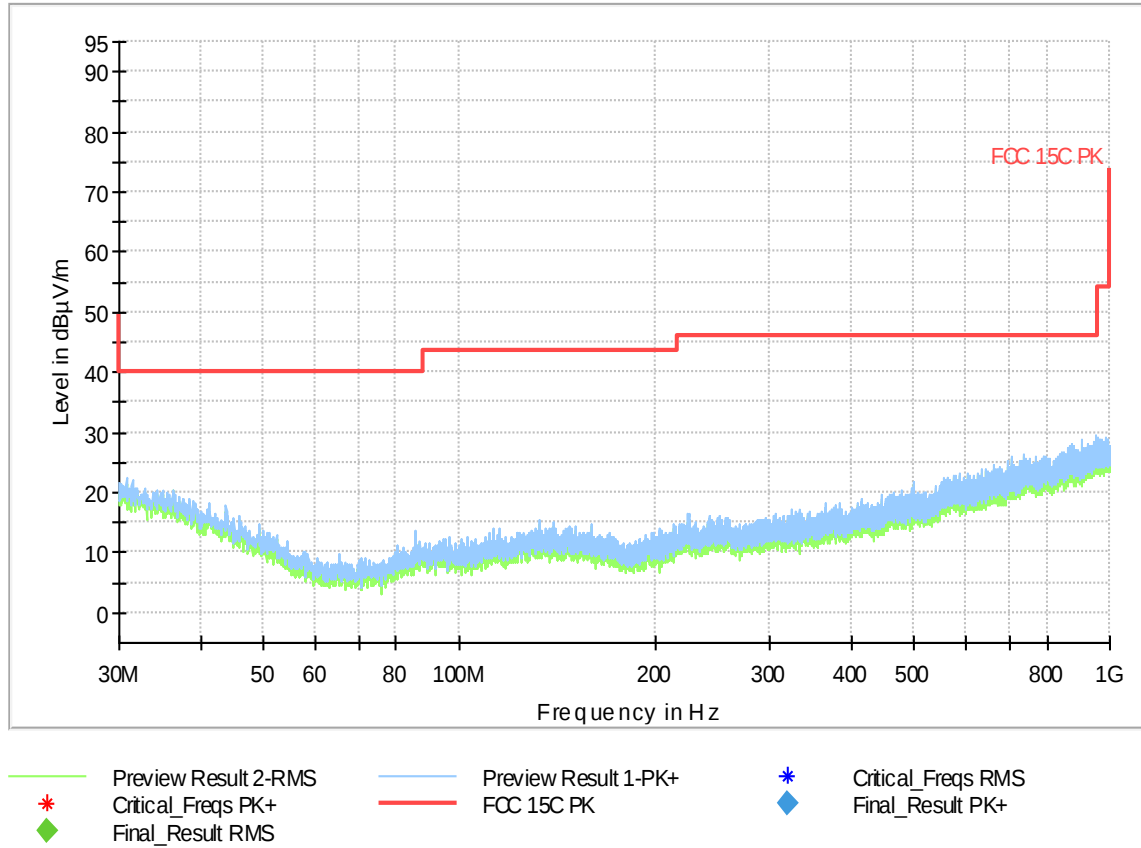
| Plot #  | Channel # | EUT # | Scan Frequency  | Critical Frequency [MHz] | Emission level [dBuV/m] | Detector | Limit             | Result |
|---------|-----------|-------|-----------------|--------------------------|-------------------------|----------|-------------------|--------|
| 1 – 3   | 0         | 2     | 30 MHz – 18 GHz | 14413.4                  | 51.02                   | RMS      | See section 8.5.2 | Pass   |
| 4 – 8   | 19        | 2     | 9 kHz – 40 GHz  | 14638.3                  | 53.42                   | RMS      | See section 8.5.2 | Pass   |
| 9 – 11  |           | 3     | 30 MHz – 18 GHz | 12201.2                  | 43.59                   | RMS      | See section 8.5.2 | Pass   |
| 12 – 14 | 39        | 2     | 30 MHz – 18 GHz | 7439.3                   | 44.7                    | RMS      | See section 8.5.2 | Pass   |

### 8.5.5 Measurement Plots:

Plot # 1 Radiated Emissions: 30MHz – 1GHz

Modulation: GFSK

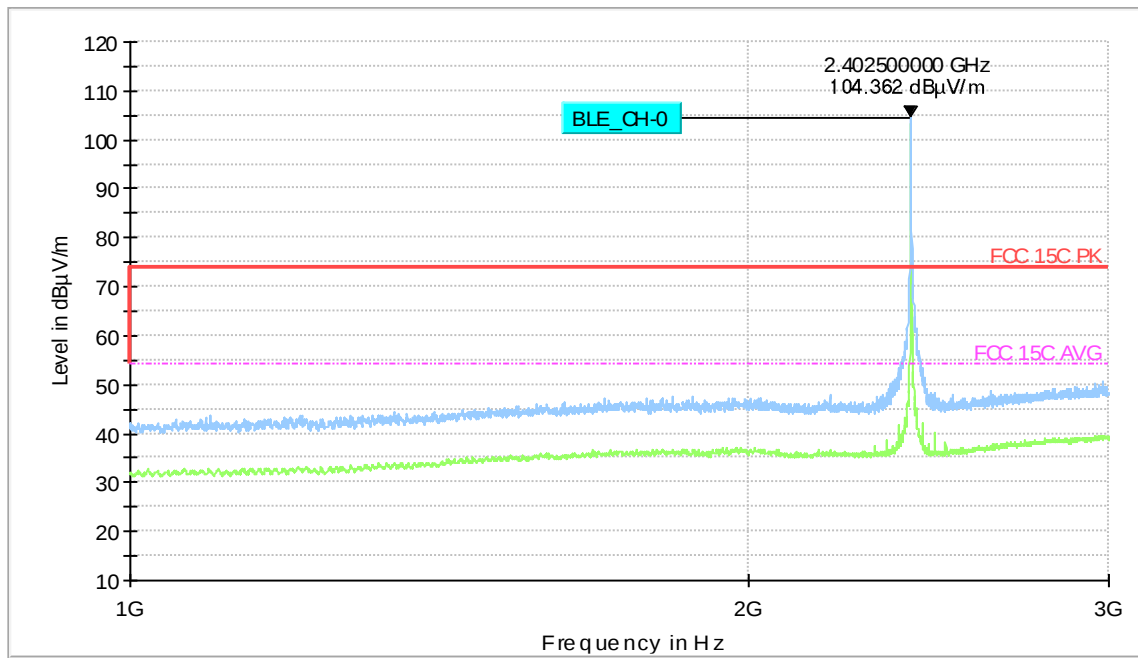
Channel: 0



Plot # 2 Radiated Emissions: 1 – 3GHz

Modulation: GFSK

Channel: 0



|                      |                      |                    |
|----------------------|----------------------|--------------------|
| Preview Result 2-RMS | Preview Result 1-PK+ | Critical_Freqs RMS |
| * Critical_Freqs PK+ | FCC 15C PK           | FCC 15C AVG        |
| ◆ Final_Result PK+   | ◆ Final_Result RMS   |                    |

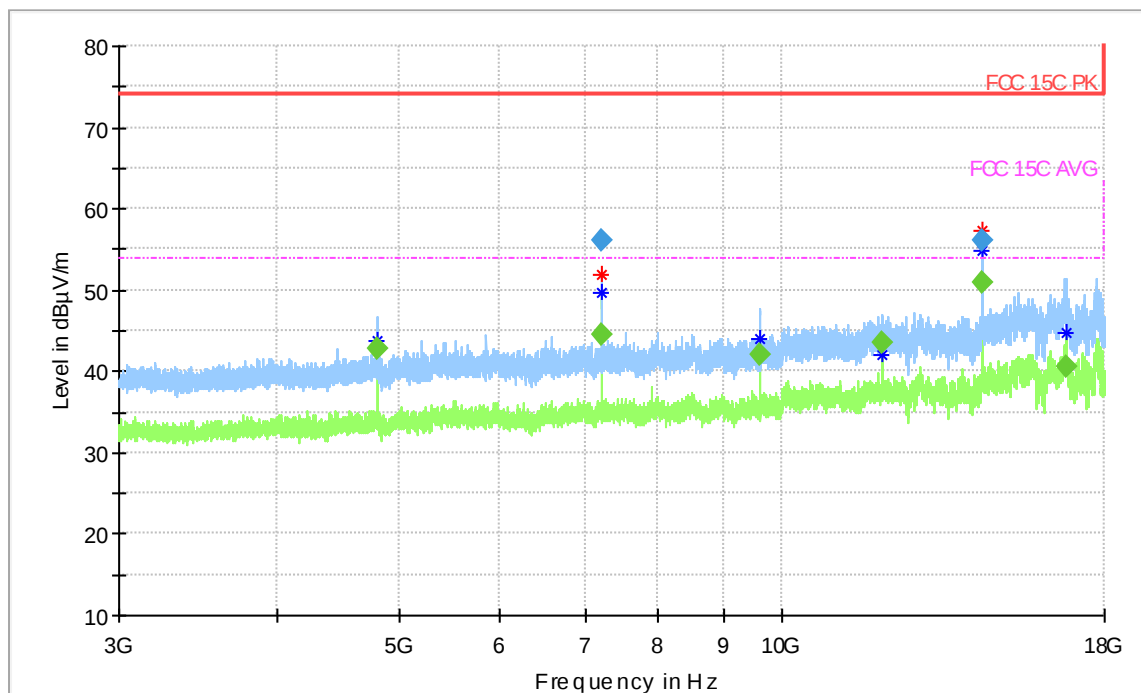
## Plot # 3 Radiated Emissions: 3 – 18GHz

Modulation: GFSK

Channel: 0

## Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | RMS (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Comment                |
|-----------------|------------------|--------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|------------------------|
| 4803.474        | ---              | 42.83        | 53.98          | 11.15       | 200.0           | 1000.0          | 292.0       | H   | 149.0         | -33          | 1:46:59 PM - 2/27/2019 |
| 7206.397        | 56.19            | ---          | 73.99          | 17.79       | 200.0           | 1000.0          | 107.0       | V   | 296.0         | -30          | 1:33:24 PM - 2/27/2019 |
| 7206.651        | ---              | 44.41        | 53.98          | 9.57        | 200.0           | 1000.0          | 114.0       | H   | 24.0          | -30          | 1:50:46 PM - 2/27/2019 |
| 9607.126        | ---              | 42.03        | 53.98          | 11.95       | 200.0           | 1000.0          | 226.0       | H   | 45.0          | -25          | 1:40:31 PM - 2/27/2019 |
| 12011.095       | ---              | 43.55        | 53.98          | 10.43       | 10.0            | 1000.0          | 230.0       | H   | 115.0         | -22          | 1:43:49 PM - 2/27/2019 |
| 14413.442       | ---              | 51.02        | 53.98          | 2.96        | 10.0            | 1000.0          | 157.0       | V   | 100.0         | -18          | 1:54:13 PM - 2/27/2019 |
| 14413.641       | 56.13            | ---          | 73.98          | 17.85       | 10.0            | 1000.0          | 142.0       | V   | 99.0          | -18          | 1:30:01 PM - 2/27/2019 |
| 16769.599       | ---              | 40.56        | 53.98          | 13.42       | 10.0            | 1000.0          | 206.0       | H   | -79.0         | -15          | 1:37:09 PM - 2/27/2019 |



— Preview Result 2-RMS      — Preview Result 1-PK+      \* Critical\_Freqs RMS  
\* Critical\_Freqs PK+      — FCC 15C PK      --- FCC 15C AVG  
◆ Final\_Result PK+      ◆ Final\_Result RMS

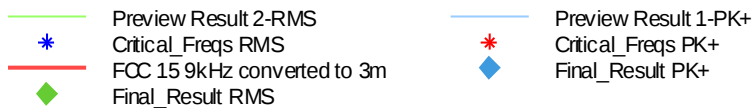
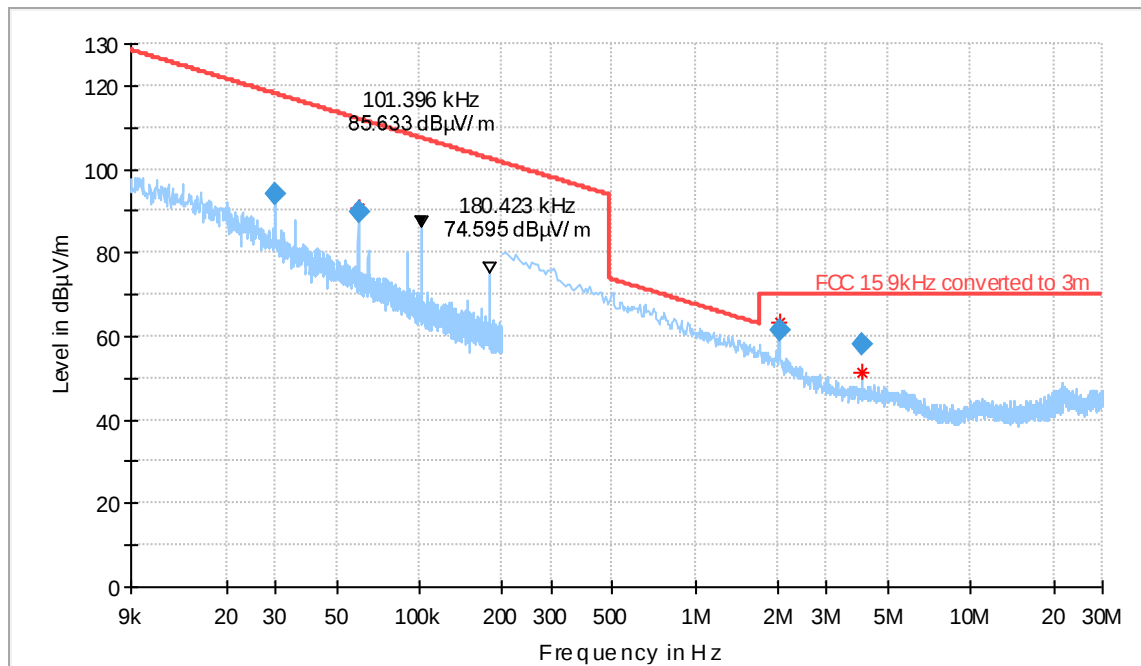
## Plot # 4 Radiated Emissions: 9KHz – 30MHz

Modulation: GFSK

Channel: 19

## Final\_Result

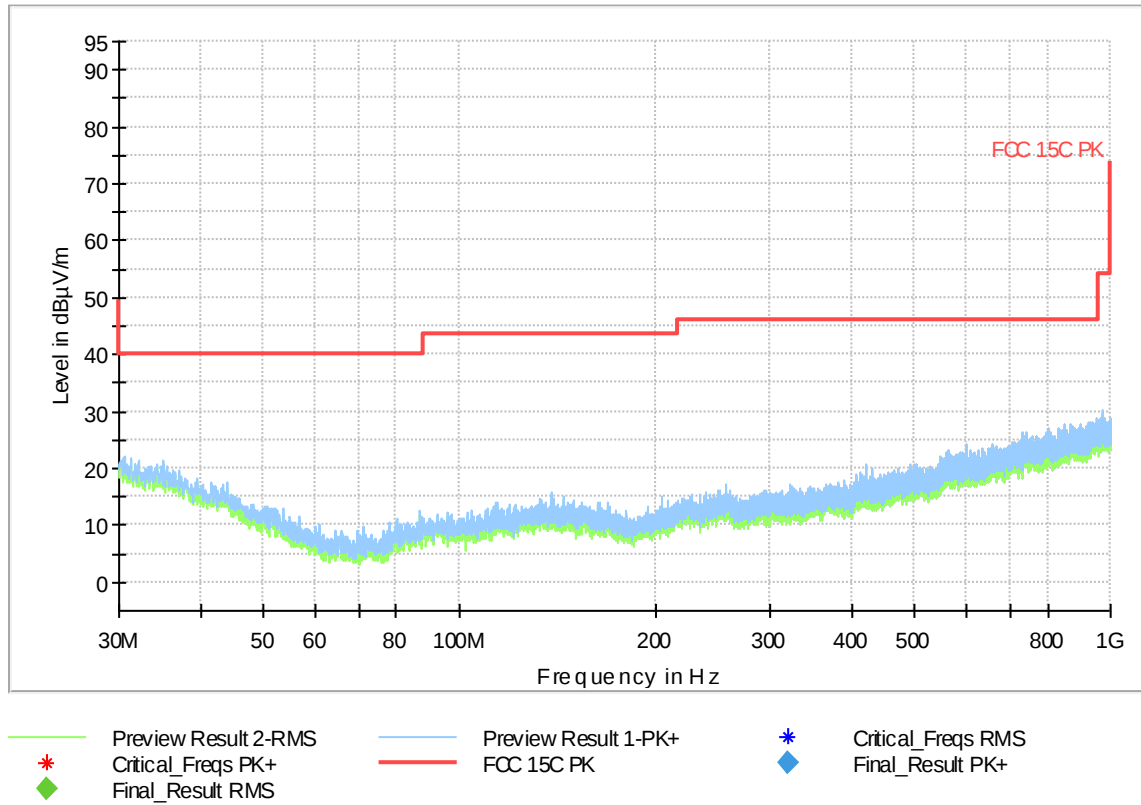
| Frequency (MHz) | MaxPeak (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Comment                |
|-----------------|------------------------|----------------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|------------------------|
| 0.030           | 93.79                  | 118.03               | 24.23       | 500.0           | 0.1             | 100.0       | H   | -87.0         | 76         | 6:40:41 PM - 2/27/2019 |
| 0.060           | 89.88                  | 112.00               | 22.11       | 500.0           | 0.1             | 100.0       | H   | -45.0         | 71         | 7:04:41 PM - 2/27/2019 |
| 2.035           | 61.26                  | 70.00                | 8.74        | 500.0           | 9.0             | 164.0       | H   | -93.0         | 43         | 6:43:09 PM - 2/27/2019 |
| 4.029           | 58.11                  | 70.00                | 11.89       | 500.0           | 9.0             | 107.0       | V   | -86.0         | 38         | 7:01:21 PM - 2/27/2019 |



Plot # 5 Radiated Emissions: 30MHz – 1GHz

Modulation: GFSK

Channel: 19



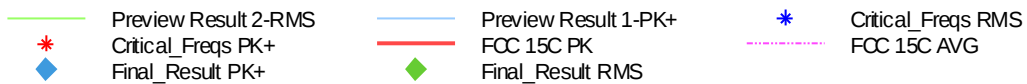
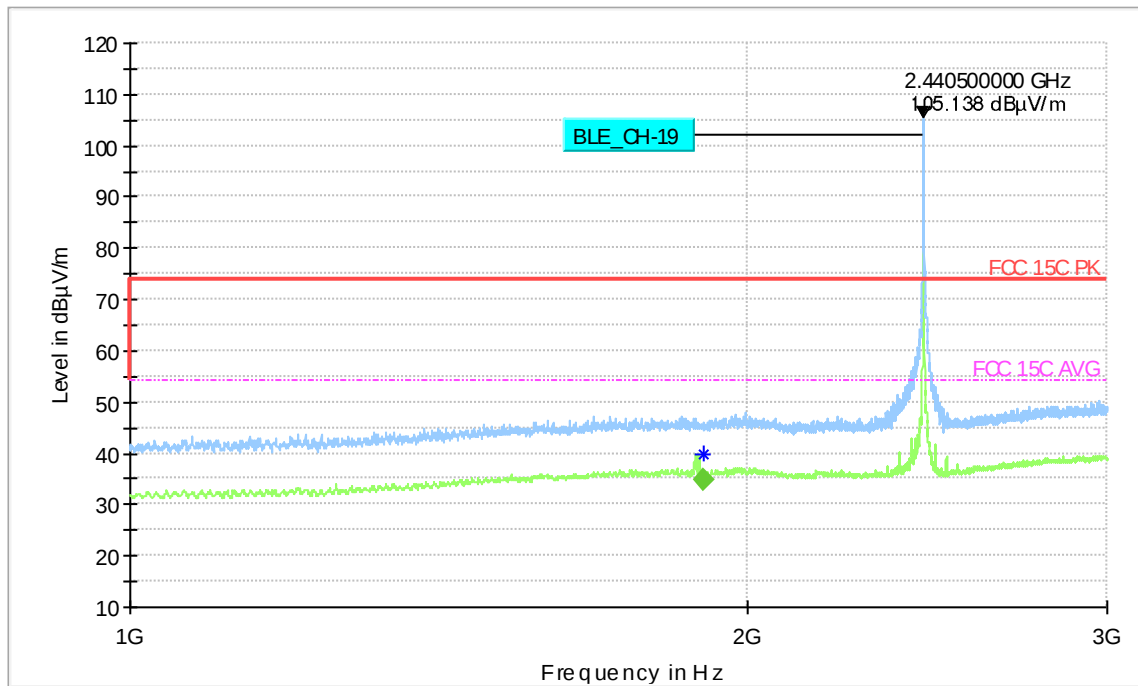
## Plot # 6 Radiated Emissions: 1 – 3GHz

Modulation: GFSK

Channel: 19

**Final Result**

| Frequency (MHz) | RMS (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Comment                |
|-----------------|--------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|------------------------|
| 1903.885        | 34.85        | 53.98          | 19.13       | 200.0           | 1000.0          | 177.0       | V   | 332.0         | 8            | 9:35:29 AM - 2/27/2019 |



## Plot # 7 Radiated Emissions: 3 – 18GHz

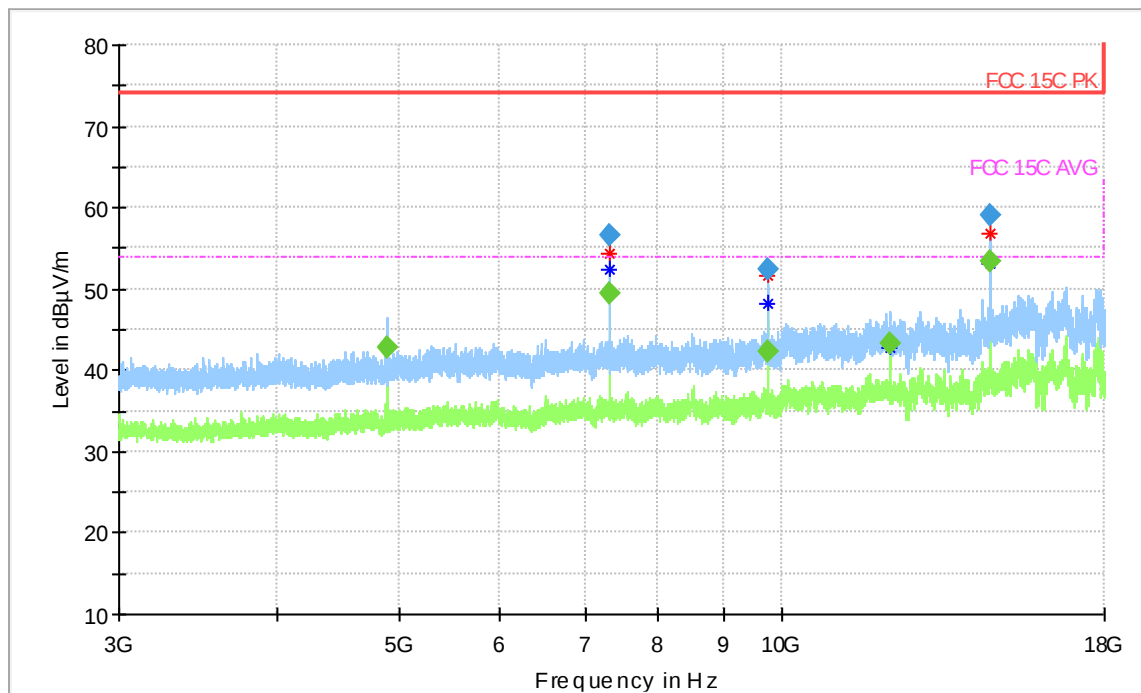
Modulation: GFSK

Channel: 19

## Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | RMS (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Comment                |
|-----------------|------------------|--------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|------------------------|
| 4880.412        | ---              | 42.88        | 53.98          | 11.10       | 200.0           | 1000.0          | 300.0       | H   | 146.0         | -33        | 2:20:52 PM - 2/27/2019 |
| 7319.146        | ---              | 49.38        | 53.98          | 4.60        | 200.0           | 1000.0          | 120.0       | V   | 290.0         | -30        | 2:37:37 PM - 2/27/2019 |
| 7319.503        | 56.64            | ---          | 73.99          | 17.35       | 200.0           | 1000.0          | 100.0       | V   | 292.0         | -30        | 2:17:30 PM - 2/27/2019 |
| 9758.959        | 52.35            | ---          | 73.98          | 21.63       | 200.0           | 1000.0          | 210.0       | H   | 228.0         | -25        | 2:07:31 PM - 2/27/2019 |
| 9760.998        | ---              | 42.40        | 53.98          | 11.58       | 200.0           | 1000.0          | 172.0       | H   | 223.0         | -25        | 2:27:36 PM - 2/27/2019 |
| 12201.191       | ---              | 43.19        | 53.98          | 10.79       | 10.0            | 1000.0          | 190.0       | H   | 310.0         | -22        | 2:24:21 PM - 2/27/2019 |
| 14638.371       | ---              | 53.42        | 53.98          | 0.56        | 10.0            | 1000.0          | 166.0       | V   | 138.0         | -17        | 2:31:02 PM - 2/27/2019 |
| 14641.510       | 59.00            | ---          | 73.98          | 14.98       | 10.0            | 1000.0          | 107.0       | V   | 144.0         | -17        | 2:14:02 PM - 2/27/2019 |

| Frequency (MHz) | MaxPeak (dBμV/m) | Corrected MaxPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|------------------|----------------------------|----------------|-------------|
| 7319.503        | 56.64            | 39.14                      | 53.98          | 14.84       |
| 9758.959        | 52.35            | 34.85                      | 53.98          | 19.13       |
| 14641.510       | 59.00            | 41.50                      | 53.98          | 12.48       |



— Preview Result 2-RMS  
— Preview Result 1-PK+  
— FCC 15C PK  
— FCC 15C AVG  
◆ Final\_Result PK+  
◆ Final\_Result RMS  
✱ Critical\_Freqs RMS  
✱ Critical\_Freqs PK+

According to the FCC Basics of Unlicensed transmitters and ANSI C63.10 section 7.5;

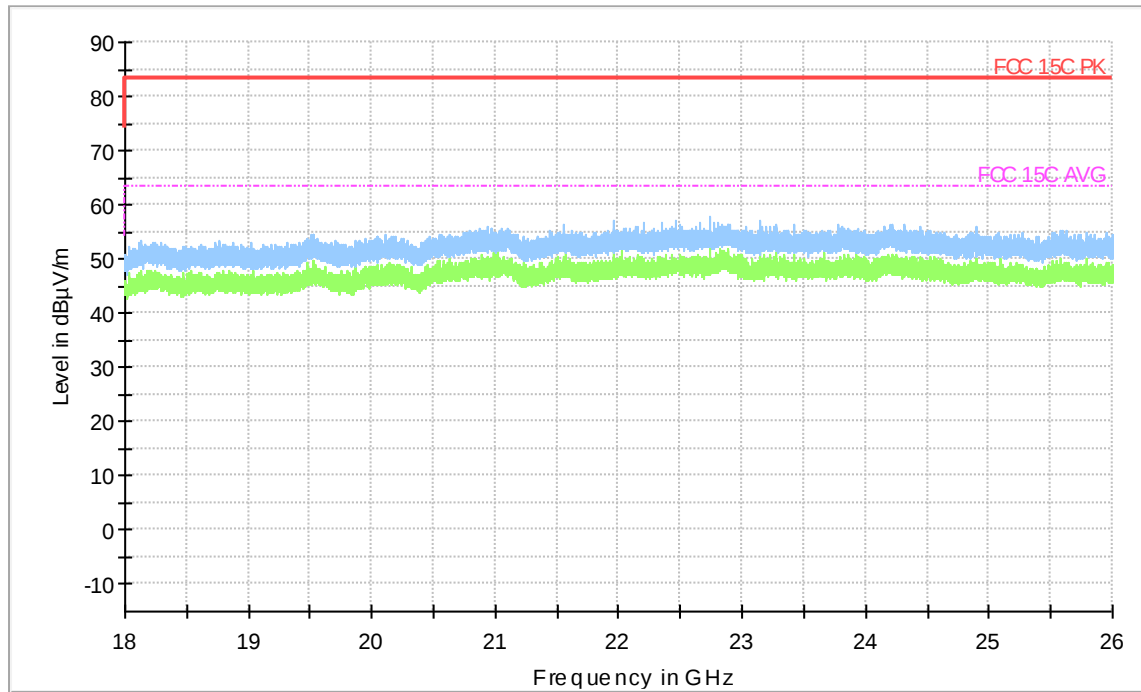
Determining the duty cycle correction factor (in dB) using  $20 * \log_{10}(\text{Duty cycle \%})$ , and apply it to the peak pulse.

$$20 * \log_{10}(0.075) = 17.5 \text{ dB}$$

Plot # 8 Radiated Emissions: 18 – 40GHz

Modulation: GFSK

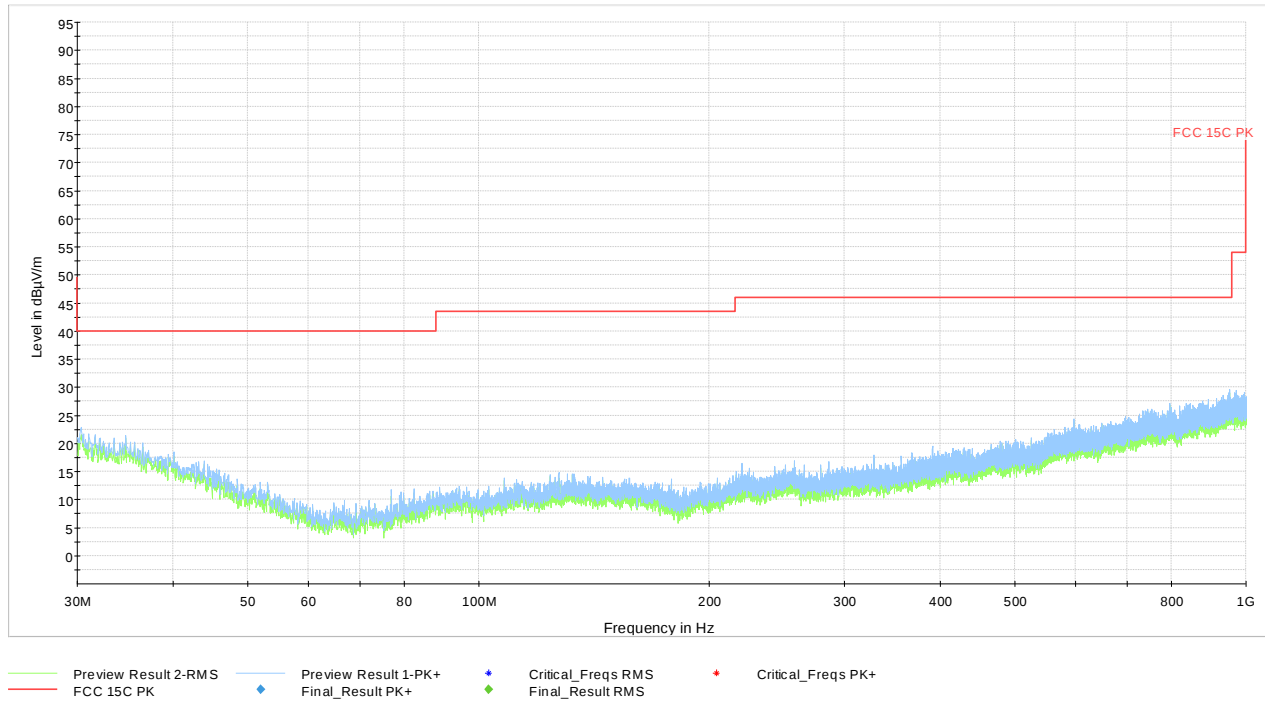
Channel: 19



**Plot # 9 Radiated Emissions: 30MHz – 1GHz**

**Modulation: GFSK**

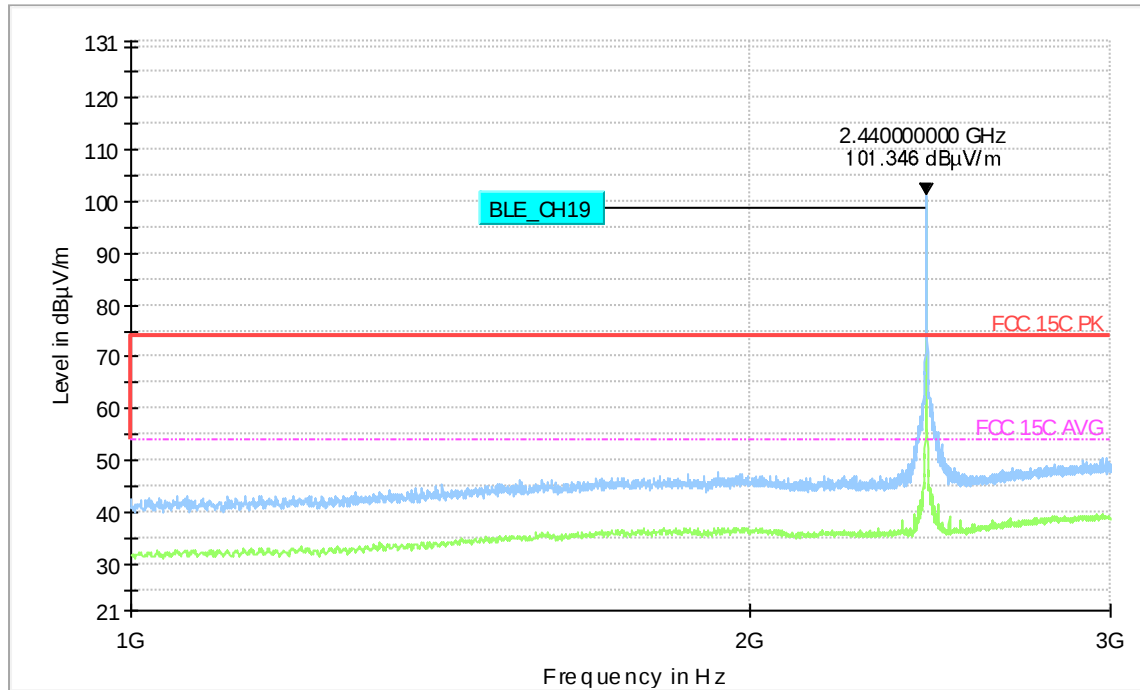
**Channel: 19**



## Plot # 10 Radiated Emissions: 1 – 3GHz

Modulation: GFSK

Channel: 19



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

Preview Result 1-PK+  
FCC 15C PK  
Final\_Result RMS

\* Critical\_Freqs RMS  
FCC 15C AVG

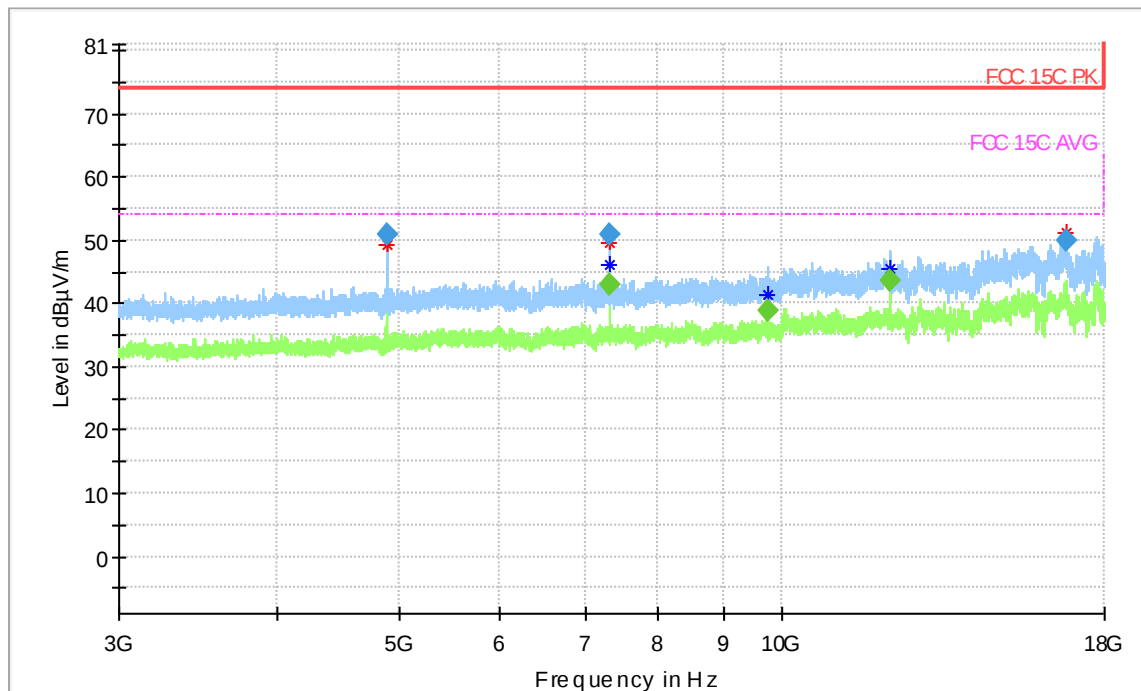
## Plot # 11 Radiated Emissions: 3 – 18GHz

Modulation: GFSK

Channel: 19

## Final\_Result

| Frequency (MHz) | MaxPeak (dBμV/m) | RMS (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Comment                 |
|-----------------|------------------|--------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|-------------------------|
| 4879.651        | 51.05            | ---          | 73.99          | 22.94       | 200.0           | 1000.0          | 223.0       | V   | 318.0         | -33        | 1:03:55 PM - 2/27/2019  |
| 7320.699        | 50.99            | ---          | 73.99          | 23.00       | 200.0           | 1000.0          | 202.0       | H   | 321.0         | -30        | 12:30:53 PM - 2/27/2019 |
| 7320.712        | ---              | 42.98        | 53.98          | 11.00       | 200.0           | 1000.0          | 156.0       | H   | 327.0         | -30        | 12:49:10 PM - 2/27/2019 |
| 9758.989        | ---              | 38.75        | 53.98          | 15.23       | 200.0           | 1000.0          | 124.0       | V   | 60.0          | -25        | 12:52:48 PM - 2/27/2019 |
| 12201.201       | ---              | 43.59        | 53.98          | 10.39       | 10.0            | 1000.0          | 107.0       | V   | 344.0         | -22        | 12:56:16 PM - 2/27/2019 |
| 16787.989       | 49.79            | ---          | 73.98          | 24.19       | 10.0            | 1000.0          | 229.0       | V   | 259.0         | -15        | 1:00:43 PM - 2/27/2019  |

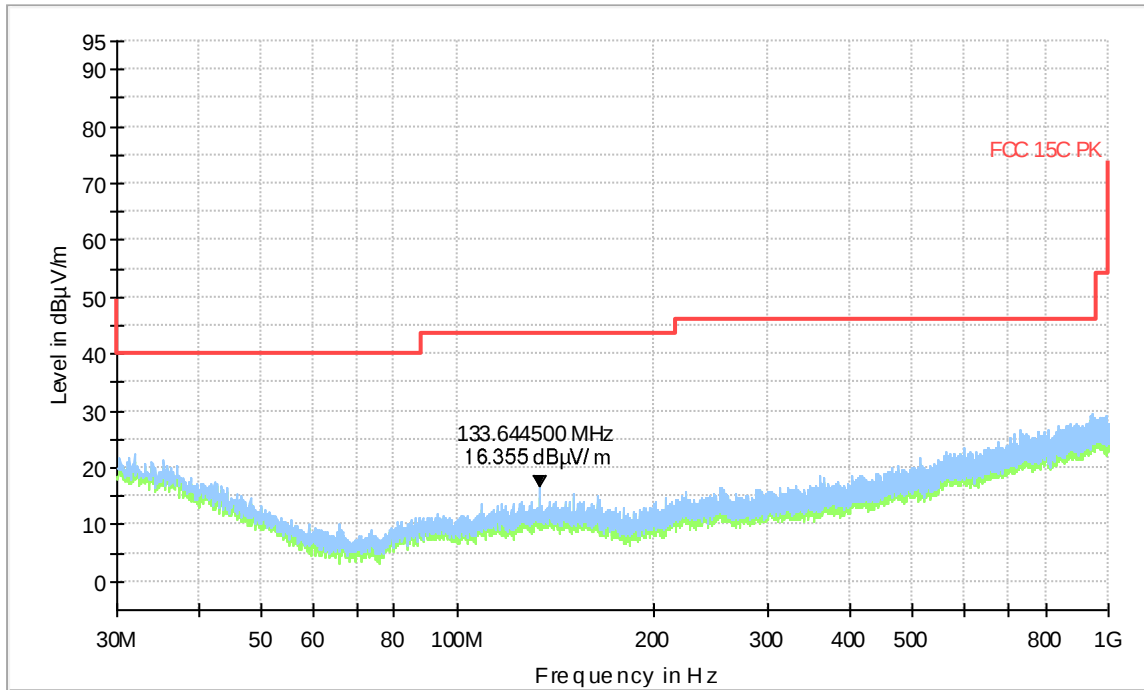


— Preview Result 2-RMS      — Preview Result 1-PK+      \* Critical\_Freqs RMS  
\* Critical\_Freqs PK+      — FCC 15C PK      --- FCC 15C AVG  
◆ Final\_Result PK+      ◆ Final\_Result RMS

Plot # 12 Radiated Emissions: 30MHz – 1GHz

Modulation: GFSK

Channel:39

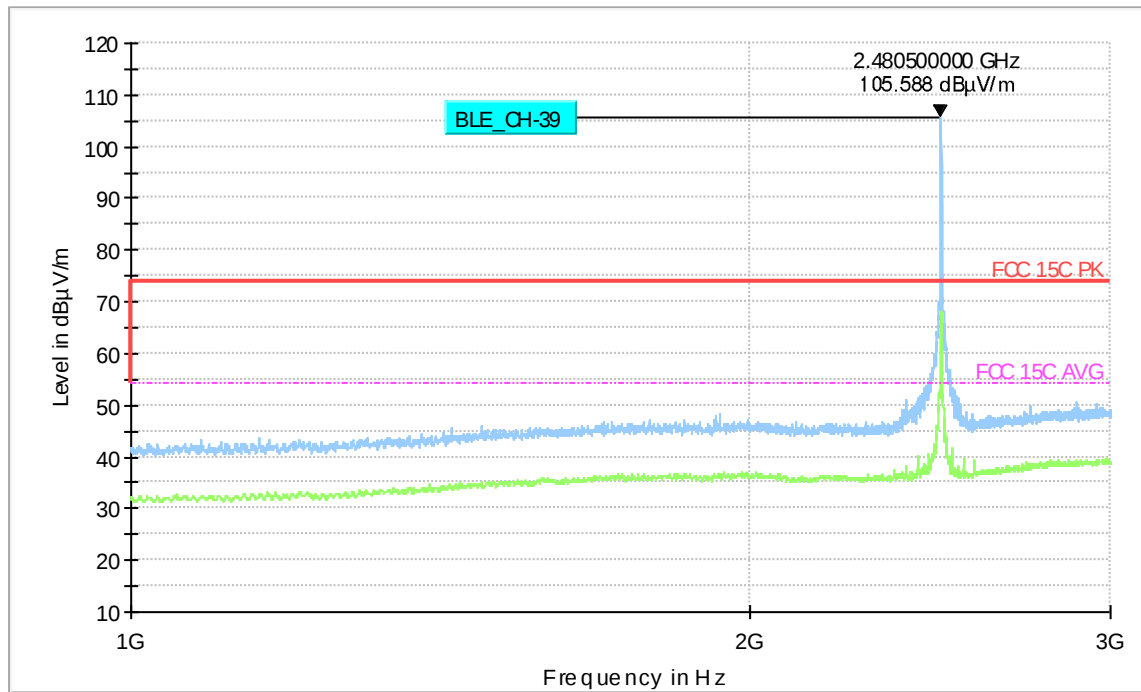


|   |                      |   |                      |   |                    |
|---|----------------------|---|----------------------|---|--------------------|
| — | Preview Result 2-RMS | — | Preview Result 1-PK+ | * | Critical_Freqs RMS |
| * | Critical_Freqs PK+   | — | FCC 15C PK           | ◆ | Final_Result PK+   |
| ◆ | Final_Result RMS     |   |                      |   |                    |

## Plot # 13 Radiated Emissions: 1 – 3GHz

Modulation: GFSK

Channel: 39



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

Preview Result 1-PK+  
FCC 15C PK  
Final\_Result RMS

\* Critical\_Freqs RMS  
FCC 15C AVG

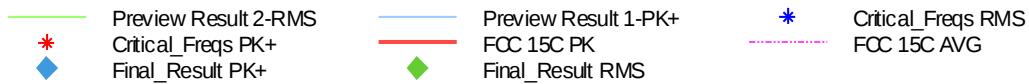
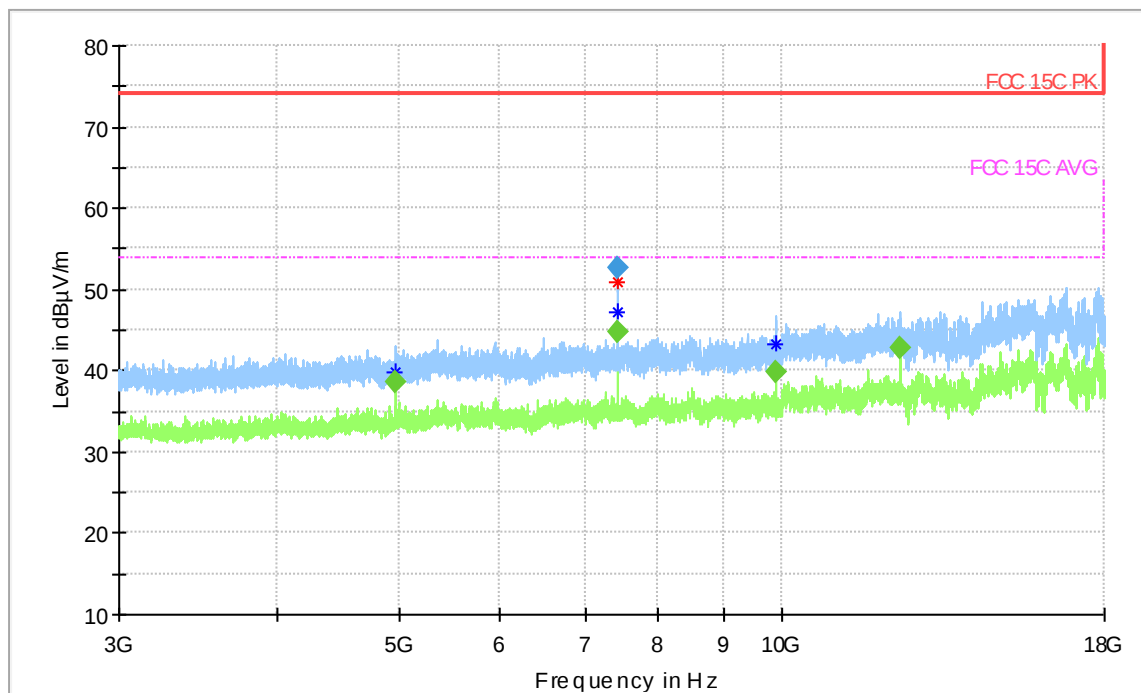
## Plot # 14 Radiated Emissions: 3 – 18GHz

Modulation: GFSK

Channel: 39

## Final\_Result

| Frequency (MHz) | MaxPeak (dBμV/m) | RMS (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Comment                |
|-----------------|------------------|--------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|------------------------|
| 4959.701        | ---              | 38.54        | 53.98          | 15.44       | 200.0           | 1000.0          | 100.0       | H   | 46.0          | -33        | 4:21:12 PM - 2/27/2019 |
| 7439.374        | ---              | 44.70        | 53.98          | 9.28        | 200.0           | 1000.0          | 132.0       | V   | 274.0         | -29        | 4:28:09 PM - 2/27/2019 |
| 7440.502        | 52.72            | ---          | 73.99          | 21.27       | 200.0           | 1000.0          | 120.0       | V   | 279.0         | -29        | 4:14:10 PM - 2/27/2019 |
| 9919.323        | ---              | 39.82        | 53.98          | 14.16       | 200.0           | 1000.0          | 107.0       | H   | -3.0          | -24        | 4:17:54 PM - 2/27/2019 |
| 12398.790       | ---              | 42.87        | 53.98          | 11.11       | 10.0            | 1000.0          | 132.0       | H   | 136.0         | -22        | 4:24:36 PM - 2/27/2019 |



## 9 Test setup photos

Setup photos are included in supporting file name: "EMC\_COMPO\_012\_18001\_FCC\_ISED\_Setup\_Photos rev3.pdf"

## 10 Test Equipment And Ancillaries Used For Testing

| Equipment Type            | Manufacturer    | Model     | Serial # | Calibration Cycle | Last Calibration Date |
|---------------------------|-----------------|-----------|----------|-------------------|-----------------------|
| PASSIVE LOOP              | ETS.LINDGREN    | 6512      | 00164698 | 3 YEARS           | 08/08/2017            |
| BILOG ANTENNA             | TESEO           | CBL 6141B | 41106    | 3 YEARS           | 11/01/2017            |
| HORN ANTENNA              | ETS.LINDGREN    | 3115      | 00035114 | 3 YEARS           | 07/31/2017            |
| HORN ANTENNA              | ETS.LINDGREN    | 3117      | 0167061  | 3 YEARS           | 08/08/2017            |
| HORN ANTENNA              | ETS.LINDGREN    | 3116C     | 00166821 | 3 YEARS           | 09/24/2017            |
| SIGNAL ANALYZER           | R&S             | FSU26     | 200065   | 2 YEARS           | 07/03/2017            |
| SIGNAL ANALYZER           | R&S             | FSV 40    | 101022   | 3 YEARS           | 07/05/2017            |
| COMPACT DIGITAL BAROMETER | CONTROL COMPANY | 35519-055 | 91119547 | 2 YEARS           | 06/20/2017            |
| THRMOMETER HUMIDIY        | DICKSON         | TM320     | 16253639 | 3 YEARS           | 11/02/2017            |

Note: 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.

## 11 Revision History

| Date       | Report Name                                      | Changes to report                                                                                                                                                                               | Report prepared by |
|------------|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 03/11/2019 | EMC_COMPO_012_18001_FCC_15.247_ISED_BLE_DTS      | Initial Version                                                                                                                                                                                 | Issa Ghanma        |
| 03/21/2019 | EMC_COMPO_012_18001_FCC_15.247_ISED_BLE_DTS_rev1 | FCC ID correction                                                                                                                                                                               | Issa Ghanma        |
| 03/26/2019 | EMC_COMPO_012_18001_FCC_15.247_ISED_BLE_DTS_rev2 | Correction: Section 3.1<br><ul style="list-style-type: none"> <li>Replace Module name with <b>Chipset manufacturer number</b>.</li> <li>Replace BLUENRG-2323 with <b>BLUENRG-232</b></li> </ul> | Issa Ghanma        |
| 05/17/2019 | EMC_COMPO_012_18001_FCC_15.247_ISED_BLE_DTS_rev3 | Correction: Section 4, 7, 8<br><ul style="list-style-type: none"> <li>558074 D01 DTS Meas Guidance version number.</li> </ul> Apply duty cycle correction factor to plot #7                     | Issa Ghanma        |