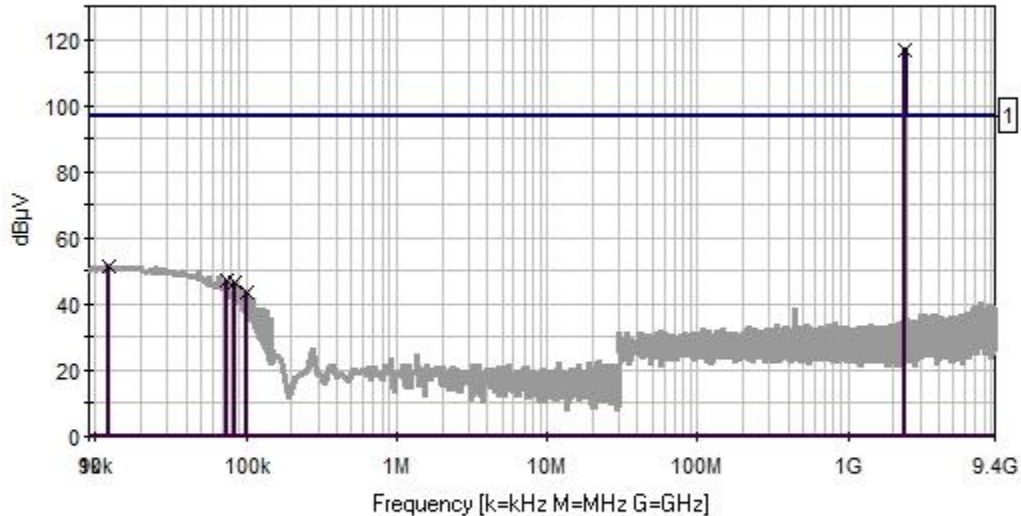


Nalloy, LLC. WO#: 102802 Sequence#: 48 Date: 3/27/2020  
15.247(d) Conducted Spurious Emissions Test Lead: 120V 60Hz Antenna Port 0



1 - 15.247(d) Conducted Spurious Emissions  
Readings  
Peak Readings  
Software Version: 5.03.12

**Test Equipment:**

| ID | Asset # | Description       | Model  | Calibration Date | Cal Due Date |
|----|---------|-------------------|--------|------------------|--------------|
|    | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019        | 2/22/2021    |

**Measurement Data:**

Reading listed by frequency.

Test Lead: Antenna Port 0

| # | Freq<br>MHz    | Rdng<br>dBμV | dB | dB | dB | dB | Dist<br>Table | Corr<br>dBμV | Spec<br>dBμV | Margin<br>dB | Polar<br>Ant |
|---|----------------|--------------|----|----|----|----|---------------|--------------|--------------|--------------|--------------|
| 1 | 12.102k        | 51.4         |    |    |    |    | +0.0          | 51.4         | 97.0         | -45.6        | Anten        |
| 2 | 74.565k        | 47.2         |    |    |    |    | +0.0          | 47.2         | 97.0         | -49.8        | Anten        |
| 3 | 83.307k        | 46.7         |    |    |    |    | +0.0          | 46.7         | 97.0         | -50.3        | Anten        |
| 4 | 100.932k       | 43.3         |    |    |    |    | +0.0          | 43.3         | 97.0         | -53.7        | Anten        |
| 5 | 2401.838M      | 116.6        |    |    |    |    | +0.0          | 116.6        | 117.0        | -0.4         | Anten        |
| 6 | 9608.569M      | 59.5         |    |    |    |    | +0.0          | 59.5         | 97.0         | -37.5        | Anten        |
| 7 | 23507.250<br>M | 43.1         |    |    |    |    | +0.0          | 43.1         | 97.0         | -53.9        | Anten        |

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **102802** Date: 3/27/2020  
 Test Type: **Conducted Emissions** Time: 10:09:36  
 Tested By: Matthew Harrison Sequence#: 49  
 Software: EMITest 5.03.12 120V 60Hz

***Equipment Tested:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

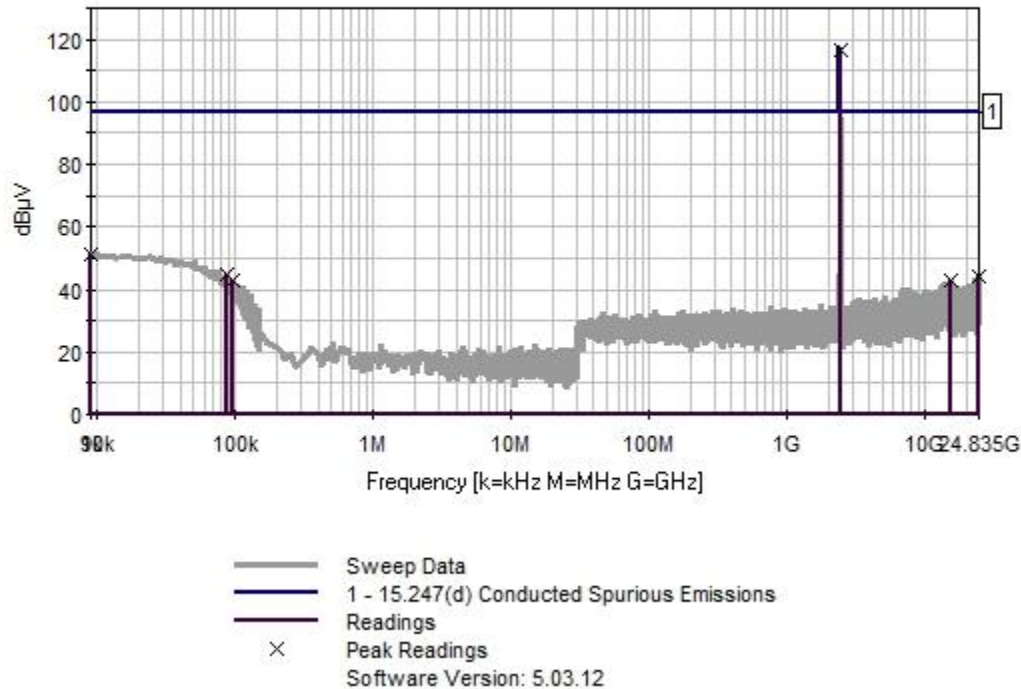
***Support Equipment:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Test Conditions / Notes:***

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Environmental Conditions:<br/>         Temperature: 22° C<br/>         Humidity: 28%<br/>         Pressure: 101.3 kPa</p> <p>Frequency Range: 9kHz-25GHz<br/>         Frequency tested: 2440<br/>         Firmware power setting: 9<br/>         EUT Firmware:<br/>         Protocol /MCS/Modulation: BT, GFSK, DH1 (Worst-Case)</p> <p>Antenna type: Linear Polarized<br/>         Antenna Gain: 3.7 dBi.</p> <p>Duty Cycle: 100% Modulated</p> <p>Test Method: ANSI C63.10: 2013<br/>         Test Mode: Transmitting<br/>         Test Setup: EUT is setup for conducted measurements.<br/>         Setup: EUT is connected to a Laptop via USB and Audio cable.</p> <p>All data rates investigated, worst-case provided.</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Nalloy, LLC. WO#: 102802 Sequence#: 49 Date: 3/27/2020  
15.247(d) Conducted Spurious Emissions Test Lead: 120V 60Hz Antenna Port 0



#### Test Equipment:

| ID | Asset # | Description       | Model  | Calibration Date | Cal Due Date |
|----|---------|-------------------|--------|------------------|--------------|
|    | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019        | 2/22/2021    |

#### Measurement Data:

Reading listed by frequency.

Test Lead: Antenna Port 0

| # | Freq<br>MHz    | Rdng<br>dBμV | dB | dB | dB | dB | Dist<br>Table | Corr<br>dBμV | Spec<br>dBμV | Margin<br>dB | Polar<br>Ant |
|---|----------------|--------------|----|----|----|----|---------------|--------------|--------------|--------------|--------------|
| 1 | 9.000k         | 51.2         |    |    |    |    | +0.0          | 51.2         | 97.0         | -45.8        | Anten        |
| 2 | 86.268k        | 45.1         |    |    |    |    | +0.0          | 45.1         | 97.0         | -51.9        | Anten        |
| 3 | 95.010k        | 43.1         |    |    |    |    | +0.0          | 43.1         | 97.0         | -53.9        | Anten        |
| 4 | 2439.836M      | 116.6        |    |    |    |    | +0.0          | 116.6        | 117.0        | -0.4         | Anten        |
| 5 | 15323.180<br>M | 43.0         |    |    |    |    | +0.0          | 43.0         | 97.0         | -54.0        | Anten        |
| 6 | 24776.620<br>M | 44.2         |    |    |    |    | +0.0          | 44.2         | 97.0         | -52.8        | Anten        |

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **102802** Date: 3/27/2020  
 Test Type: **Conducted Emissions** Time: 10:06:39  
 Tested By: Matthew Harrison Sequence#: 50  
 Software: EMITest 5.03.12 120V 60Hz

***Equipment Tested:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

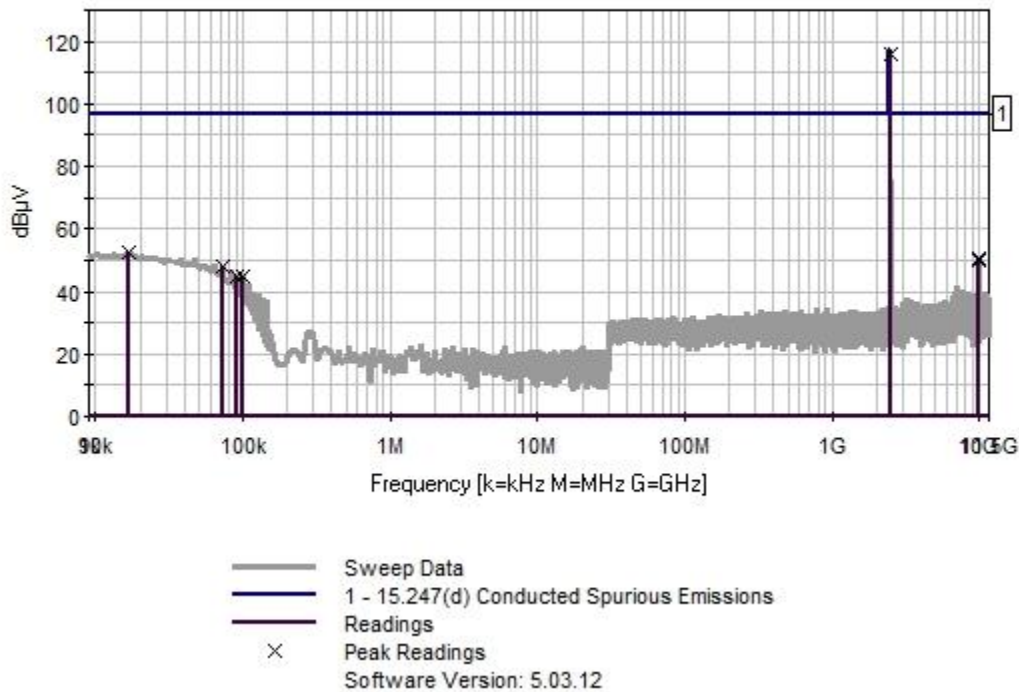
***Support Equipment:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Test Conditions / Notes:***

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions:<br>Temperature: 22° C<br>Humidity: 28%<br>Pressure: 101.3 kPa<br><br>Frequency Range: 9kHz-25GHz<br>Frequency tested: 2480<br>Firmware power setting: 9<br>EUT Firmware:<br>Protocol /MCS/Modulation: BT, GFSK, DH1 (Worst-Case)<br><br>Antenna type: Linear Polarized<br>Antenna Gain: 3.7 dBi.<br><br>Duty Cycle: 100% Modulated<br><br>Test Method: ANSI C63.10: 2013<br>Test Mode: Transmitting<br>Test Setup: EUT is setup for conducted measurements.<br>Setup: EUT is connected to a Laptop via USB and Audio cable.<br><br>All data rates investigated, worst-case provided. |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Nalloy, LLC. WO#: 102802 Sequence#: 50 Date: 3/27/2020  
15.247(d) Conducted Spurious Emissions Test Lead: 120V 60Hz Antenna Port 0



**Test Equipment:**

| ID | Asset # | Description       | Model  | Calibration Date | Cal Due Date |
|----|---------|-------------------|--------|------------------|--------------|
|    | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019        | 2/22/2021    |

**Measurement Data:**

Reading listed by margin.

Test Lead: Antenna Port 0

| # | Freq<br>MHz | Rdng<br>dBμV | dB | dB | dB | dB | Dist<br>Table | Corr<br>dBμV | Spec<br>dBμV | Margin<br>dB | Polar<br>Ant |
|---|-------------|--------------|----|----|----|----|---------------|--------------|--------------|--------------|--------------|
| 1 | 2479.838M   | 116.1        |    |    |    |    | +0.0          | 116.1        | 117.0        | -0.9         | Anten        |
| 2 | 17.037k     | 52.3         |    |    |    |    | +0.0          | 52.3         | 97.0         | -44.7        | Anten        |
| 3 | 9920.480M   | 50.5         |    |    |    |    | +0.0          | 50.5         | 97.0         | -46.5        | Anten        |
| 4 | 9919.980M   | 49.8         |    |    |    |    | +0.0          | 49.8         | 97.0         | -47.2        | Anten        |
| 5 | 73.437k     | 47.9         |    |    |    |    | +0.0          | 47.9         | 97.0         | -49.1        | Anten        |

|   |                |      |      |      |      |       |       |
|---|----------------|------|------|------|------|-------|-------|
| 6 | 91.062k        | 44.8 | +0.0 | 44.8 | 97.0 | -52.2 | Anten |
| 7 | 99.945k        | 44.6 | +0.0 | 44.6 | 97.0 | -52.4 | Anten |
| 8 | 24791.000<br>M | 44.2 | +0.0 | 44.2 | 97.0 | -52.8 | Anten |
| 9 | 23647.290<br>M | 43.2 | +0.0 | 43.2 | 97.0 | -53.8 | Anten |

## Band Edge

### Band Edge Summary

Limit applied: Max Power/100kHz - 20dB.

Operating Mode: Single Channel (Low and High)

| Frequency (MHz) | Modulation    | Measured (dBm) | Limit (dBm) | Results |
|-----------------|---------------|----------------|-------------|---------|
| 2400            | GFSK          | 62.6           | <97         | Pass    |
| 2483.5          | GFSK          | 50.7           | <97         | Pass    |
| 2400            | $\pi/4$ DQPSK | 59.4           | <95         | Pass    |
| 2483.5          | $\pi/4$ DQPSK | 48.5           | <95         | Pass    |
| 2400            | 8DPSK         | 59.8           | <95         | Pass    |
| 2483.5          | 8DPSK         | 47.4           | <95         | Pass    |

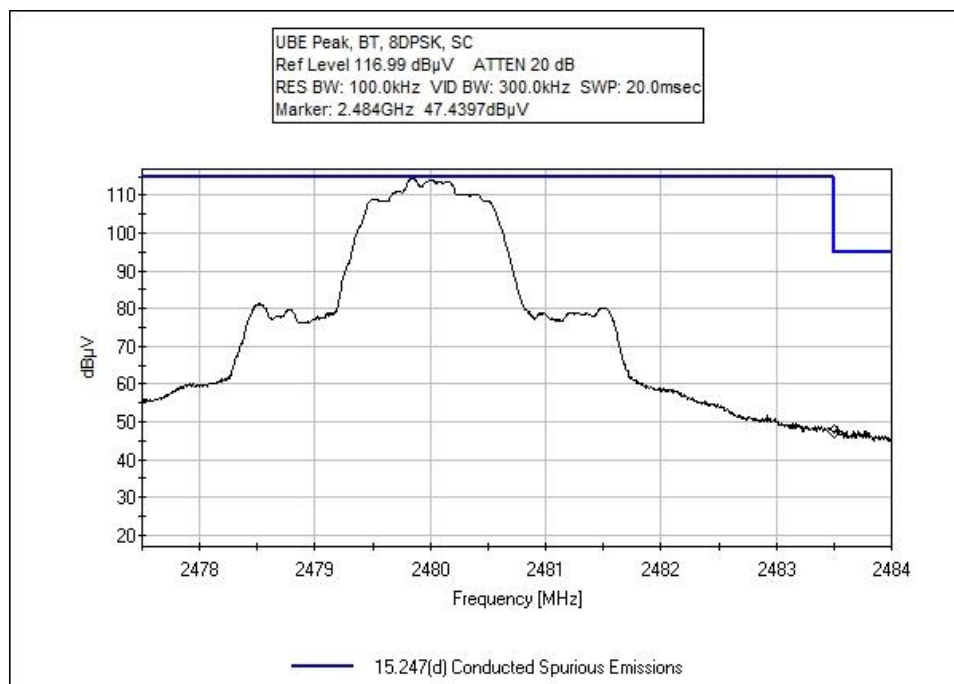
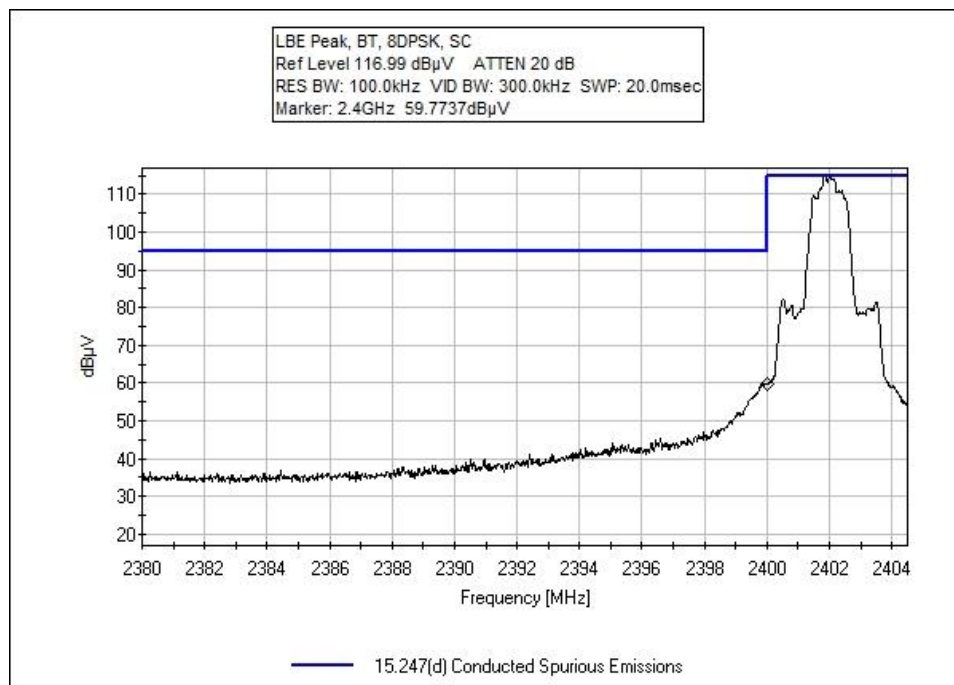
### Band Edge Summary

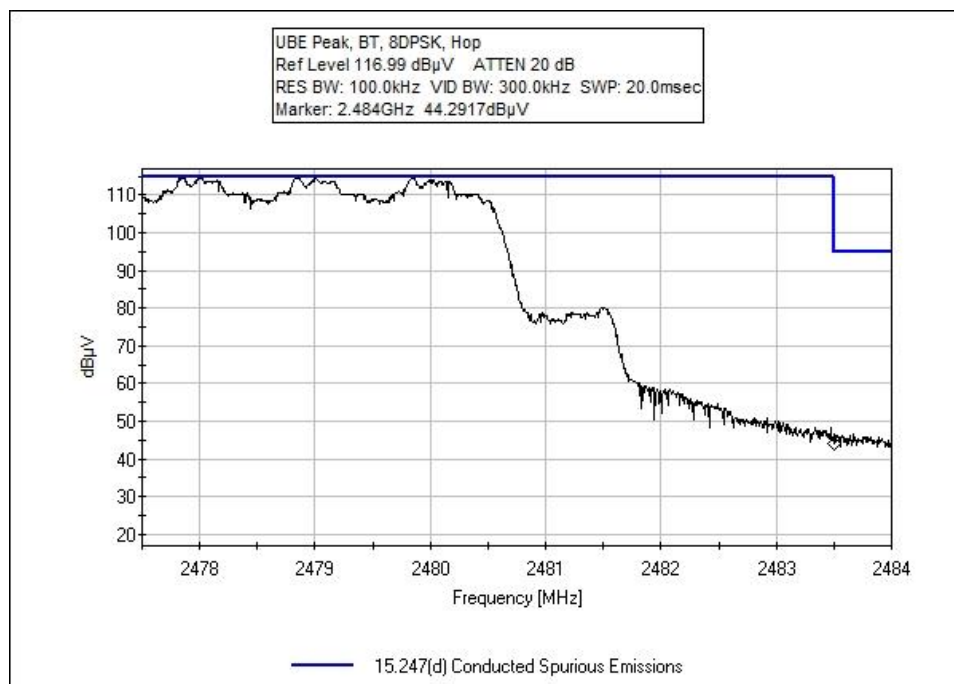
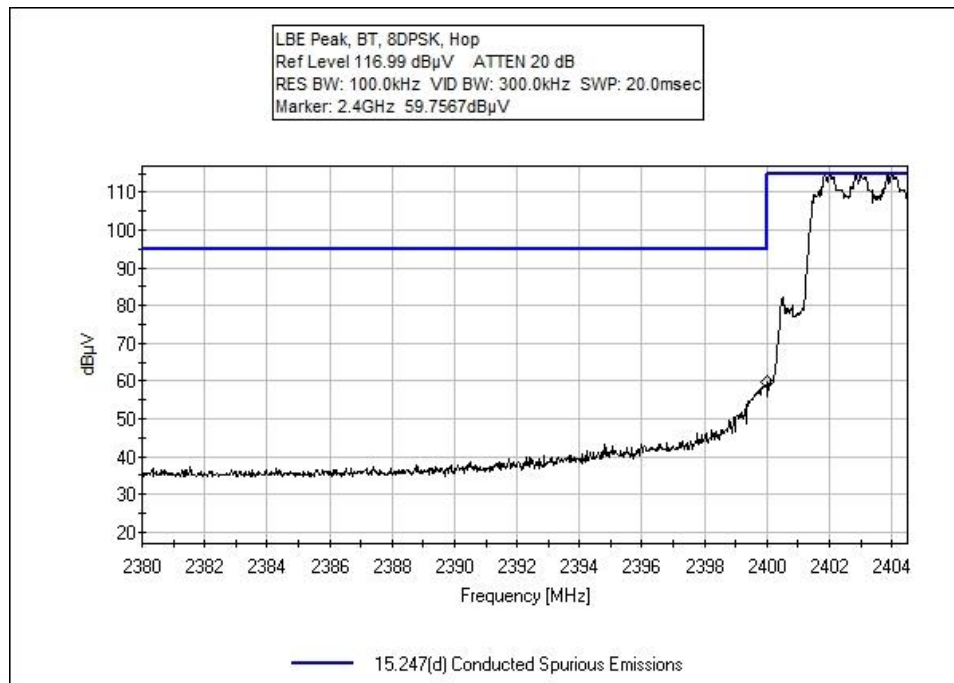
Limit applied: Max Power/100kHz - 20dB.

Operating Mode: Hopping

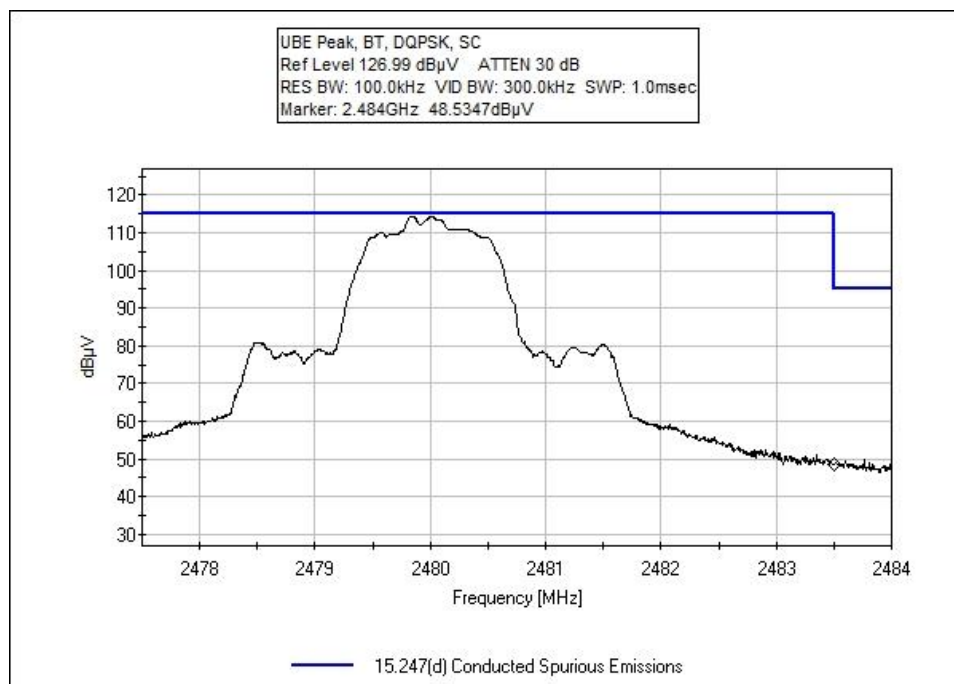
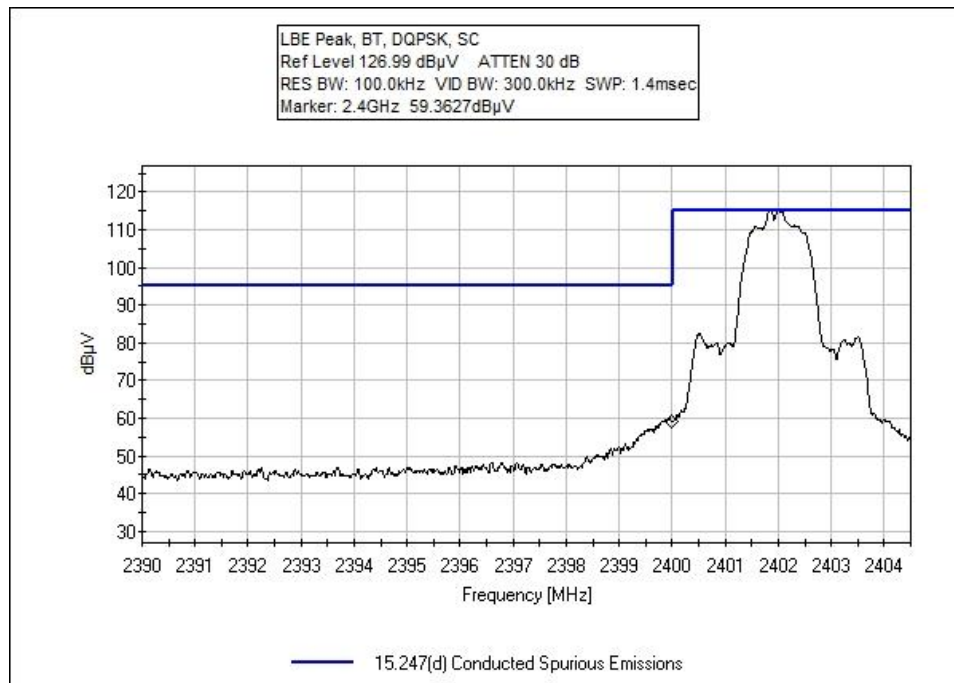
| Frequency (MHz) | Modulation    | Measured (dBm) | Limit (dBm) | Results |
|-----------------|---------------|----------------|-------------|---------|
| 2400            | GFSK          | 62.2           | <97         | Pass    |
| 2483.5          | GFSK          | 47.2           | <97         | Pass    |
| 2400            | $\pi/4$ DQPSK | 58.5           | <95         | Pass    |
| 2483.5          | $\pi/4$ DQPSK | 45.5           | <95         | Pass    |
| 2400            | 8DPSK         | 59.8           | <95         | Pass    |
| 2483.5          | 8DPSK         | 44.3           | <95         | Pass    |

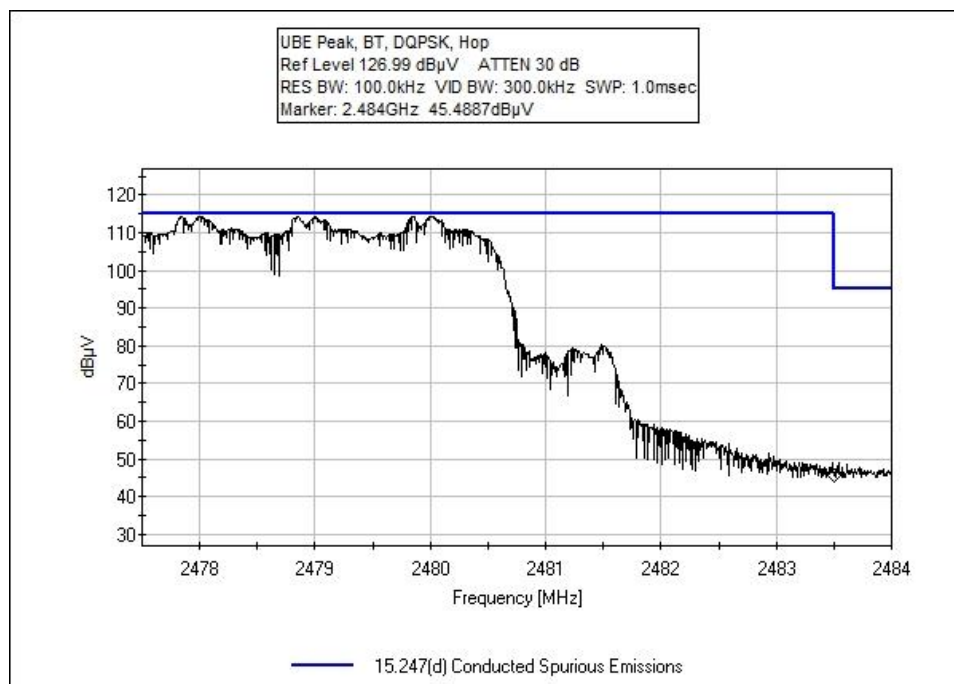
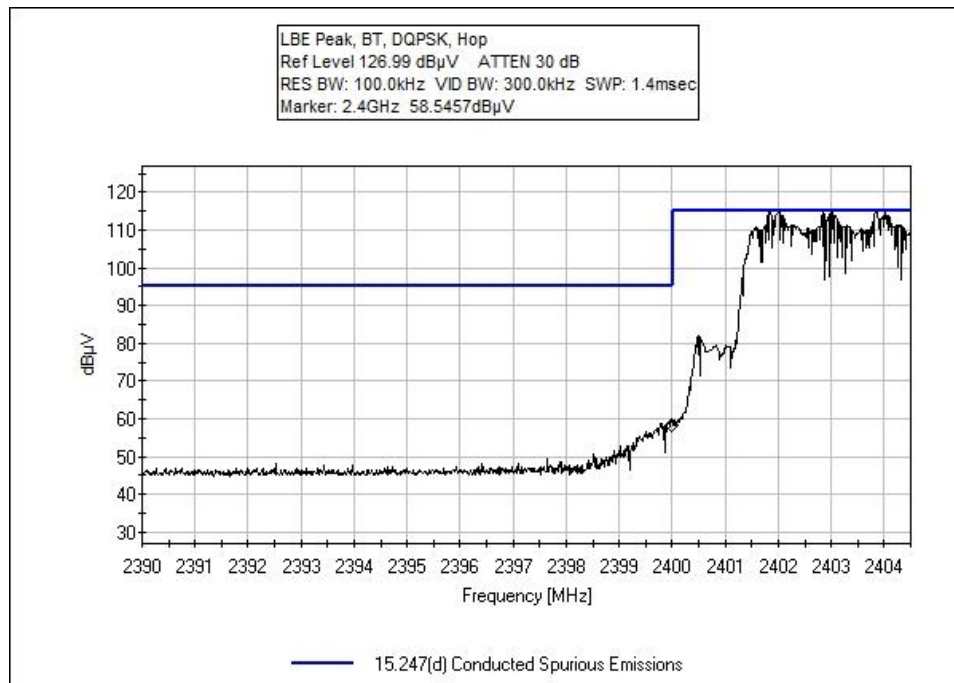
## 8DPSK Band Edge Plots



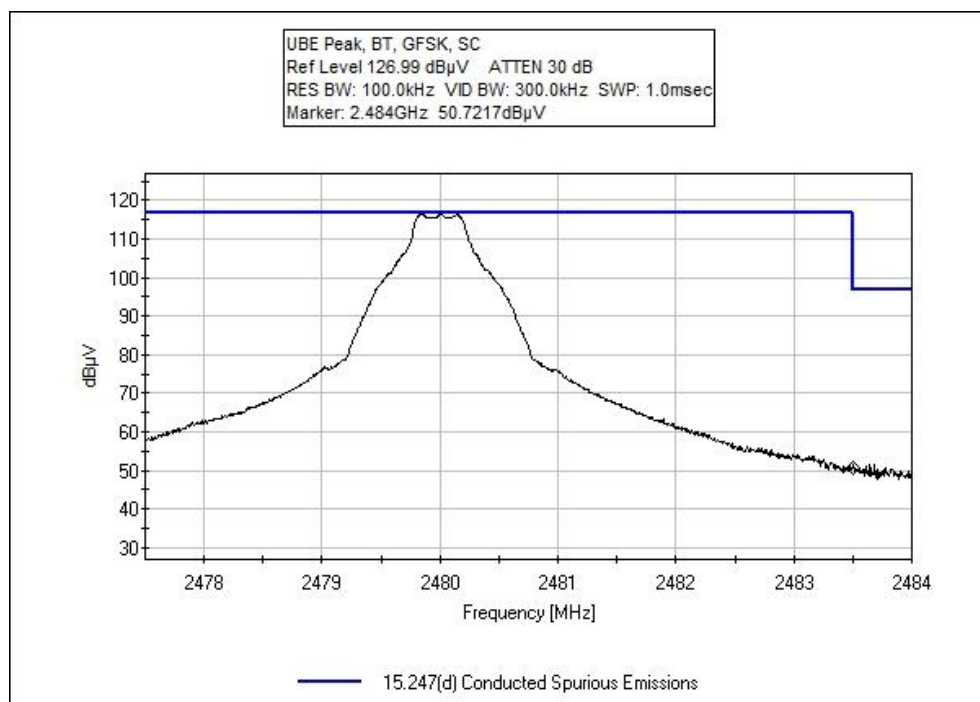
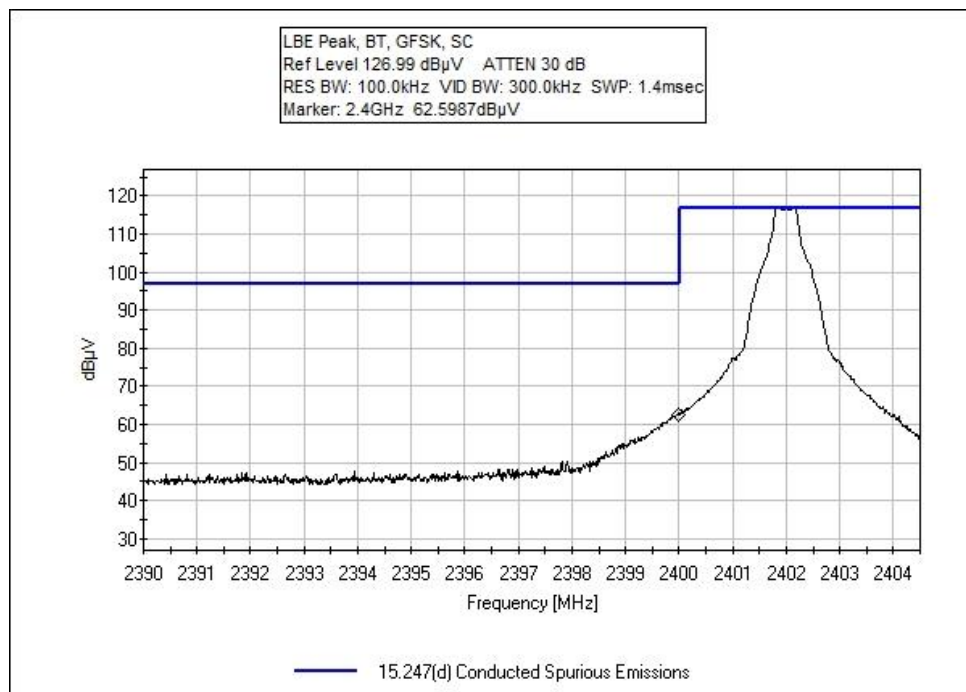


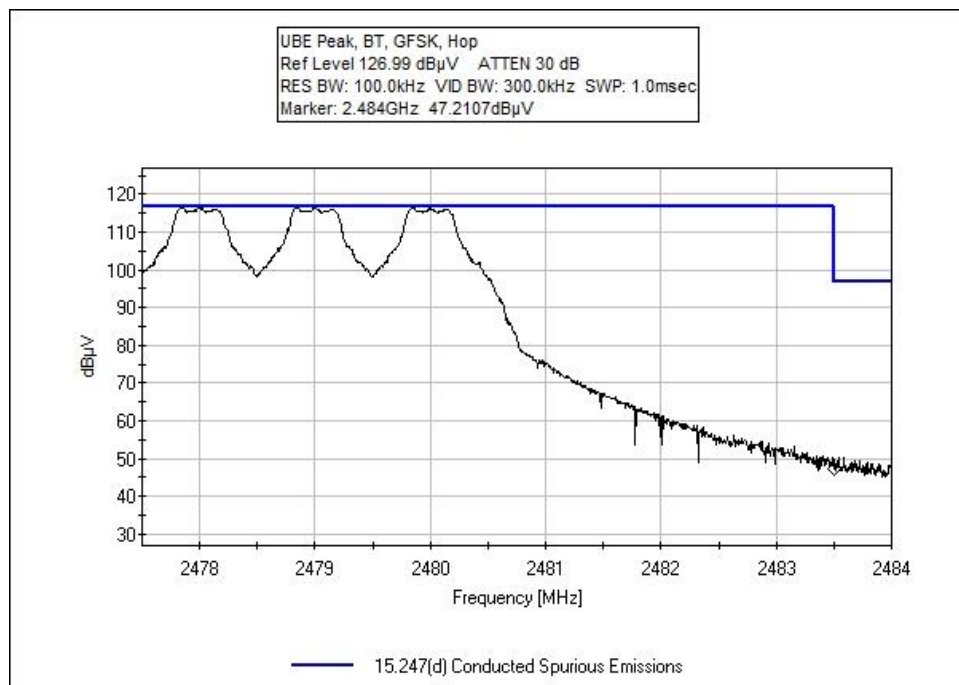
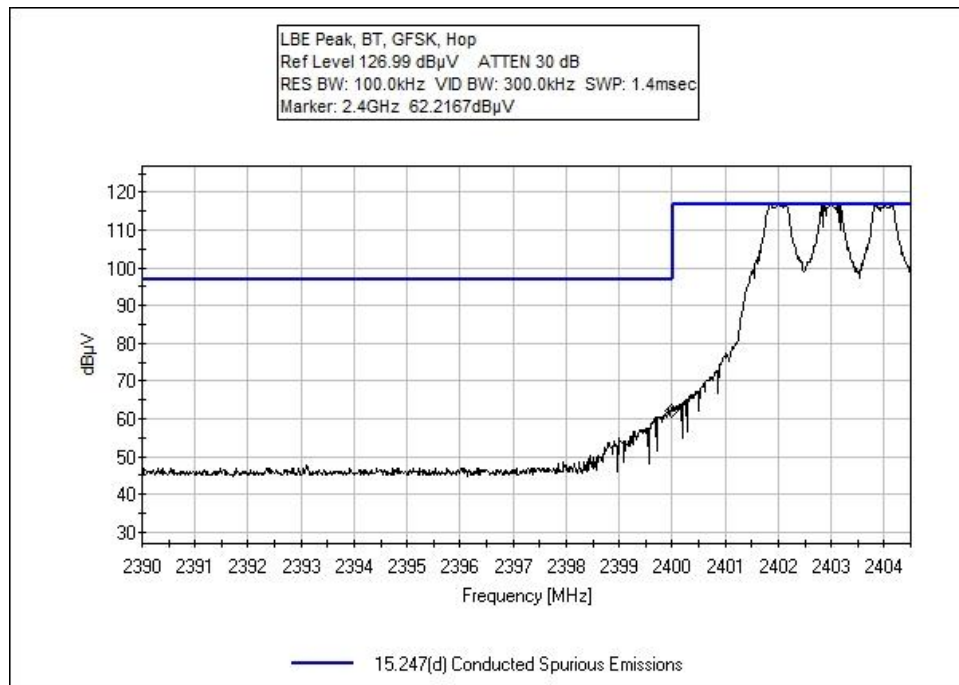
## DQPSK Band Edge Plots





## GFSK Band Edge Plots





### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **102802** Date: 3/27/2020  
 Test Type: **Conducted Emissions** Time: 06:57:17  
 Tested By: Matthew Harrison Sequence#: 48  
 Software: EMITest 5.03.12 120V 60Hz

#### Equipment Tested:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Support Equipment:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Test Conditions / Notes:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions:<br>Temperature: 22° C<br>Humidity: 28%<br>Pressure: 101.3 kPa<br><br>Frequency Range: 2.4-2.4835GHz<br>Frequency tested: 2402, 2480<br>Firmware power setting: 9<br>EUT Firmware:<br>Protocol /MCS/Modulation: BT, 8DPSK, 3DH1 (Worst-Case)<br><br>Antenna type: Linear Polarized<br>Antenna Gain: 3.7 dBi.<br><br>Duty Cycle: 100% Modulated<br><br>Test Method: ANSI C63.10: 2013<br>Test Mode: Transmitting<br>Test Setup: EUT is setup for conducted measurements.<br>Setup: EUT is connected to a Laptop via USB and Audio cable.<br><br>All data rates investigated, worst-case provided. |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Test Equipment:**

| ID | Asset # | Description       | Model  | Calibration Date | Cal Due Date |
|----|---------|-------------------|--------|------------------|--------------|
| T1 | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019        | 2/22/2021    |

**Measurement Data:**

Reading listed by margin.

Test Lead: Antenna Port 0

| # | Freq<br>MHz | Rdng<br>dBμV | T1<br>dB |  |  |  | Dist<br>Table | Corr<br>dBμV | Spec<br>dBμV | Margin<br>dB | Polar<br>Ant |
|---|-------------|--------------|----------|--|--|--|---------------|--------------|--------------|--------------|--------------|
| 1 | 2401.830M   | 115.0        | +0.0     |  |  |  | +0.0          | 115.0        | 115.0        | +0.0         | Anten        |
|   |             |              |          |  |  |  |               |              | SC           |              |              |
| 2 | 2400.000M   | 59.8         | +0.0     |  |  |  | +0.0          | 59.8         | 95.0         | -35.2        | Anten        |
|   |             |              |          |  |  |  |               |              | SC           |              |              |
| 3 | 2400.000M   | 59.8         | +0.0     |  |  |  | +0.0          | 59.8         | 95.0         | -35.2        | Anten        |
|   |             |              |          |  |  |  |               |              | Hop          |              |              |
| 4 | 2483.500M   | 47.4         | +0.0     |  |  |  | +0.0          | 47.4         | 95.0         | -47.6        | Anten        |
|   |             |              |          |  |  |  |               |              | SC           |              |              |
| 5 | 2483.500M   | 44.3         | +0.0     |  |  |  | +0.0          | 44.3         | 95.0         | -50.7        | Anten        |
|   |             |              |          |  |  |  |               |              | Hop          |              |              |

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **102802** Date: 3/26/2020  
 Test Type: **Conducted Emissions** Time: 16:47:44  
 Tested By: Matthew Harrison Sequence#: 47  
 Software: EMITest 5.03.12 120V 60Hz

***Equipment Tested:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Support Equipment:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Test Conditions / Notes:***

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions:<br>Temperature: 22° C<br>Humidity: 28%<br>Pressure: 101.3 kPa<br><br>Frequency Range: 2.4-2.4835GHz<br>Frequency tested: 2402, 2480<br>Firmware power setting: 9<br>EUT Firmware:<br>Protocol /MCS/Modulation: BT, DQPSK, 2DH1 (Worst-Case)<br><br>Antenna type: Linear Polarized<br>Antenna Gain: 3.7 dBi.<br><br>Duty Cycle: 100% Modulated<br><br>Test Method: ANSI C63.10: 2013<br>Test Mode: Transmitting<br>Test Setup: EUT is setup for conducted measurements.<br>Setup: EUT is connected to a Laptop via USB and Audio cable.<br><br>All data rates investigated, worst-case provided. |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Test Equipment:**

| ID | Asset # | Description       | Model  | Calibration Date | Cal Due Date |
|----|---------|-------------------|--------|------------------|--------------|
| T1 | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019        | 2/22/2021    |

**Measurement Data:**

Reading listed by margin.

Test Lead: Antenna Port 0

| # | Freq<br>MHz | Rdng<br>dBμV | T1<br>dB |  |  |  | Dist<br>Table | Corr<br>dBμV | Spec<br>dBμV | Margin<br>dB | Polar<br>Ant |
|---|-------------|--------------|----------|--|--|--|---------------|--------------|--------------|--------------|--------------|
| 1 | 2401.830M   | 115.0        | +0.0     |  |  |  | +0.0          | 115.0        | 115.0        | +0.0         | Anten        |
|   |             |              |          |  |  |  |               |              | SC           |              |              |
| 2 | 2400.000M   | 59.4         | +0.0     |  |  |  | +0.0          | 59.4         | 95.0         | -35.6        | Anten        |
|   |             |              |          |  |  |  |               |              | SC           |              |              |
| 3 | 2400.000M   | 58.5         | +0.0     |  |  |  | +0.0          | 58.5         | 95.0         | -36.5        | Anten        |
|   |             |              |          |  |  |  |               |              | Hop          |              |              |
| 4 | 2483.500M   | 48.5         | +0.0     |  |  |  | +0.0          | 48.5         | 95.0         | -46.5        | Anten        |
|   |             |              |          |  |  |  |               |              | SC           |              |              |
| 5 | 2483.500M   | 45.5         | +0.0     |  |  |  | +0.0          | 45.5         | 95.0         | -49.5        | Anten        |
|   |             |              |          |  |  |  |               |              | Hop          |              |              |

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **102802** Date: 3/26/2020  
 Test Type: **Conducted Emissions** Time: 16:26:40  
 Tested By: Matthew Harrison Sequence#: 46  
 Software: EMITest 5.03.12 120V 60Hz

***Equipment Tested:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Support Equipment:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Test Conditions / Notes:***

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions:<br>Temperature: 22° C<br>Humidity: 28%<br>Pressure: 101.3 kPa<br><br>Frequency Range: 2.4-2.4835GHz<br>Frequency tested: 2402, 2440, 2480<br>Firmware power setting: 9<br>EUT Firmware:<br>Protocol /MCS/Modulation: BT, GFSK, DH1 (Worst-Case)<br><br>Antenna type: Linear Polarized<br>Antenna Gain: 3.7 dBi.<br><br>Duty Cycle: 100% Modulated<br><br>Test Method: ANSI C63.10: 2013<br>Test Mode: Transmitting<br>Test Setup: EUT is setup for conducted measurements.<br>Setup: EUT is connected to a Laptop via USB and Audio cable.<br><br>All data rates investigated, worst-case provided. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Test Equipment:**

| ID | Asset #/Serial # | Description       | Model  | Calibration Date | Cal Due Date |
|----|------------------|-------------------|--------|------------------|--------------|
| T1 | AN02673          | Spectrum Analyzer | E4446A | 2/22/2019        | 2/22/2021    |

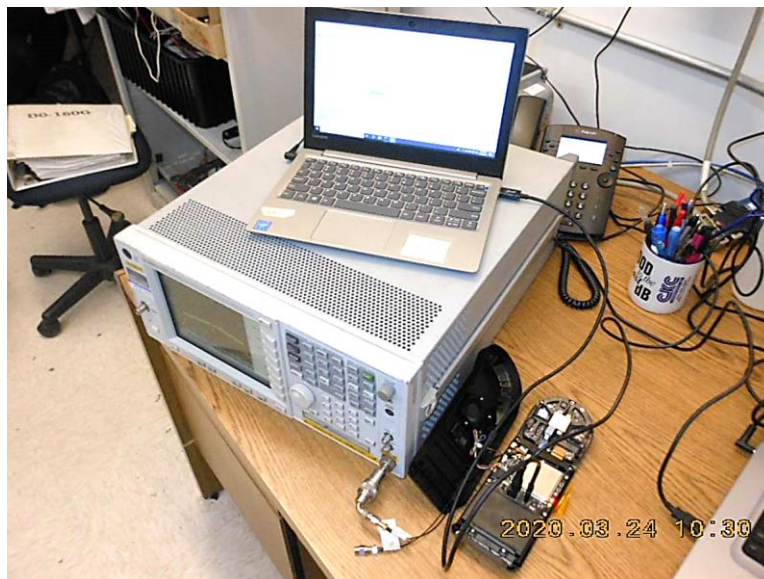
**Measurement Data:**

Reading listed by margin.

Test Lead: Antenna Port 0

| # | Freq<br>MHz | Rdng<br>dBμV | T1<br>dB |  |  |  | Dist<br>Table | Corr<br>dBμV | Spec<br>dBμV | Margin<br>dB | Polar<br>Ant |
|---|-------------|--------------|----------|--|--|--|---------------|--------------|--------------|--------------|--------------|
| 1 | 2402.137M   | 117.0        | +0.0     |  |  |  | +0.0          | 117.0        | 117.0        | +0.0         | Anten        |
|   |             |              |          |  |  |  |               |              | SC           |              |              |
| 2 | 2400.000M   | 62.6         | +0.0     |  |  |  | +0.0          | 62.6         | 97.0         | -34.4        | Anten        |
|   |             |              |          |  |  |  |               |              | SC           |              |              |
| 3 | 2400.000M   | 62.2         | +0.0     |  |  |  | +0.0          | 62.2         | 97.0         | -34.8        | Anten        |
|   |             |              |          |  |  |  |               |              | Hop          |              |              |
| 4 | 2483.500M   | 50.7         | +0.0     |  |  |  | +0.0          | 50.7         | 97.0         | -46.3        | Anten        |
|   |             |              |          |  |  |  |               |              | SC           |              |              |
| 5 | 2483.500M   | 47.2         | +0.0     |  |  |  | +0.0          | 47.2         | 97.0         | -49.8        | Anten        |

**Test Setup Photo(s)**



## 15.247(d) Radiated Emissions & Band Edge

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **102802** Date: 4/7/2020  
 Test Type: **Maximized Emissions** Time: 10:12:27  
 Tested By: Matthew Harrison Sequence#: 83  
 Software: EMITest 5.03.12

#### Equipment Tested:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

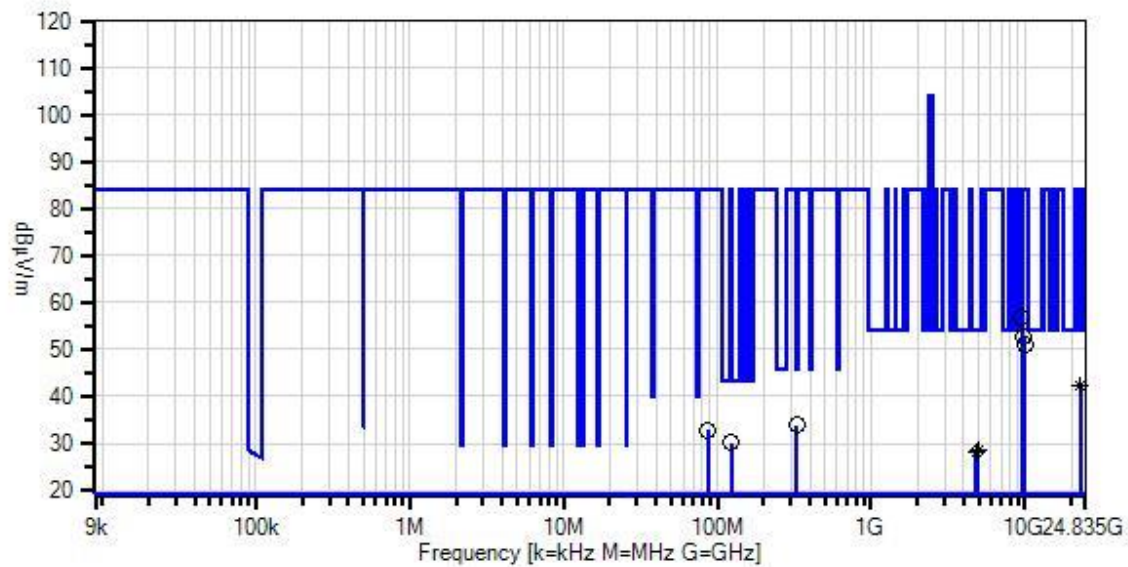
#### Support Equipment:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Test Conditions / Notes:

Environmental Conditions:  
 Temperature: 21° C  
 Humidity: 33%  
 Pressure: 101.3 kPa  
  
 Frequency Range: 9kHz-25GHz  
 Frequency tested: 2402, 2440, 2480  
 Firmware power setting: 9  
 EUT Firmware:  
 Protocol /MCS/Modulation: BT, 8DPSK, 3DH1 (Worst-Case)  
  
 Antenna type: Linear Polarized  
 Antenna Gain: 3.7 dBi.  
  
 Duty Cycle: 100% Modulated  
  
 Test Method: ANSI C63.10: 2013  
 Test Mode: Transmitting  
 Test Setup: EUT is setup 1.5m high on a Styrofoam table.  
 Setup: EUT is connected to a Laptop via USB and Audio cable.  
  
 All data rates and Low, Mid, High channels investigated, worst-case provided.

Nalloy, LLC. WO#: 102802 Sequence#: 83 Date: 4/7/2020  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Perp + Para



— Sweep Data  
 ○ Peak Readings  
 \* Average Readings  
 Software Version: 5.03.12

— Readings  
 × QP Readings  
 ▼ Ambient  
 — 1 - 15.247(d) / 15.209 Radiated Spurious Emissions

**Test Equipment:**

| ID  | Asset #    | Description                            | Model                           | Calibration Date | Cal Due Date |
|-----|------------|----------------------------------------|---------------------------------|------------------|--------------|
| T1  | AN01467    | Horn Antenna-ANSI<br>C63.5 Calibration | 3115                            | 7/5/2019         | 7/5/2021     |
| T2  | ANP06515   | Cable                                  | Heliac                          | 6/29/2018        | 6/29/2020    |
| T3  | ANP06540   | Cable                                  | Heliac                          | 8/23/2019        | 8/23/2021    |
| T4  | AN02872    | Spectrum Analyzer                      | E4440A                          | 11/18/2019       | 11/18/2021   |
| T5  | AN03540    | Preamp                                 | 83017A                          | 5/13/2019        | 5/13/2021    |
| T6  | ANP07504   | Cable                                  | CLU40-KMKM-<br>02.00F           | 1/17/2019        | 1/17/2021    |
| T7  | AN03116    | High Pass Filter                       | 11SH10-00313                    | 1/22/2019        | 1/22/2021    |
| T8  | AN02763-69 | Waveguide                              | Multiple                        | 4/23/2018        | 4/23/2020    |
| T9  | ANP06678   | Cable                                  | 32026-29801-<br>29801-144       | 2/20/2020        | 2/20/2022    |
| T10 | ANP07211   | Cable                                  | 32026-29801-<br>29801-18        | 8/7/2019         | 8/7/2021     |
| T11 | ANP07212   | Cable                                  | 32026-29801-<br>29801-18        | 8/7/2019         | 8/7/2021     |
| T12 | AN02742    | Active Horn Antenna                    | AMFW-5F-<br>18002650-20-<br>10P | 10/16/2018       | 10/16/2020   |
| T13 | AN02307    | Preamp                                 | 8447D                           | 1/10/2020        | 1/10/2022    |
| T14 | AN03628    | Biconilog Antenna                      | 3142E                           | 6/11/2019        | 6/11/2021    |
| T15 | ANP06123   | Attenuator                             | 18N-6                           | 4/5/2019         | 4/5/2021     |
| T16 | ANP05305   | Cable                                  | ETSI-50T                        | 9/6/2019         | 9/6/2021     |
| T17 | ANP05360   | Cable                                  | RG214                           | 2/3/2020         | 2/3/2022     |
| T18 | AN00052    | Loop Antenna                           | 6502                            | 5/7/2018         | 5/7/2020     |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| # | Freq      | Rdng | T1   | T2   | T3   | T4    | Dist  | Corr   | Spec   | Margin | Polar |
|---|-----------|------|------|------|------|-------|-------|--------|--------|--------|-------|
|   |           |      | T5   | T6   | T7   | T8    |       |        |        |        |       |
|   |           |      | T9   | T10  | T11  | T12   |       |        |        |        |       |
|   |           |      | T13  | T14  | T15  | T16   |       |        |        |        |       |
|   |           |      | T17  | T18  |      |       |       |        |        |        |       |
|   | MHz       | dBμV | dB   | dB   | dB   | dB    | Table | dBμV/m | dBμV/m | dB     | Ant   |
| 1 | 22979.840 | 44.9 | +0.0 | +0.0 | +0.0 | +0.0  | +0.0  | 42.4   | 54.0   | -11.6  | Vert  |
|   | M         |      | +0.0 | +0.0 | +0.0 | +1.7  |       |        |        |        |       |
|   | Ave       |      | +9.5 | +0.8 | +1.3 | -15.8 |       |        |        |        |       |
|   |           |      | +0.0 | +0.0 | +0.0 | +0.0  |       |        |        |        |       |
|   |           |      | +0.0 | +0.0 |      |       |       |        |        |        |       |
| ^ | 22979.840 | 50.5 | +0.0 | +0.0 | +0.0 | +0.0  | +0.0  | 48.0   | 54.0   | -6.0   | Vert  |
|   | M         |      | +0.0 | +0.0 | +0.0 | +1.7  |       |        |        |        |       |
|   |           |      | +9.5 | +0.8 | +1.3 | -15.8 |       |        |        |        |       |
|   |           |      | +0.0 | +0.0 | +0.0 | +0.0  |       |        |        |        |       |
|   |           |      | +0.0 | +0.0 |      |       |       |        |        |        |       |

|    |                  |      |       |       |      |      |      |      |      |       |      |
|----|------------------|------|-------|-------|------|------|------|------|------|-------|------|
| 3  | 328.800M         | 38.4 | +0.0  | +0.0  | +0.2 | +0.0 | +0.0 | 33.9 | 46.0 | -12.1 | Vert |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | -27.1 | +14.5 | +5.8 | +0.9 |      |      |      |       |      |
|    |                  |      | +1.2  | +0.0  |      |      |      |      |      |       |      |
| 4  | 123.100M         | 42.7 | +0.0  | +0.0  | +0.1 | +0.0 | +0.0 | 30.1 | 43.5 | -13.4 | Vert |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | -27.6 | +7.9  | +5.8 | +0.5 |      |      |      |       |      |
|    |                  |      | +0.7  | +0.0  |      |      |      |      |      |       |      |
| 5  | 4960.000M<br>Ave | 23.7 | +32.6 | +4.2  | +0.9 | +0.0 | +0.0 | 28.7 | 54.0 | -25.3 | Vert |
|    |                  |      | -33.6 | +0.4  | +0.5 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  |      |      |      |      |      |       |      |
| ^  | 4960.000M        | 38.4 | +32.6 | +4.2  | +0.9 | +0.0 | +0.0 | 43.4 | 54.0 | -10.6 | Vert |
|    |                  |      | -33.6 | +0.4  | +0.5 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  |      |      |      |      |      |       |      |
| 7  | 4804.000M<br>Ave | 23.3 | +32.4 | +4.1  | +0.9 | +0.0 | +0.0 | 28.3 | 54.0 | -25.7 | Vert |
|    |                  |      | -33.6 | +0.6  | +0.6 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  |      |      |      |      |      |       |      |
| ^  | 4804.000M        | 36.5 | +32.4 | +4.1  | +0.9 | +0.0 | +0.0 | 41.5 | 54.0 | -12.5 | Vert |
|    |                  |      | -33.6 | +0.6  | +0.6 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  |      |      |      |      |      |       |      |
| 9  | 4880.000M<br>Ave | 23.1 | +32.5 | +4.2  | +0.9 | +0.0 | +0.0 | 28.1 | 54.0 | -25.9 | Vert |
|    |                  |      | -33.6 | +0.5  | +0.5 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  |      |      |      |      |      |       |      |
| ^  | 4880.000M        | 36.7 | +32.5 | +4.2  | +0.9 | +0.0 | +0.0 | 41.7 | 54.0 | -12.3 | Vert |
|    |                  |      | -33.6 | +0.5  | +0.5 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  |      |      |      |      |      |       |      |
| 11 | 9607.945M        | 43.9 | +37.6 | +6.2  | +1.4 | +0.0 | +0.0 | 56.7 | 84.1 | -27.4 | Vert |
|    |                  |      | -33.9 | +0.5  | +1.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  |      |      |      |      |      |       |      |
| 12 | 9759.730M        | 40.4 | +37.5 | +6.3  | +1.3 | +0.0 | +0.0 | 52.7 | 84.1 | -31.4 | Vert |
|    |                  |      | -33.9 | +0.4  | +0.7 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |      |       |      |
|    |                  |      | +0.0  | +0.0  |      |      |      |      |      |       |      |

|    |           |      |       |      |      |      |       |       |      |        |      |
|----|-----------|------|-------|------|------|------|-------|-------|------|--------|------|
| 13 | 9919.195M | 38.6 | +37.5 | +6.3 | +1.3 | +0.0 | +0.0  | 51.1  | 84.1 | -33.0  | Vert |
|    |           |      | -33.9 | +0.5 | +0.8 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 |      |      |       |       |      |        |      |
| 14 | 87.200M   | 46.8 | +0.0  | +0.0 | +0.1 | +0.0 | +0.0  | 32.8  | 84.1 | -51.3  | Vert |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | -27.8 | +7.0 | +5.8 | +0.4 |       |       |      |        |      |
|    |           |      | +0.5  | +0.0 |      |      |       |       |      |        |      |
| 15 | 25.373M   | 20.7 | +0.0  | +0.3 | +0.1 | +0.0 | -40.0 | -12.0 | 84.1 | -96.1  | Perp |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +6.9 |      |      |       |       |      |        |      |
| 16 | 27.343M   | 20.3 | +0.0  | +0.3 | +0.1 | +0.0 | -40.0 | -13.0 | 84.1 | -97.1  | Perp |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +6.3 |      |      |       |       |      |        |      |
| 17 | 74.988k   | 39.3 | +0.0  | +0.0 | +0.0 | +0.0 | -80.0 | -31.0 | 84.1 | -115.1 | Perp |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0 |       |       |      |        |      |
|    |           |      | +0.0  | +9.7 |      |      |       |       |      |        |      |

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **102802** Date: 4/7/2020  
 Test Type: **Maximized Emissions** Time: 10:23:24  
 Tested By: Matthew Harrison Sequence#: 82  
 Software: EMITest 5.03.12

***Equipment Tested:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

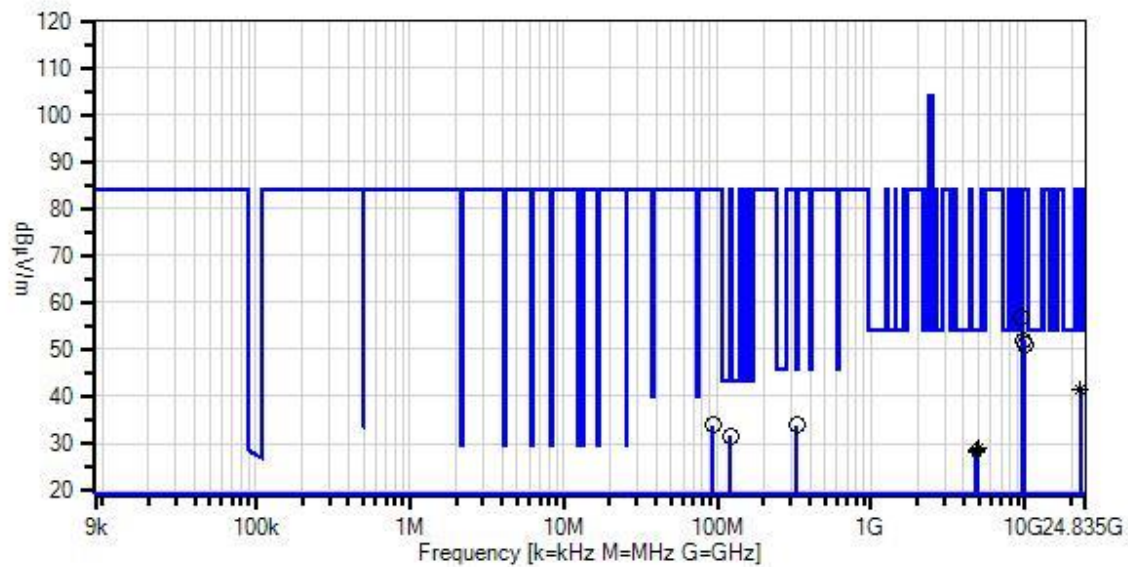
***Support Equipment:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Test Conditions / Notes:***

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions:<br>Temperature: 21° C<br>Humidity: 33%<br>Pressure: 101.3 kPa<br><br>Frequency Range: 9kHz-25GHz<br>Frequency tested: 2402, 2440, 2480<br>Firmware power setting: 9<br>EUT Firmware:<br>Protocol /MCS/Modulation: BT, DQPSK, 2DH1 (Worst-Case)<br><br>Antenna type: Linear Polarized<br>Antenna Gain: 3.7 dBi.<br><br>Duty Cycle: 100% Modulated<br><br>Test Method: ANSI C63.10: 2013<br>Test Mode: Transmitting<br>Test Setup: EUT is setup 1.5m high on a Styrofoam table.<br>Setup: EUT is connected to a Laptop via USB and Audio cable.<br><br>All data rates and Low, Mid, High channels investigated, worst-case provided. |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Nalloy, LLC. WO#: 102802 Sequence#: 82 Date: 4/7/2020  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Perp + Para



— Sweep Data  
 ○ Peak Readings  
 \* Average Readings  
 Software Version: 5.03.12

— Readings  
 × QP Readings  
 ▼ Ambient  
 — 1 - 15.247(d) / 15.209 Radiated Spurious Emissions

**Test Equipment:**

| ID  | Asset #    | Description                            | Model                           | Calibration Date | Cal Due Date |
|-----|------------|----------------------------------------|---------------------------------|------------------|--------------|
| T1  | AN01467    | Horn Antenna-ANSI<br>C63.5 Calibration | 3115                            | 7/5/2019         | 7/5/2021     |
| T2  | ANP06515   | Cable                                  | Heliac                          | 6/29/2018        | 6/29/2020    |
| T3  | ANP06540   | Cable                                  | Heliac                          | 8/23/2019        | 8/23/2021    |
|     | AN02872    | Spectrum Analyzer                      | E4440A                          | 11/18/2019       | 11/18/2021   |
| T4  | AN03540    | Preamplifier                           | 83017A                          | 5/13/2019        | 5/13/2021    |
| T5  | ANP07504   | Cable                                  | CLU40-KMKM-<br>02.00F           | 1/17/2019        | 1/17/2021    |
| T6  | AN03116    | High Pass Filter                       | 11SH10-00313                    | 1/22/2019        | 1/22/2021    |
| T7  | AN02742    | Active Horn Antenna                    | AMFW-5F-<br>18002650-20-<br>10P | 10/16/2018       | 10/16/2020   |
| T8  | AN02763-69 | Waveguide                              | Multiple                        | 4/23/2018        | 4/23/2020    |
| T9  | ANP06678   | Cable                                  | 32026-29801-<br>29801-144       | 2/20/2020        | 2/20/2022    |
| T10 | ANP07211   | Cable                                  | 32026-29801-<br>29801-18        | 8/7/2019         | 8/7/2021     |
| T11 | ANP07212   | Cable                                  | 32026-29801-<br>29801-18        | 8/7/2019         | 8/7/2021     |
| T12 | AN02307    | Preamplifier                           | 8447D                           | 1/10/2020        | 1/10/2022    |
| T13 | AN03628    | Biconilog Antenna                      | 3142E                           | 6/11/2019        | 6/11/2021    |
| T14 | ANP06123   | Attenuator                             | 18N-6                           | 4/5/2019         | 4/5/2021     |
| T15 | ANP05305   | Cable                                  | ETSI-50T                        | 9/6/2019         | 9/6/2021     |
| T16 | ANP05360   | Cable                                  | RG214                           | 2/3/2020         | 2/3/2022     |
| T17 | AN00052    | Loop Antenna                           | 6502                            | 5/7/2018         | 5/7/2020     |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| # | Freq     | Rdng | T1    | T2   | T3   | T4    | Dist  | Corr   | Spec   | Margin | Polar |
|---|----------|------|-------|------|------|-------|-------|--------|--------|--------|-------|
|   |          |      | T5    | T6   | T7   | T8    |       |        |        |        |       |
|   |          |      | T9    | T10  | T11  | T12   |       |        |        |        |       |
|   |          |      | T13   | T14  | T15  | T16   |       |        |        |        |       |
|   |          |      | T17   |      |      |       |       |        |        |        |       |
|   | MHz      | dBμV | dB    | dB   | dB   | dB    | Table | dBμV/m | dBμV/m | dB     | Ant   |
| 1 | 328.800M | 38.3 | +0.0  | +0.0 | +0.2 | +0.0  | +0.0  | 33.8   | 46.0   | -12.2  | Vert  |
|   |          |      | +0.0  | +0.0 | +0.0 | +0.0  |       |        |        |        |       |
|   |          |      | +0.0  | +0.0 | +0.0 | -27.1 |       |        |        |        |       |
|   |          |      | +14.5 | +5.8 | +0.9 | +1.2  |       |        |        |        |       |
|   |          |      | +0.0  |      |      |       |       |        |        |        |       |

|    |                       |      |                                       |                                      |                                       |                                       |      |      |      |       |      |
|----|-----------------------|------|---------------------------------------|--------------------------------------|---------------------------------------|---------------------------------------|------|------|------|-------|------|
| 2  | 22979.910<br>M<br>Ave | 43.9 | +0.0<br>+0.0<br>+9.5<br>+0.0<br>+0.0  | +0.0<br>+0.0<br>+0.8<br>+0.0<br>+0.0 | +0.0<br>-15.8<br>+1.3<br>+0.0<br>+0.0 | +0.0<br>+1.7<br>+0.0<br>+0.0<br>+0.0  | +0.0 | 41.4 | 54.0 | -12.6 | Vert |
| ^  | 22979.910<br>M        | 50.2 | +0.0<br>+0.0<br>+9.5<br>+0.0<br>+0.0  | +0.0<br>+0.0<br>+0.8<br>+0.0<br>+0.0 | +0.0<br>-15.8<br>+1.3<br>+0.0<br>+0.0 | +0.0<br>+1.7<br>+0.0<br>+0.0<br>+0.0  | +0.0 | 47.7 | 54.0 | -6.3  | Vert |
| 4  | 4960.000M<br>Ave      | 23.8 | +32.6<br>+0.4<br>+0.0<br>+0.0<br>+0.0 | +4.2<br>+0.5<br>+0.0<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | -33.6<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +0.0 | 28.8 | 54.0 | -25.2 | Vert |
| ^  | 4960.000M             | 39.7 | +32.6<br>+0.4<br>+0.0<br>+0.0<br>+0.0 | +4.2<br>+0.5<br>+0.0<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | -33.6<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +0.0 | 44.7 | 54.0 | -9.3  | Vert |
| 6  | 4804.000M<br>Ave      | 23.4 | +32.4<br>+0.6<br>+0.0<br>+0.0<br>+0.0 | +4.1<br>+0.6<br>+0.0<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | -33.6<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +0.0 | 28.4 | 54.0 | -25.6 | Vert |
| ^  | 4804.000M             | 38.3 | +32.4<br>+0.6<br>+0.0<br>+0.0<br>+0.0 | +4.1<br>+0.6<br>+0.0<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | -33.6<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +0.0 | 43.3 | 54.0 | -10.7 | Vert |
| 8  | 4880.000M<br>Ave      | 23.1 | +32.5<br>+0.5<br>+0.0<br>+0.0<br>+0.0 | +4.2<br>+0.5<br>+0.0<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | -33.6<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +0.0 | 28.1 | 54.0 | -25.9 | Vert |
| ^  | 4880.000M             | 38.2 | +32.5<br>+0.5<br>+0.0<br>+0.0<br>+0.0 | +4.2<br>+0.5<br>+0.0<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | -33.6<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +0.0 | 43.2 | 54.0 | -10.8 | Vert |
| 10 | 9608.390M             | 43.9 | +37.6<br>+0.5<br>+0.0<br>+0.0<br>+0.0 | +6.2<br>+1.0<br>+0.0<br>+0.0<br>+0.0 | +1.4<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | -33.9<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +0.0 | 56.7 | 84.0 | -27.3 | Vert |
| 11 | 9760.905M             | 39.6 | +37.5<br>+0.4<br>+0.0<br>+0.0<br>+0.0 | +6.3<br>+0.7<br>+0.0<br>+0.0<br>+0.0 | +1.3<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | -33.9<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +0.0 | 51.9 | 84.0 | -32.1 | Vert |

|    |           |      |       |      |      |       |       |       |      |        |      |
|----|-----------|------|-------|------|------|-------|-------|-------|------|--------|------|
| 12 | 9920.540M | 38.5 | +37.5 | +6.3 | +1.3 | -33.9 | +0.0  | 51.0  | 84.0 | -33.0  | Vert |
|    |           |      | +0.5  | +0.8 | +0.0 | +0.0  |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0  |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0  |       |       |      |        |      |
|    |           |      | +0.0  |      |      |       |       |       |      |        |      |
| 13 | 93.000M   | 47.1 | +0.0  | +0.0 | +0.1 | +0.0  | +0.0  | 33.8  | 84.0 | -50.2  | Vert |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0  |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | -27.7 |       |       |      |        |      |
|    |           |      | +7.4  | +5.8 | +0.5 | +0.6  |       |       |      |        |      |
|    |           |      | +0.0  |      |      |       |       |       |      |        |      |
| 14 | 122.200M  | 44.1 | +0.0  | +0.0 | +0.1 | +0.0  | +0.0  | 31.5  | 84.0 | -52.5  | Vert |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0  |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | -27.6 |       |       |      |        |      |
|    |           |      | +7.9  | +5.8 | +0.5 | +0.7  |       |       |      |        |      |
|    |           |      | +0.0  |      |      |       |       |       |      |        |      |
| 15 | 26.478M   | 22.0 | +0.0  | +0.3 | +0.1 | +0.0  | -40.0 | -11.0 | 84.0 | -95.0  | Perp |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0  |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0  |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0  |       |       |      |        |      |
|    |           |      | +6.6  |      |      |       |       |       |      |        |      |
| 16 | 83.025k   | 38.0 | +0.0  | +0.0 | +0.0 | +0.0  | -80.0 | -32.3 | 84.0 | -116.3 | Perp |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0  |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0  |       |       |      |        |      |
|    |           |      | +0.0  | +0.0 | +0.0 | +0.0  |       |       |      |        |      |
|    |           |      | +9.7  |      |      |       |       |       |      |        |      |

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **102802** Date: 4/7/2020  
 Test Type: **Maximized Emissions** Time: 10:37:45  
 Tested By: Matthew Harrison Sequence#: 81  
 Software: EMITest 5.03.12

***Equipment Tested:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

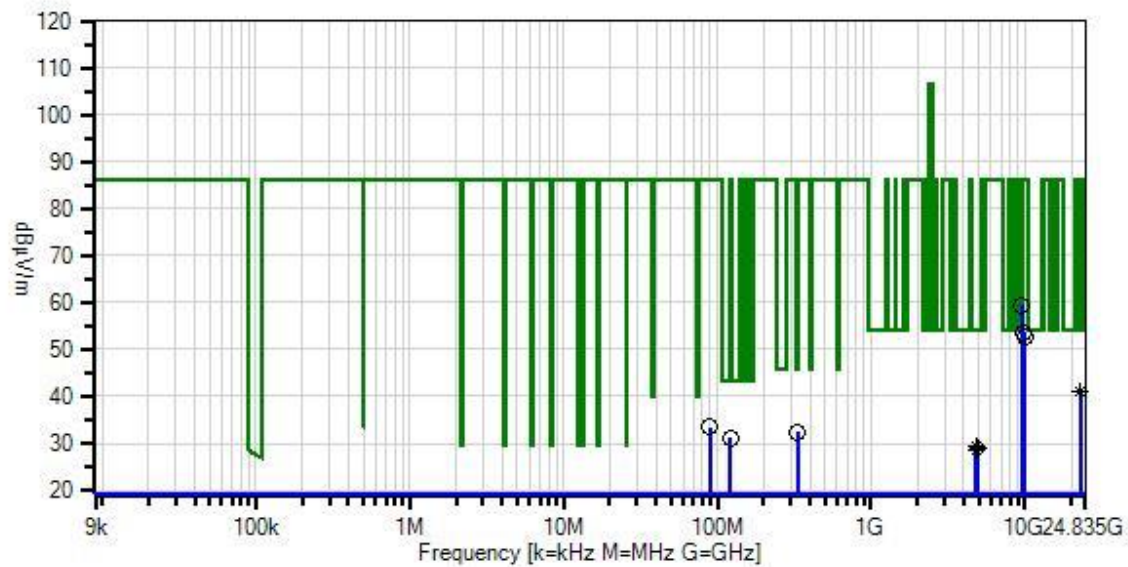
***Support Equipment:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Test Conditions / Notes:***

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions:<br>Temperature: 21° C<br>Humidity: 33%<br>Pressure: 101.3 kPa<br><br>Frequency Range: 9kHz-25GHz<br>Frequency tested: 2402, 2440, 2480<br>Firmware power setting: 9<br>EUT Firmware:<br>Protocol /MCS/Modulation: BT, GFSK, DH1 (Worst-Case)<br><br>Antenna type: Linear Polarized<br>Antenna Gain: 3.7 dBi.<br><br>Duty Cycle: 100% Modulated<br><br>Test Method: ANSI C63.10: 2013<br>Test Mode: Transmitting<br>Test Setup: EUT is setup 1.5m high on a Styrofoam table for above 1GHz and 0.8m high below 1GHz.<br>Setup: EUT is connected to a Laptop via USB and Audio cable.<br><br>All data rates and Low, Mid, High channels investigated, worst-case provided. |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Nalloy, LLC. WO#: 102802 Sequence#: 81 Date: 4/7/2020  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert & Horz



— Sweep Data  
 ○ Peak Readings  
 \* Average Readings  
 Software Version: 5.03.12

— Readings  
 × QP Readings  
 ▼ Ambient  
 — 1 - 15.247(d) / 15.209 Radiated Spurious Emissions

**Test Equipment:**

| ID  | Asset #    | Description                            | Model                           | Calibration Date | Cal Due Date |
|-----|------------|----------------------------------------|---------------------------------|------------------|--------------|
| T1  | AN01467    | Horn Antenna-ANSI<br>C63.5 Calibration | 3115                            | 7/5/2019         | 7/5/2021     |
| T2  | ANP06515   | Cable                                  | Heliac                          | 6/29/2018        | 6/29/2020    |
| T3  | ANP06540   | Cable                                  | Heliac                          | 8/23/2019        | 8/23/2021    |
|     | AN02872    | Spectrum Analyzer                      | E4440A                          | 11/18/2019       | 11/18/2021   |
| T4  | AN03540    | Preamplifier                           | 83017A                          | 5/13/2019        | 5/13/2021    |
| T5  | ANP07504   | Cable                                  | CLU40-KMKM-<br>02.00F           | 1/17/2019        | 1/17/2021    |
| T6  | AN03116    | High Pass Filter                       | 11SH10-00313                    | 1/22/2019        | 1/22/2021    |
| T7  | AN02742    | Active Horn Antenna                    | AMFW-5F-<br>18002650-20-<br>10P | 10/16/2018       | 10/16/2020   |
| T8  | AN02763-69 | Waveguide                              | Multiple                        | 4/23/2018        | 4/23/2020    |
| T9  | ANP06678   | Cable                                  | 32026-29801-<br>29801-144       | 2/20/2020        | 2/20/2022    |
| T10 | ANP07211   | Cable                                  | 32026-29801-<br>29801-18        | 8/7/2019         | 8/7/2021     |
| T11 | ANP07212   | Cable                                  | 32026-29801-<br>29801-18        | 8/7/2019         | 8/7/2021     |
| T12 | AN02307    | Preamplifier                           | 8447D                           | 1/10/2020        | 1/10/2022    |
| T13 | AN03628    | Biconilog Antenna                      | 3142E                           | 6/11/2019        | 6/11/2021    |
| T14 | ANP06123   | Attenuator                             | 18N-6                           | 4/5/2019         | 4/5/2021     |
| T15 | ANP05305   | Cable                                  | ETSI-50T                        | 9/6/2019         | 9/6/2021     |
| T16 | ANP05360   | Cable                                  | RG214                           | 2/3/2020         | 2/3/2022     |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| # | Freq                  | Rdng | T1<br>T5<br>T9<br>T13         | T2<br>T6<br>T10<br>T14       | T3<br>T7<br>T11<br>T15        | T4<br>T8<br>T12<br>T16        | Dist  | Corr   | Spec   | Margin | Polar |
|---|-----------------------|------|-------------------------------|------------------------------|-------------------------------|-------------------------------|-------|--------|--------|--------|-------|
|   | MHz                   | dBμV | dB                            | dB                           | dB                            | dB                            | Table | dBμV/m | dBμV/m | dB     | Ant   |
| 1 | 121.200M              | 43.7 | +0.0<br>+0.0<br>+0.0<br>+8.0  | +0.0<br>+0.0<br>+0.0<br>+5.8 | +0.1<br>+0.0<br>+0.0<br>+0.5  | +0.0<br>+0.0<br>-27.6<br>+0.7 | +0.0  | 31.2   | 43.5   | -12.3  | Vert  |
| 2 | 22979.880<br>M<br>Ave | 43.4 | +0.0<br>+0.0<br>+9.5<br>+0.0  | +0.0<br>+0.0<br>+0.8<br>+0.0 | +0.0<br>-15.8<br>+1.3<br>+0.0 | +0.0<br>+1.7<br>+0.0<br>+0.0  | +0.0  | 40.9   | 54.0   | -13.1  | Vert  |
| ^ | 22979.880<br>M        | 49.7 | +0.0<br>+0.0<br>+9.5<br>+0.0  | +0.0<br>+0.0<br>+0.8<br>+0.0 | +0.0<br>-15.8<br>+1.3<br>+0.0 | +0.0<br>+1.7<br>+0.0<br>+0.0  | +0.0  | 47.2   | 54.0   | -6.8   | Vert  |
| 4 | 330.700M              | 36.9 | +0.0<br>+0.0<br>+0.0<br>+14.6 | +0.0<br>+0.0<br>+0.0<br>+5.8 | +0.2<br>+0.0<br>+0.0<br>+0.9  | +0.0<br>+0.0<br>-27.1<br>+1.2 | +0.0  | 32.5   | 46.0   | -13.5  | Vert  |

|    |                  |      |                               |                              |                              |                               |       |       |      |        |      |
|----|------------------|------|-------------------------------|------------------------------|------------------------------|-------------------------------|-------|-------|------|--------|------|
| 5  | 4804.000M<br>Ave | 24.5 | +32.4<br>+0.6<br>+0.0<br>+0.0 | +4.1<br>+0.6<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0 | -33.6<br>+0.0                 | +0.0  | 29.5  | 54.0 | -24.5  | Vert |
| ^  | 4804.000M        | 39.9 | +32.4<br>+0.6<br>+0.0<br>+0.0 | +4.1<br>+0.6<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0 | -33.6<br>+0.0                 | +0.0  | 44.9  | 54.0 | -9.1   | Vert |
| 7  | 4960.000M<br>Ave | 24.1 | +32.6<br>+0.4<br>+0.0<br>+0.0 | +4.2<br>+0.5<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0 | -33.6<br>+0.0                 | +0.0  | 29.1  | 54.0 | -24.9  | Vert |
| ^  | 4960.000M        | 39.6 | +32.6<br>+0.4<br>+0.0<br>+0.0 | +4.2<br>+0.5<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0 | -33.6<br>+0.0                 | +0.0  | 44.6  | 54.0 | -9.4   | Vert |
| 9  | 4880.000M<br>Ave | 23.5 | +32.5<br>+0.5<br>+0.0<br>+0.0 | +4.2<br>+0.5<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0 | -33.6<br>+0.0                 | +0.0  | 28.5  | 54.0 | -25.5  | Vert |
| ^  | 4880.000M        | 39.4 | +32.5<br>+0.5<br>+0.0<br>+0.0 | +4.2<br>+0.5<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0 | -33.6<br>+0.0                 | +0.0  | 44.4  | 54.0 | -9.6   | Vert |
| 11 | 9608.585M        | 46.7 | +37.6<br>+0.5<br>+0.0<br>+0.0 | +6.2<br>+1.0<br>+0.0<br>+0.0 | +1.4<br>+0.0<br>+0.0<br>+0.0 | -33.9<br>+0.0                 | +0.0  | 59.5  | 86.3 | -26.8  | Vert |
| 12 | 9760.205M        | 41.3 | +37.5<br>+0.4<br>+0.0<br>+0.0 | +6.3<br>+0.7<br>+0.0<br>+0.0 | +1.3<br>+0.0<br>+0.0<br>+0.0 | -33.9<br>+0.0                 | +0.0  | 53.6  | 86.3 | -32.7  | Vert |
| 13 | 9919.765M        | 40.0 | +37.5<br>+0.5<br>+0.0<br>+0.0 | +6.3<br>+0.8<br>+0.0<br>+0.0 | +1.3<br>+0.0<br>+0.0<br>+0.0 | -33.9<br>+0.0                 | +0.0  | 52.5  | 86.3 | -33.8  | Vert |
| 14 | 89.200M          | 47.4 | +0.0<br>+0.0<br>+0.0<br>+7.1  | +0.0<br>+0.0<br>+0.0<br>+5.8 | +0.1<br>+0.0<br>+0.0<br>+0.4 | +0.0<br>+0.0<br>-27.8<br>+0.5 | +0.0  | 33.5  | 86.3 | -52.8  | Vert |
| 15 | 25.911M          | 19.7 | +0.0<br>+0.0<br>+0.0<br>+19.3 | +0.0<br>+0.0<br>+0.0<br>+5.8 | +0.1<br>+0.0<br>+0.0<br>+0.3 | +0.0<br>+0.0<br>-27.9<br>+0.3 | -40.0 | -22.4 | 86.3 | -108.7 | Vert |
| 16 | 37.482k          | 44.0 | +0.0<br>+0.0<br>+0.0<br>+0.0  | +0.0<br>+0.0<br>+0.0<br>+5.8 | +0.0<br>+0.0<br>+0.0<br>+0.0 | +0.0<br>+0.0<br>+0.0<br>+0.0  | -80.0 | -30.2 | 86.3 | -116.5 | Vert |

## Band Edge

### Band Edge Summary

Operating Mode: Single Channel (Low and High)

| Frequency (MHz) | Modulation    | Ant. Type        | Field Strength (dBuV/m @3m) | Limit (dBuV/m @3m) | Results |
|-----------------|---------------|------------------|-----------------------------|--------------------|---------|
| 2390.0          | GFSK          | Linear Polarized | 39.2                        | <54                | Pass    |
| 2400.0          | GFSK          | Linear Polarized | 74.2                        | <86.3              | Pass    |
| 2483.5          | GFSK          | Linear Polarized | 30.8                        | <54                | Pass    |
| 2390.0          | $\pi/4$ DQPSK | Linear Polarized | 38.9                        | <54                | Pass    |
| 2400.0          | $\pi/4$ DQPSK | Linear Polarized | 77.4                        | <83                | Pass    |
| 2483.5          | $\pi/4$ DQPSK | Linear Polarized | 40                          | <54                | Pass    |
| 2390.0          | 8DPSK         | Linear Polarized | 38.8                        | <54                | Pass    |
| 2400.0          | 8DPSK         | Linear Polarized | 77.8                        | <84.1              | Pass    |
| 2483.5          | 8DPSK         | Linear Polarized | 40.2                        | <54                | Pass    |

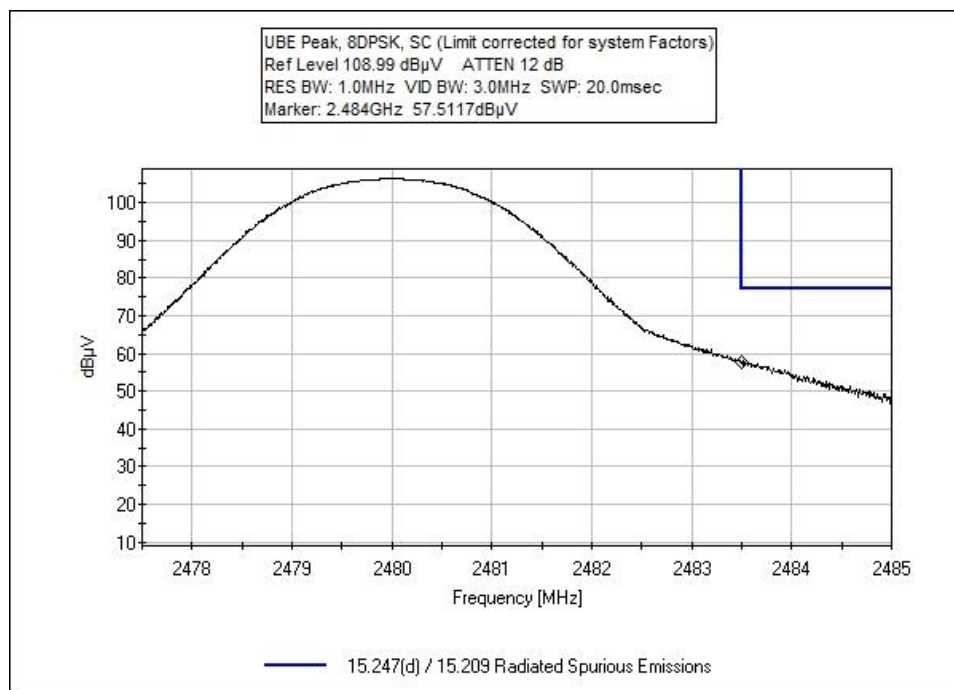
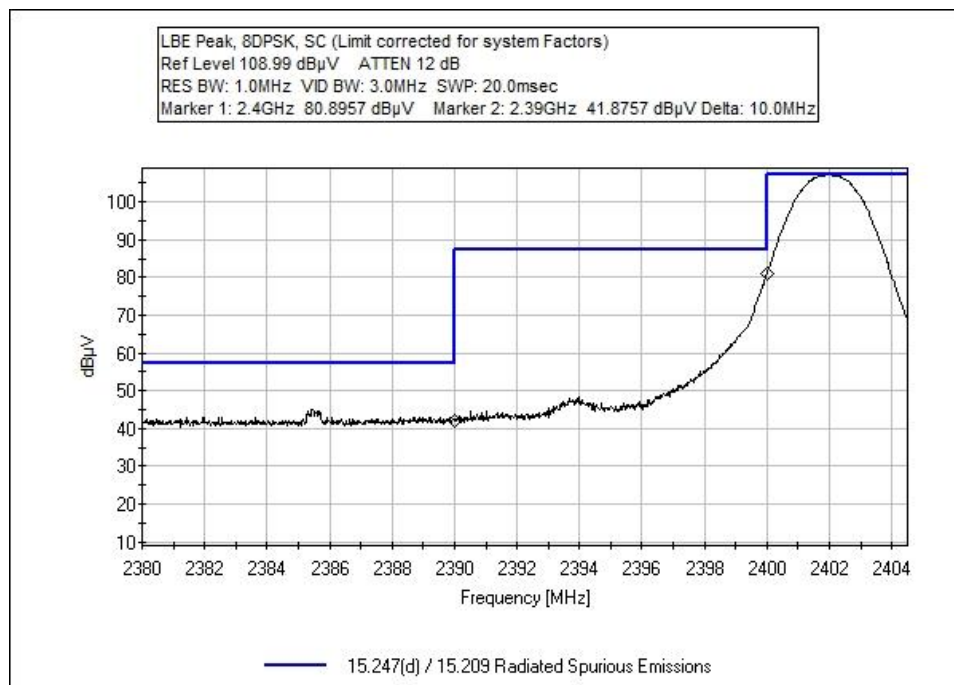
### Band Edge Summary

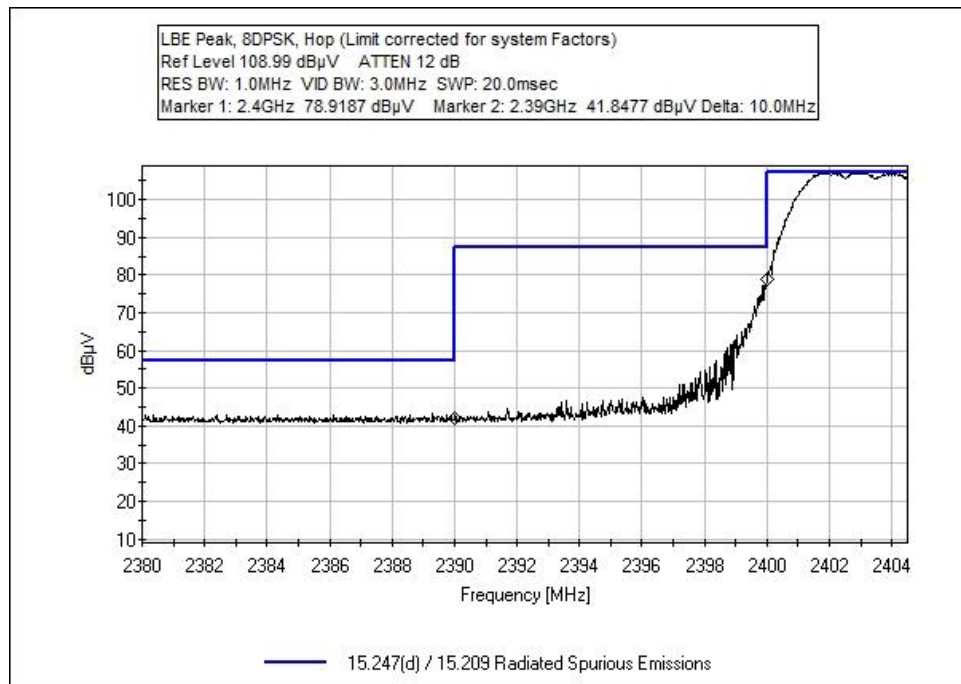
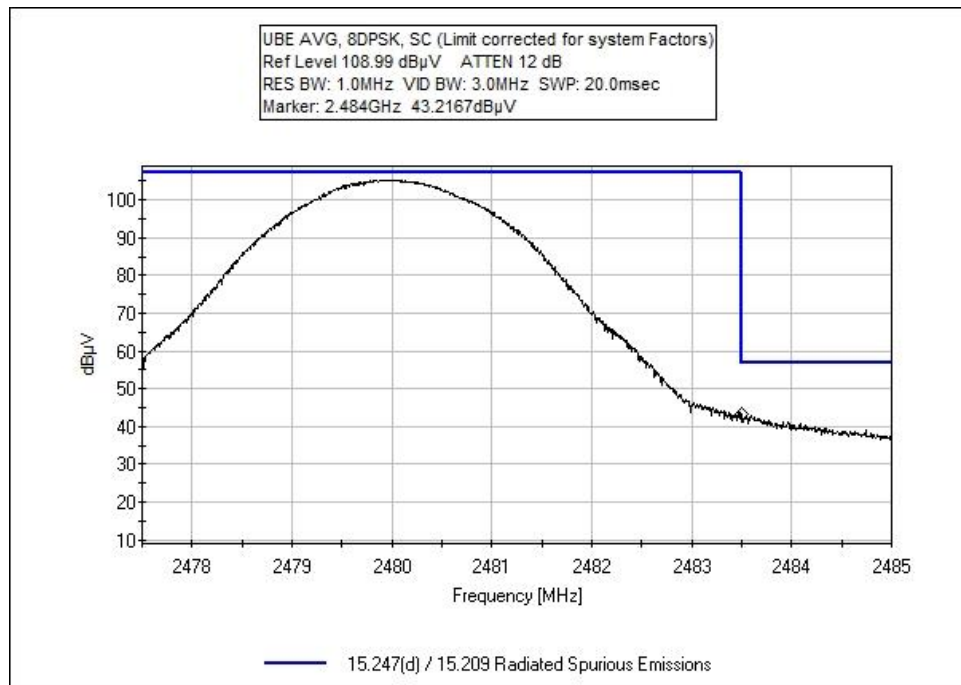
Operating Mode: Hopping

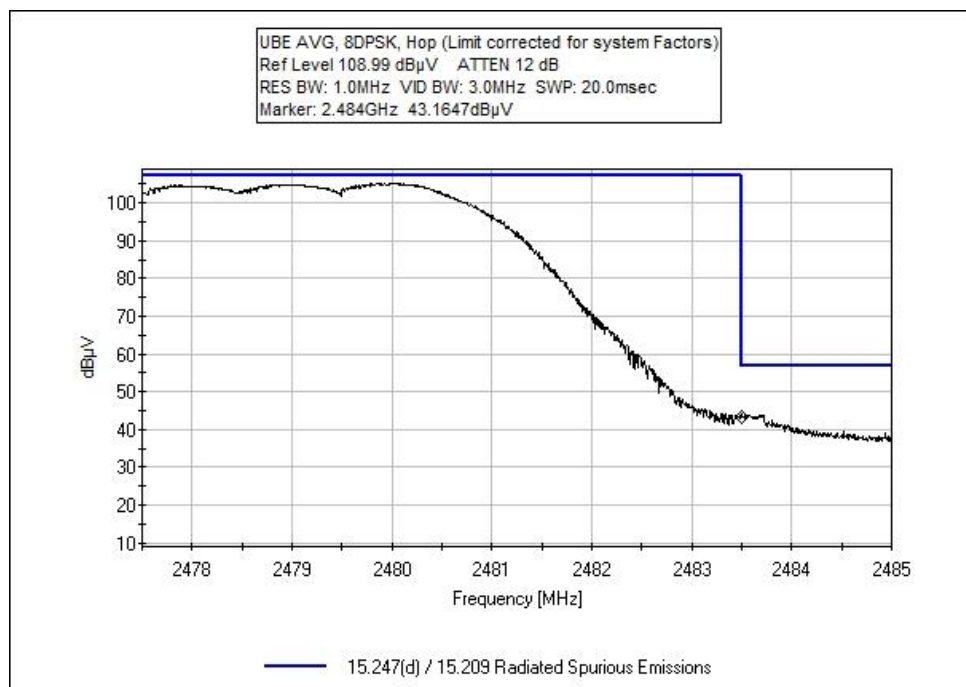
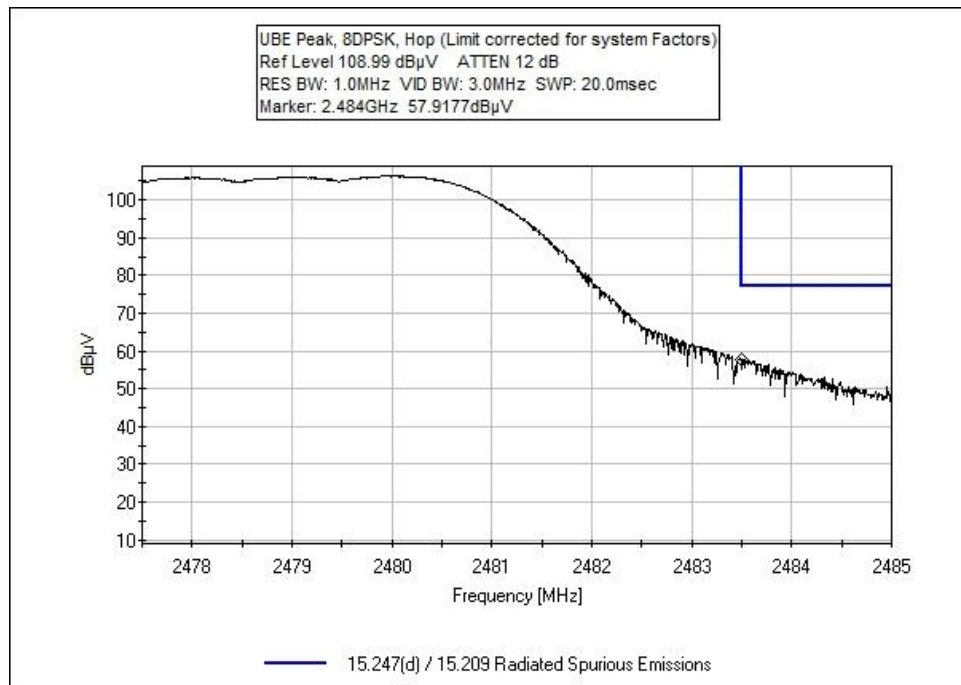
| Frequency (MHz) | Modulation    | Ant. Type        | Field Strength (dBuV/m @3m) | Limit (dBuV/m @3m) | Results |
|-----------------|---------------|------------------|-----------------------------|--------------------|---------|
| 2390.0          | GFSK          | Linear Polarized | 40.3                        | <54                | Pass    |
| 2400.0          | GFSK          | Linear Polarized | 75                          | <86.3              | Pass    |
| 2483.5          | GFSK          | Linear Polarized | 42.7                        | <54                | Pass    |
| 2390.0          | $\pi/4$ DQPSK | Linear Polarized | 39                          | <54                | Pass    |
| 2400.0          | $\pi/4$ DQPSK | Linear Polarized | 77.2                        | <83                | Pass    |
| 2483.5          | $\pi/4$ DQPSK | Linear Polarized | 37.9                        | <54                | Pass    |
| 2390.0          | 8DPSK         | Linear Polarized | 38.7                        | <54                | Pass    |
| 2400.0          | 8DPSK         | Linear Polarized | 75.8                        | <84.1              | Pass    |
| 2483.5          | 8DPSK         | Linear Polarized | 40.2                        | <54                | Pass    |

\*Note: In order to avoid averaging blanking intervals, an RMS average detector was used.

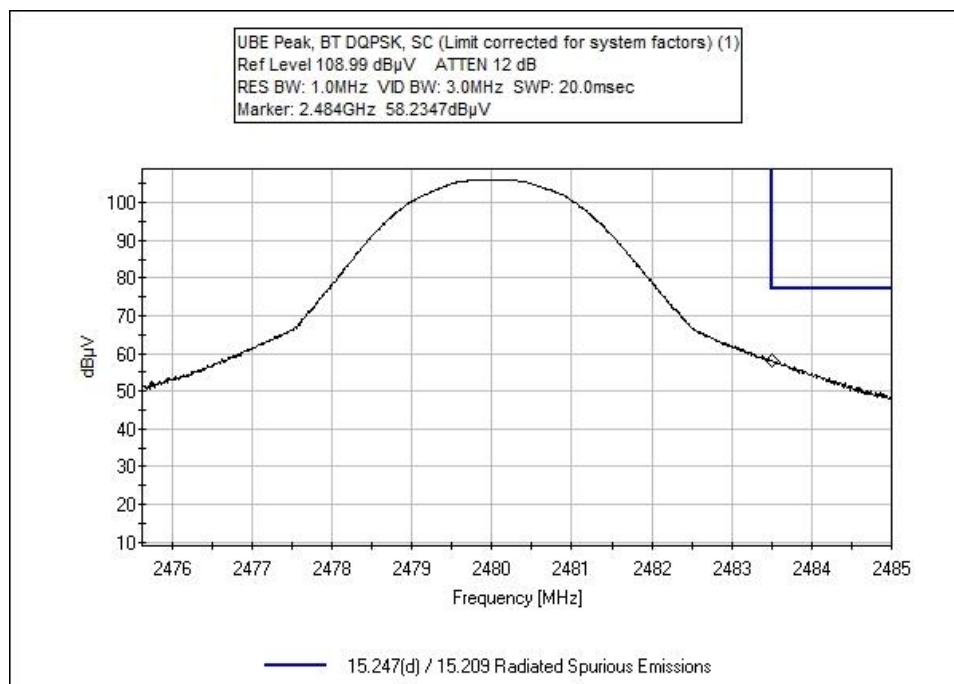
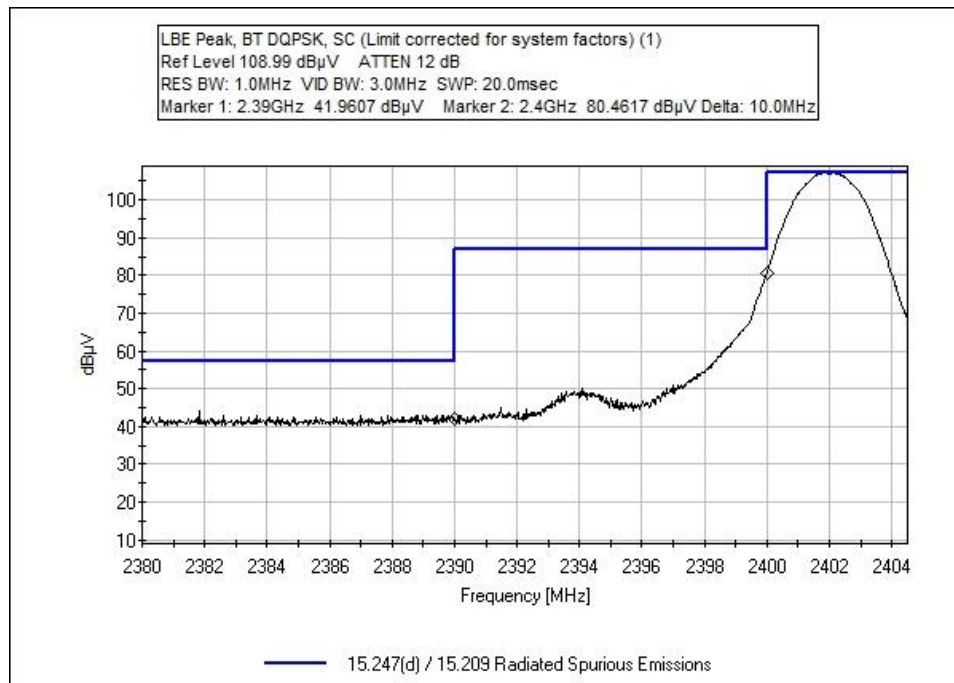
## 8DPSK Band Edge Plots

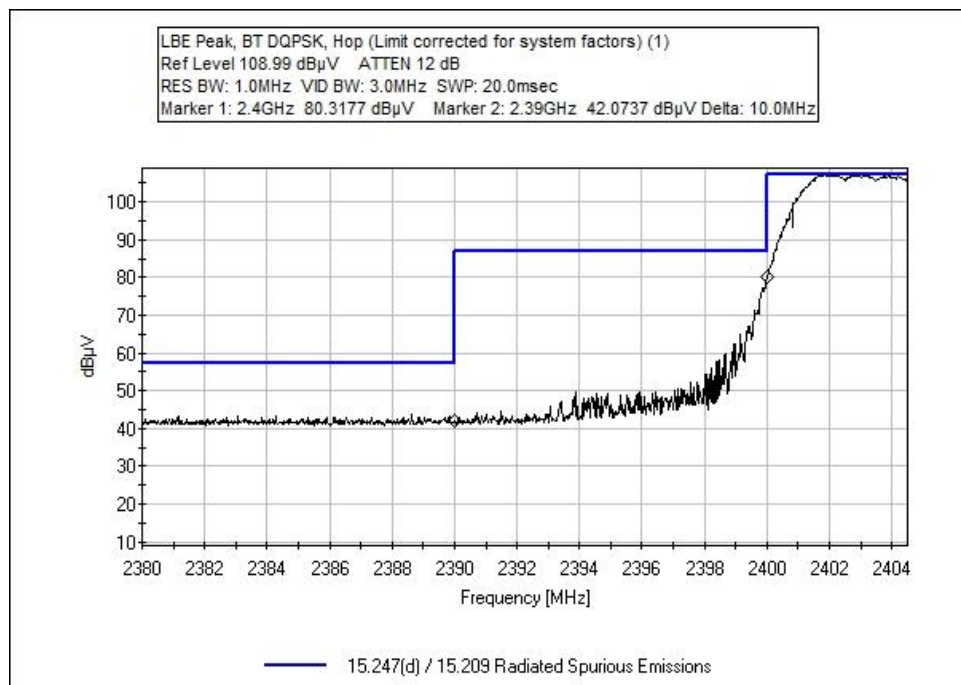
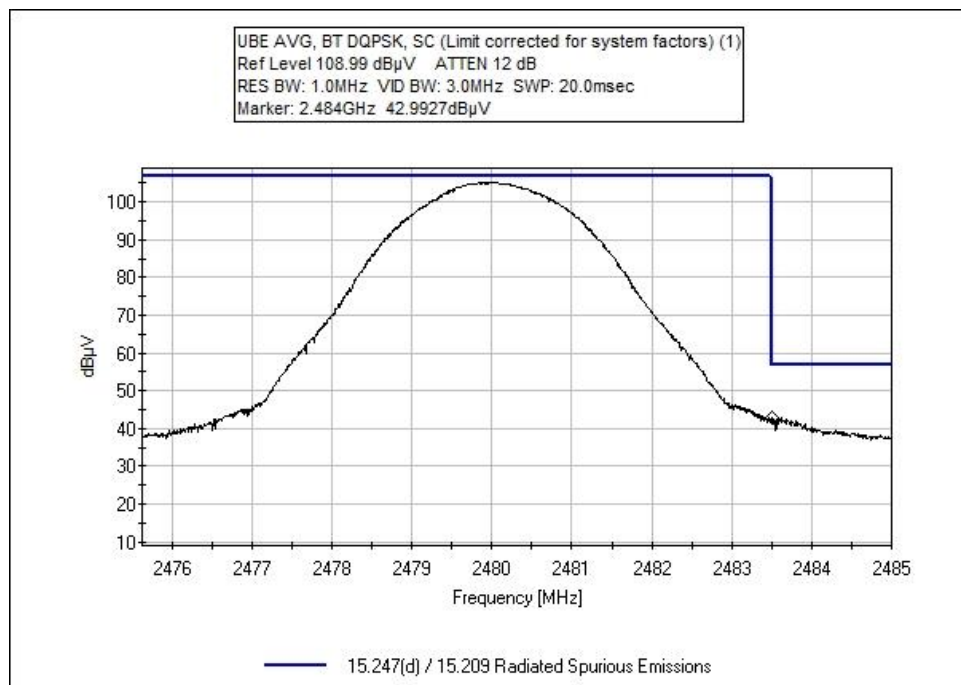


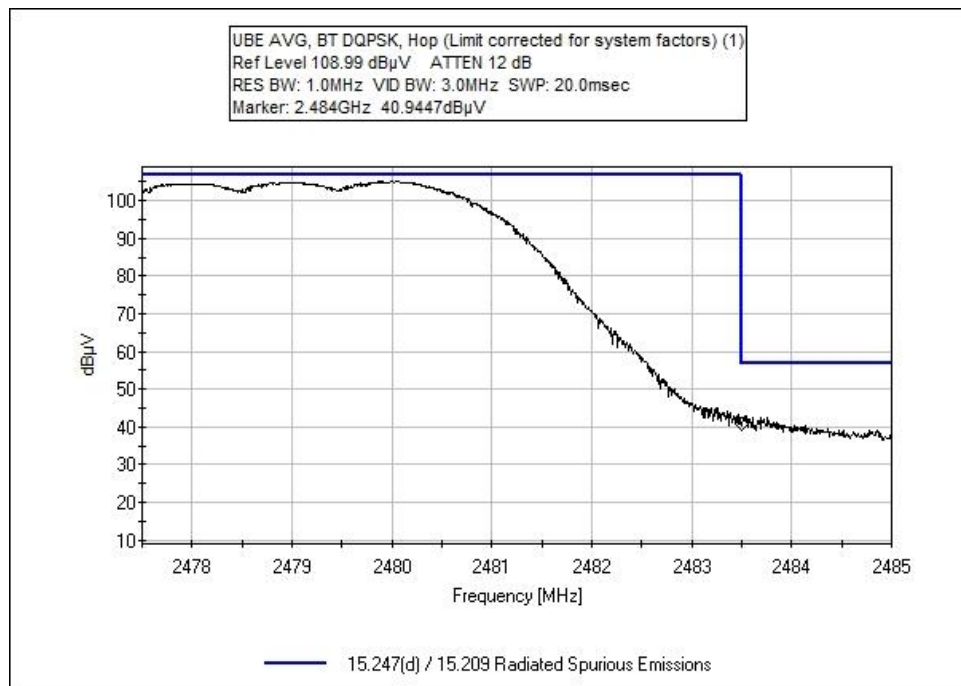
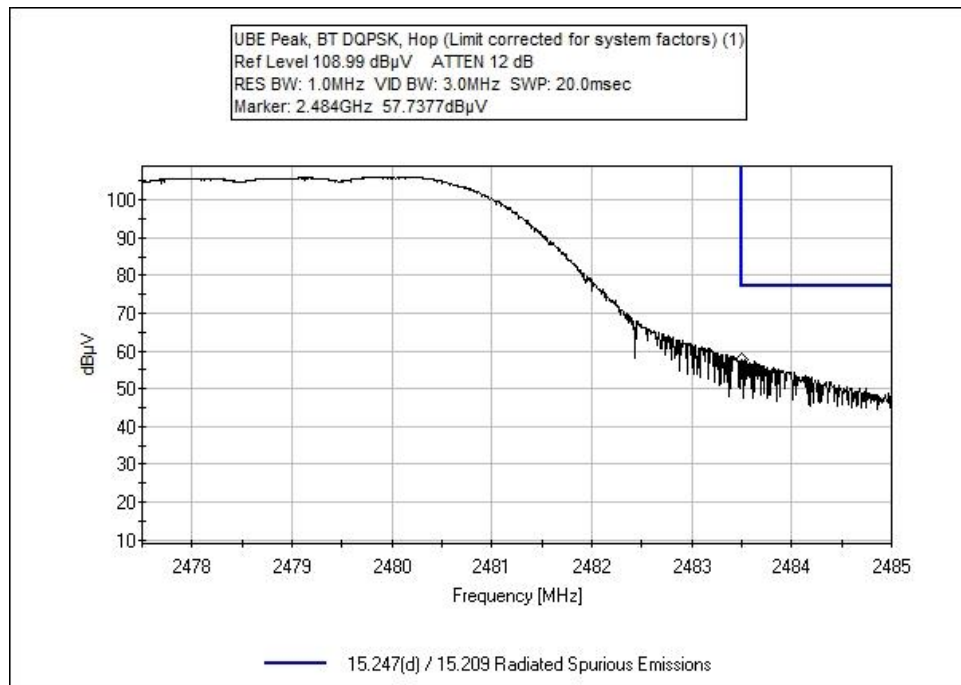




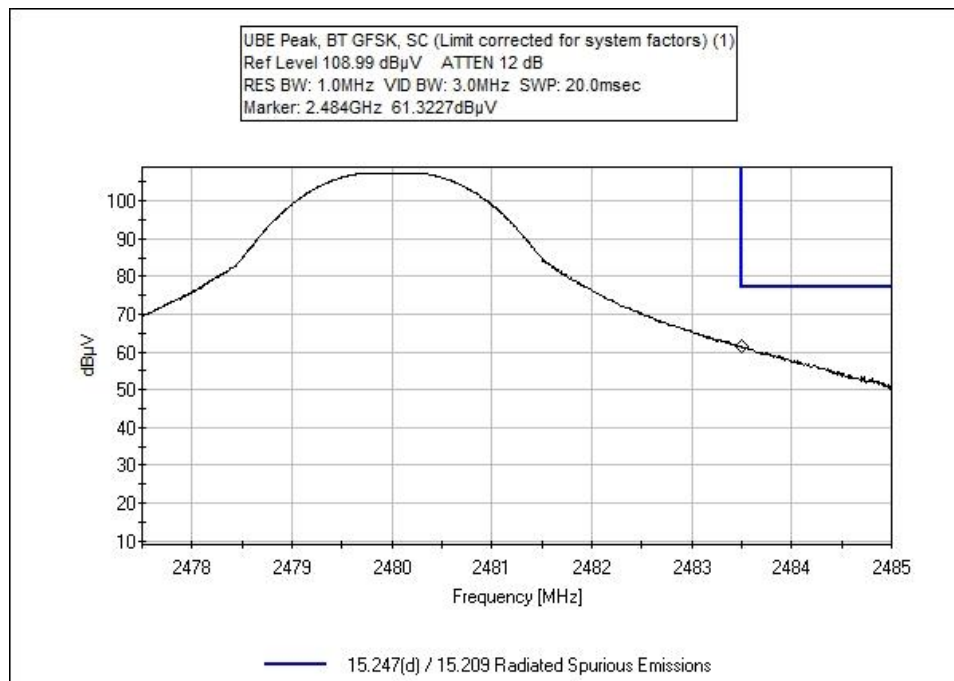
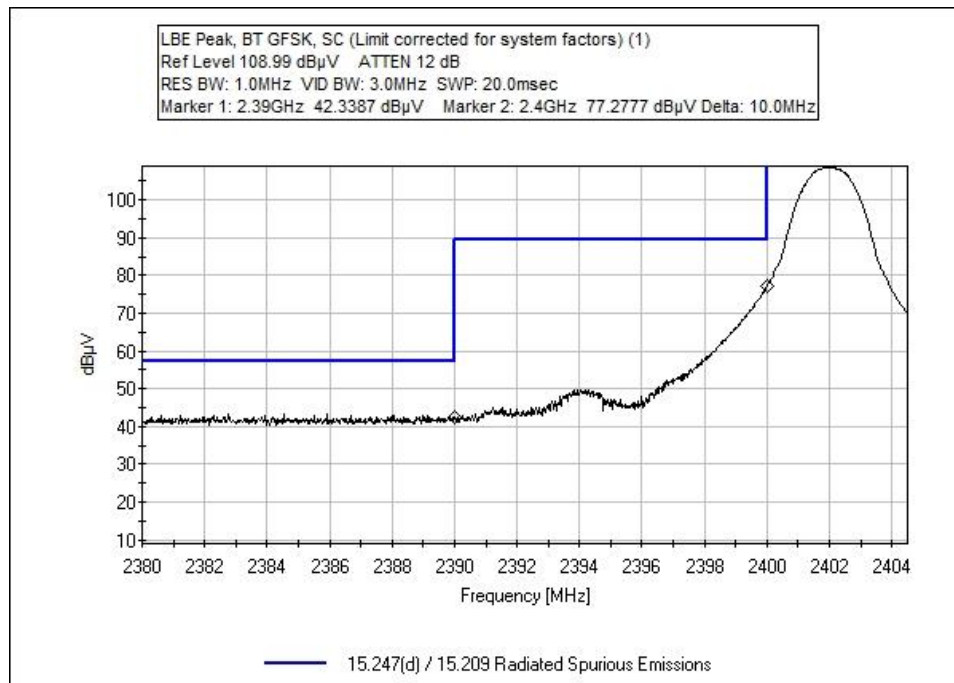
## DQPSK Band Edge Plots

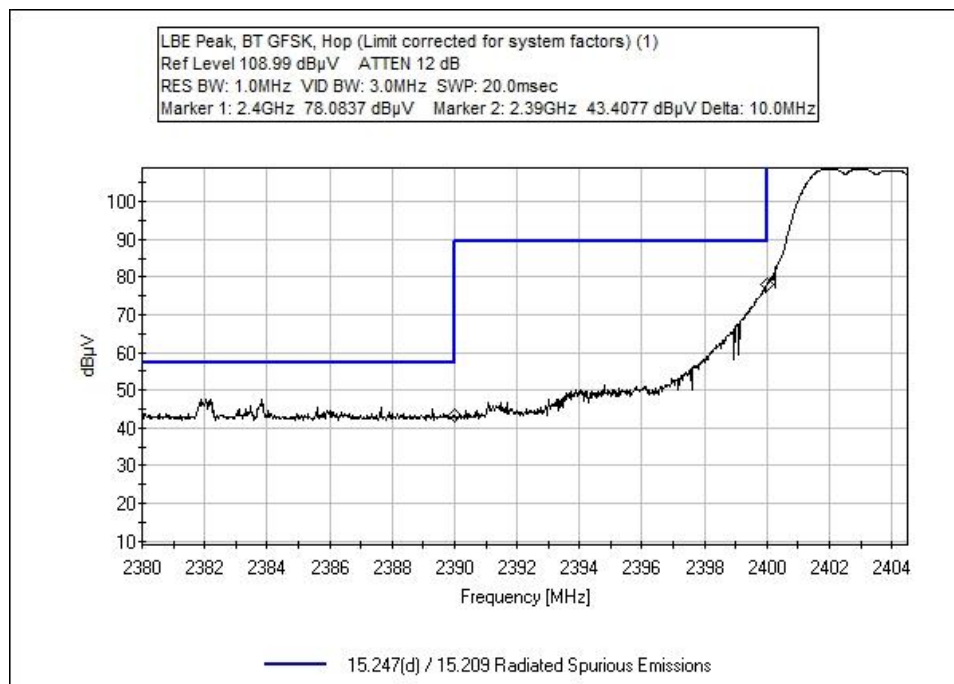
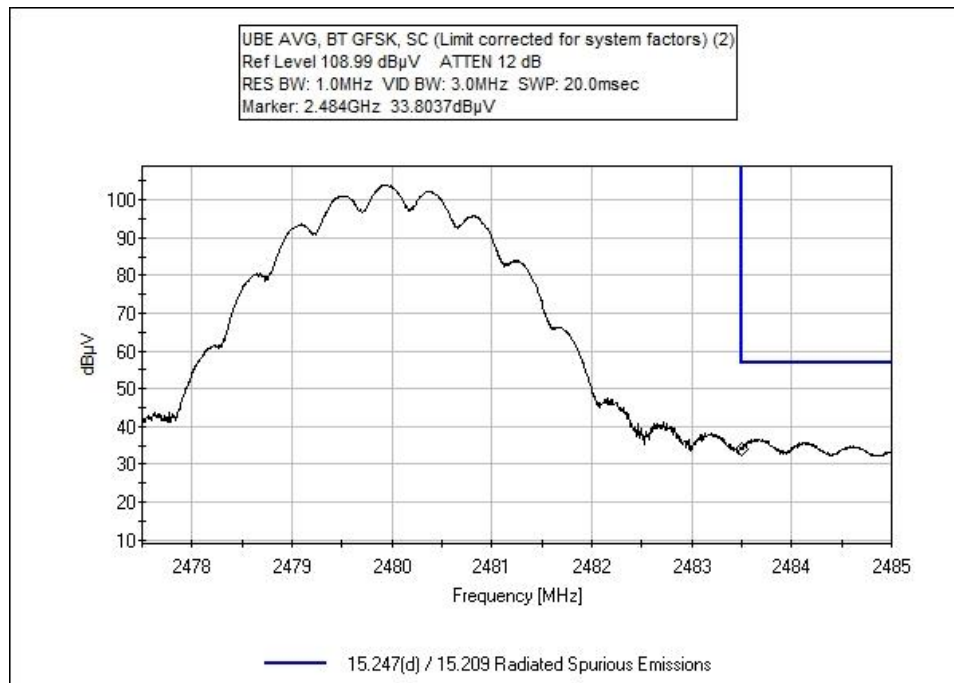


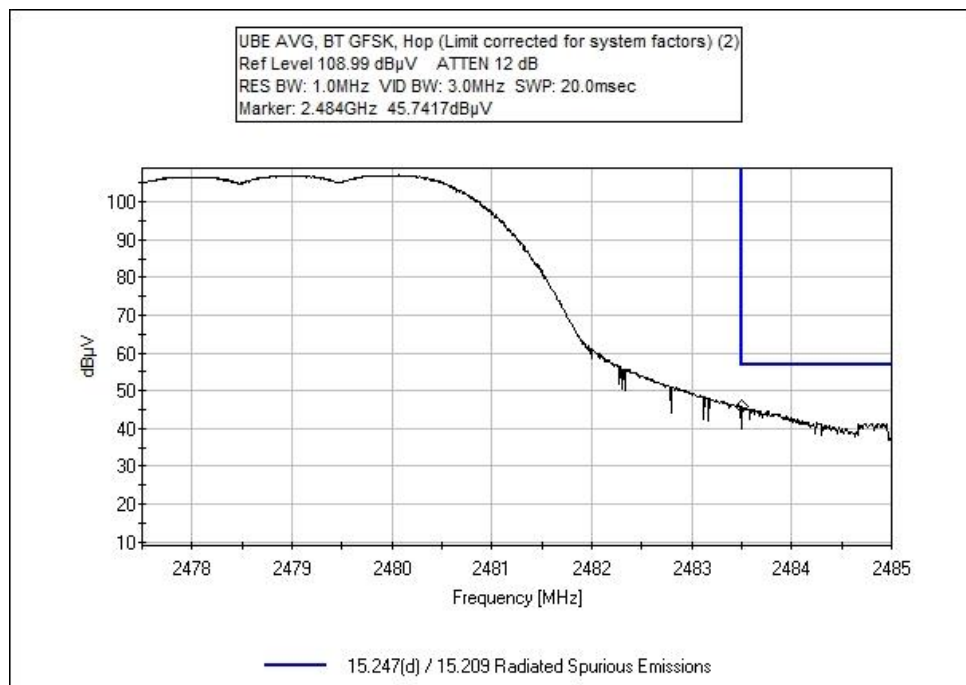
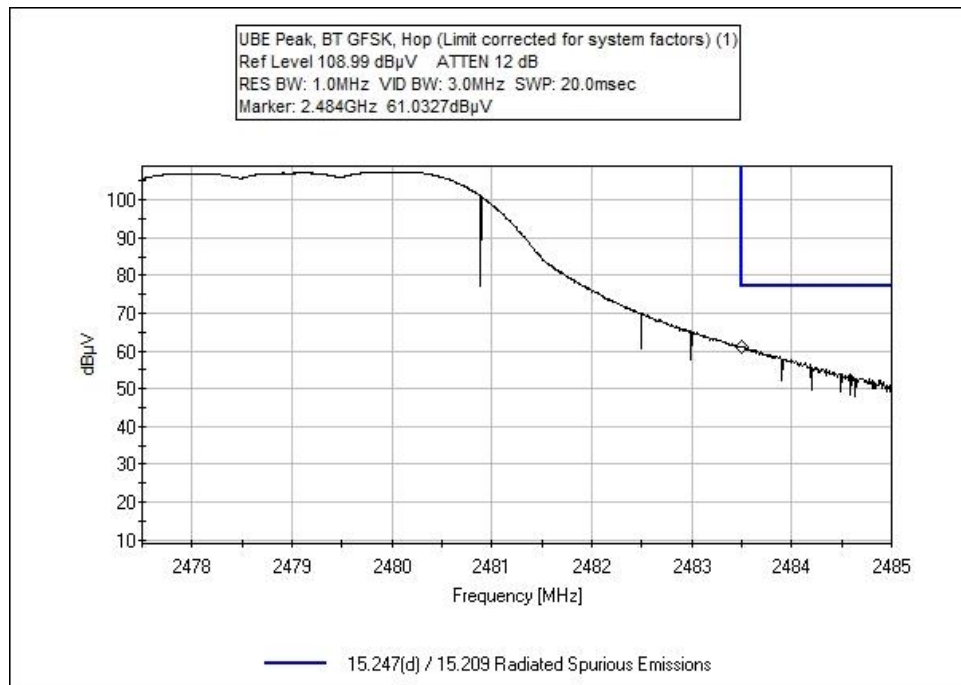




## GFSK Band Edge Plots







### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **102802** Date: 3/26/2020  
 Test Type: **Maximized Emissions** Time: 11:14:36  
 Tested By: Matthew Harrison Sequence#: 45  
 Software: EMITest 5.03.12

#### Equipment Tested:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Support Equipment:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Test Conditions / Notes:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions:<br>Temperature: 22° C<br>Humidity: 28%<br>Pressure: 101.3 kPa<br><br>Frequency Range: 2.380-2.485GHz<br>Frequency tested: 2402, 2480<br>Firmware power setting: 9<br>EUT Firmware:<br>Protocol /MCS/Modulation: BT, 8DPSK, 3DH1 (Worst-Case)<br><br>Antenna type: Linear Polarized<br>Antenna Gain: 3.7 dBi.<br><br>Duty Cycle: 100% Modulated<br><br>Test Method: ANSI C63.10: 2013<br>Test Mode: Transmitting<br>Test Setup: EUT is setup 1.5m high on a Styrofoam table.<br>Setup: EUT is connected to a Laptop via USB and Audio cable.<br><br>All data rates investigated, worst-case provided. |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Test Equipment:**

| ID | Asset #  | Description                            | Model                 | Calibration Date | Cal Due Date |
|----|----------|----------------------------------------|-----------------------|------------------|--------------|
| T1 | AN01467  | Horn Antenna-ANSI<br>C63.5 Calibration | 3115                  | 7/5/2019         | 7/5/2021     |
| T2 | ANP06515 | Cable                                  | Heliac                | 6/29/2018        | 6/29/2020    |
| T3 | ANP06540 | Cable                                  | Heliac                | 8/23/2019        | 8/23/2021    |
| T4 | AN02872  | Spectrum Analyzer                      | E4440A                | 11/18/2019       | 11/18/2021   |
| T5 | AN03540  | Preamp                                 | 83017A                | 5/13/2019        | 5/13/2021    |
| T6 | ANP07504 | Cable                                  | CLU40-KMKM-<br>02.00F | 1/17/2019        | 1/17/2021    |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| # | Freq             | Rdng | T1<br>T5       | T2<br>T6     | T3   | T4   | Dist  | Corr   | Spec        | Margin | Polar |
|---|------------------|------|----------------|--------------|------|------|-------|--------|-------------|--------|-------|
|   | MHz              | dBμV | dB             | dB           | dB   | dB   | Table | dBμV/m | dBμV/m      | dB     | Ant   |
| 1 | 2400.000M        | 80.9 | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 77.8   | 84.1<br>SC  | -6.3   | Vert  |
| 2 | 2400.000M        | 78.9 | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 75.8   | 84.1<br>Hop | -8.3   | Vert  |
| 3 | 2483.500M<br>Ave | 43.2 | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 40.2   | 54.0<br>Hop | -13.8  | Vert  |
| 4 | 2483.500M<br>Ave | 43.2 | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 40.2   | 54.0<br>SC  | -13.8  | Vert  |
| ^ | 2483.500M        | 57.9 | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 54.9   | 74.0<br>Hop | -19.1  | Vert  |
| ^ | 2483.500M        | 57.5 | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 54.5   | 74.0<br>SC  | -19.5  | Vert  |
| 7 | 2390.000M        | 41.9 | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 38.8   | 54.0<br>SC  | -15.2  | Vert  |
| 8 | 2390.000M        | 41.8 | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 38.7   | 54.0<br>Hop | -15.3  | Vert  |

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **102802** Date: 3/26/2020  
 Test Type: **Maximized Emissions** Time: 10:28:08  
 Tested By: Matthew Harrison Sequence#: 44  
 Software: EMITest 5.03.12

***Equipment Tested:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Support Equipment:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Test Conditions / Notes:***

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions:<br>Temperature: 22° C<br>Humidity: 28%<br>Pressure: 101.3 kPa<br><br>Frequency Range: 2.380-2.485GHz<br>Frequency tested: 2402, 2480<br>Firmware power setting: 9<br>EUT Firmware:<br>Protocol /MCS/Modulation: BT, pi/4 DQPSK, 2DH1 (Worst-Case)<br><br>Antenna type: Linear Polarized<br>Antenna Gain: 3.7 dBi.<br><br>Duty Cycle: 100% Modulated<br><br>Test Method: ANSI C63.10: 2013<br>Test Mode: Transmitting<br>Test Setup: EUT is setup 1.5m high on a Styrofoam table.<br>Setup: EUT is connected to a Laptop via USB and Audio cable.<br><br>All data rates investigated, worst-case provided. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Test Equipment:**

| ID | Asset #  | Description                            | Model                 | Calibration Date | Cal Due Date |
|----|----------|----------------------------------------|-----------------------|------------------|--------------|
| T1 | AN01467  | Horn Antenna-ANSI<br>C63.5 Calibration | 3115                  | 7/5/2019         | 7/5/2021     |
| T2 | ANP06515 | Cable                                  | Heliac                | 6/29/2018        | 6/29/2020    |
| T3 | ANP06540 | Cable                                  | Heliac                | 8/23/2019        | 8/23/2021    |
| T4 | AN02872  | Spectrum Analyzer                      | E4440A                | 11/18/2019       | 11/18/2021   |
| T5 | AN03540  | Preamplifier                           | 83017A                | 5/13/2019        | 5/13/2021    |
| T6 | ANP07504 | Cable                                  | CLU40-KMKM-<br>02.00F | 1/17/2019        | 1/17/2021    |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| # | Freq             | Rdng | T1<br>T5       | T2<br>T6     | T3   | T4   | Dist  | Corr   | Spec        | Margin | Polar |
|---|------------------|------|----------------|--------------|------|------|-------|--------|-------------|--------|-------|
|   | MHz              | dBμV | dB             | dB           | dB   | dB   | Table | dBμV/m | dBμV/m      | dB     | Ant   |
| 1 | 2400.000M        | 80.5 | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 77.4   | 84.0<br>SC  | -6.6   | Vert  |
| 2 | 2400.000M        | 80.3 | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 77.2   | 84.0<br>Hop | -6.8   | Vert  |
| 3 | 2483.500M<br>Ave | 43.0 | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 40.0   | 54.0<br>SC  | -14.0  | Vert  |
| ^ | 2483.500M        | 40.9 | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 37.9   | 54.0<br>Hop | -16.1  | Vert  |
| ^ | 2483.500M        | 58.2 | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 55.2   | 74.0<br>SC  | -18.8  | Vert  |
| ^ | 2483.500M        | 57.7 | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 54.7   | 74.0<br>Hop | -19.3  | Vert  |
| 7 | 2390.000M        | 42.1 | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 39.0   | 54.0<br>Hop | -15.0  | Vert  |
| 8 | 2390.000M        | 42.0 | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 38.9   | 54.0<br>SC  | -15.1  | Vert  |

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **102802** Date: 3/26/2020  
 Test Type: **Maximized Emissions** Time: 08:33:47  
 Tested By: Matthew Harrison Sequence#: 43  
 Software: EMITest 5.03.12

***Equipment Tested:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Support Equipment:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Test Conditions / Notes:***

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions:<br>Temperature: 22° C<br>Humidity: 28%<br>Pressure: 101.3 kPa<br><br>Frequency Range: 2.380-2.486GHz<br>Frequency tested: 2402, 2480<br>Firmware power setting: 9<br>EUT Firmware:<br>Protocol /MCS/Modulation: BT, GFSK, DH1 (Worst-Case)<br><br>Antenna type: Linear Polarized<br>Antenna Gain: 3.7 dBi.<br><br>Duty Cycle: 100% Modulated<br><br>Test Method: ANSI C63.10: 2013<br>Test Mode: Transmitting<br>Test Setup: EUT is setup 1.5m high on a Styrofoam table.<br>Setup: EUT is connected to a Laptop via USB and Audio cable.<br><br>All data rates investigated, worst-case provided. |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Test Equipment:**

| ID | Asset #  | Description                            | Model                 | Calibration Date | Cal Due Date |
|----|----------|----------------------------------------|-----------------------|------------------|--------------|
| T1 | AN01467  | Horn Antenna-ANSI<br>C63.5 Calibration | 3115                  | 7/5/2019         | 7/5/2021     |
| T2 | ANP06515 | Cable                                  | Heliast               | 6/29/2018        | 6/29/2020    |
| T3 | ANP06540 | Cable                                  | Heliast               | 8/23/2019        | 8/23/2021    |
| T4 | AN02872  | Spectrum Analyzer                      | E4440A                | 11/18/2019       | 11/18/2021   |
| T5 | AN03540  | Preamp                                 | 83017A                | 5/13/2019        | 5/13/2021    |
| T6 | ANP07504 | Cable                                  | CLU40-KMKM-<br>02.00F | 1/17/2019        | 1/17/2021    |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| #  | Freq             | Rdng  | T1<br>T5       | T2<br>T6     | T3   | T4   | Dist  | Corr   | Spec         | Margin | Polar |
|----|------------------|-------|----------------|--------------|------|------|-------|--------|--------------|--------|-------|
|    | MHz              | dBμV  | dB             | dB           | dB   | dB   | Table | dBμV/m | dBμV/m       | dB     | Ant   |
| 1  | 2401.852M        | 109.4 | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 106.3  | 106.3<br>SC  | +0.0   | Vert  |
| 2  | 2401.878M        | 108.5 | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 105.4  | 106.3<br>Hop | -0.9   | Vert  |
| 3  | 2480.140M        | 107.5 | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 104.5  | 106.3<br>SC  | -1.8   | Vert  |
| 4  | 2480.538M        | 104.9 | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 101.9  | 106.3<br>Hop | -4.4   | Vert  |
| 5  | 2483.500M<br>Ave | 45.7  | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 42.7   | 54.0<br>Hop  | -11.3  | Vert  |
| 6  | 2400.000M        | 78.1  | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 75.0   | 86.3<br>Hop  | -11.3  | Vert  |
| 7  | 2400.000M        | 77.3  | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 74.2   | 86.3<br>SC   | -12.1  | Vert  |
| 8  | 2390.000M        | 43.4  | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 40.3   | 54.0<br>Hop  | -13.7  | Vert  |
| 9  | 2390.000M        | 42.3  | +27.7<br>-34.3 | +2.6<br>+0.3 | +0.6 | +0.0 | +0.0  | 39.2   | 54.0<br>SC   | -14.8  | Vert  |
| 10 | 2483.500M<br>Ave | 33.8  | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 30.8   | 54.0<br>SC   | -23.2  | Vert  |
| ^  | 2483.500M        | 61.3  | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 58.3   | 74.0<br>SC   | -15.7  | Vert  |
| ^  | 2483.500M        | 61.0  | +27.6<br>-34.2 | +2.7<br>+0.3 | +0.6 | +0.0 | +0.0  | 58.0   | 74.0<br>Hop  | -16.0  | Vert  |

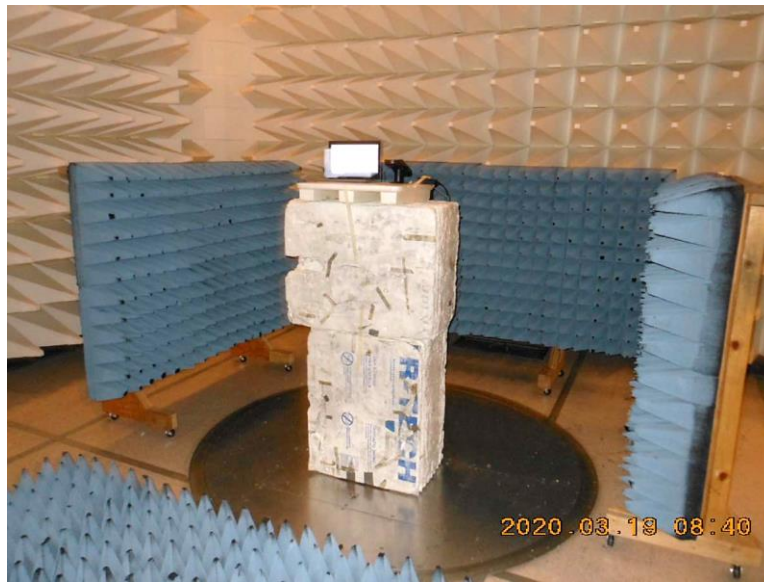
Test Setup Photo(s)



Below 1GHz



Below 1GHz



Above 1GHz



Above 1GHz

## 15.207 AC Conducted Emissions

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.207 AC Mains - Average**  
 Work Order #: **102802** Date: 4/1/2020  
 Test Type: **Conducted Emissions** Time: 07:33:32  
 Tested By: Matthew Harrison Sequence#: 84  
 Software: EMITest 5.03.12 120V 60Hz

#### Equipment Tested:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Support Equipment:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Test Conditions / Notes:

Environmental Conditions:  
 Temperature: 22° C  
 Humidity: 28%  
 Pressure: 101.3 kPa

Frequency Range: 150kHz-30MHz  
 Frequency tested: Hopping  
 Firmware power setting: 9  
 EUT Firmware:  
 Protocol /MCS/Modulation: BT, GFSK, DH1 (Worst-Case)

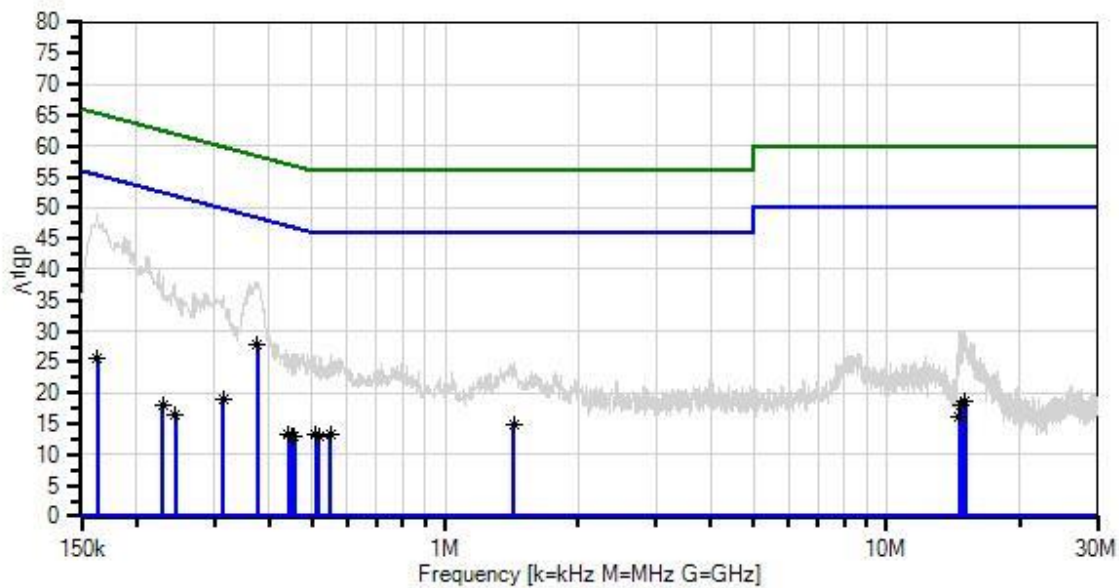
Antenna type: Linear Polarized  
 Antenna Gain: 3.7 dBi.

Duty Cycle: 100% Modulated

Test Method: ANSI C63.10: 2013  
 Test Mode: Transmitting  
 Test Setup: EUT is setup for conducted measurements.  
 Setup: EUT is connected to a Laptop via USB and Audio cable.

All modes, channels, and data rates investigated, worst-case provided.

Nalloy, LLC. WO#: 102802 Sequence#: 84 Date: 4/1/2020  
15.207 AC Mains - Average Test Lead: 120V 60Hz Line



— Sweep Data

x QP Readings

Software Version: 5.03.12

— Readings

\* Average Readings

— 1 - 15.207 AC Mains - Average

○ Peak Readings

▼ Ambient

— 2 - 15.207 AC Mains - Quasi-peak

#### Test Equipment:

| ID | Asset #  | Description         | Model               | Calibration Date | Cal Due Date |
|----|----------|---------------------|---------------------|------------------|--------------|
|    | AN02872  | Spectrum Analyzer   | E4440A              | 11/18/2019       | 11/18/2021   |
| T1 | ANP06219 | Attenuator          | 768-10              | 4/13/2018        | 4/13/2020    |
| T2 | ANP06515 | Cable               | Heliac              | 6/29/2018        | 6/29/2020    |
| T3 | ANP06540 | Cable               | Heliac              | 8/23/2019        | 8/23/2021    |
| T4 | AN01311  | 50uH LISN-Line1 (L) | 3816/2              | 2/24/2020        | 2/24/2022    |
|    | AN01311  | 50uH LISN-Line2 (N) | 3816/2              | 2/24/2020        | 2/24/2022    |
| T5 | AN02611  | High Pass Filter    | HE9615-150K-50-720B | 1/10/2020        | 1/10/2022    |

**Measurement Data:**

Reading listed by margin.

Test Lead: Line

| #  | Freq     | Rdng | T1<br>T5<br>dB | T2<br>dB | T3<br>dB | T4<br>dB | Dist<br>Table | Corr<br>dB $\mu$ V | Spec<br>dB $\mu$ V | Margin<br>dB | Polar<br>Ant |
|----|----------|------|----------------|----------|----------|----------|---------------|--------------------|--------------------|--------------|--------------|
| 1  | 376.161k | 19.1 | +9.1           | +0.0     | +0.0     | -0.6     | +0.0          | 27.8               | 48.4               | -20.6        | Line         |
|    | Ave      |      | +0.2           |          |          |          |               |                    |                    |              |              |
| ^  | 376.161k | 29.5 | +9.1           | +0.0     | +0.0     | -0.6     | +0.0          | 38.2               | 48.4               | -10.2        | Line         |
|    |          |      | +0.2           |          |          |          |               |                    |                    |              |              |
| 3  | 163.090k | 17.7 | +9.1           | +0.0     | +0.0     | -1.6     | +0.0          | 25.7               | 55.3               | -29.6        | Line         |
|    | Ave      |      | +0.5           |          |          |          |               |                    |                    |              |              |
| ^  | 163.089k | 40.9 | +9.1           | +0.0     | +0.0     | -1.6     | +0.0          | 48.9               | 55.3               | -6.4         | Line         |
|    |          |      | +0.5           |          |          |          |               |                    |                    |              |              |
| 5  | 315.076k | 10.4 | +9.1           | +0.0     | +0.0     | -0.7     | +0.0          | 18.9               | 49.8               | -30.9        | Line         |
|    | Ave      |      | +0.1           |          |          |          |               |                    |                    |              |              |
| ^  | 315.075k | 27.2 | +9.1           | +0.0     | +0.0     | -0.7     | +0.0          | 35.7               | 49.8               | -14.1        | Line         |
|    |          |      | +0.1           |          |          |          |               |                    |                    |              |              |
| 7  | 1.430M   | 5.9  | +9.1           | +0.1     | +0.0     | -0.3     | +0.0          | 15.0               | 46.0               | -31.0        | Line         |
|    | Ave      |      | +0.2           |          |          |          |               |                    |                    |              |              |
| ^  | 1.430M   | 16.1 | +9.1           | +0.1     | +0.0     | -0.3     | +0.0          | 25.2               | 46.0               | -20.8        | Line         |
|    |          |      | +0.2           |          |          |          |               |                    |                    |              |              |
| 9  | 15.049M  | 9.7  | +9.1           | +0.2     | +0.1     | -0.6     | +0.0          | 18.7               | 50.0               | -31.3        | Line         |
|    | Ave      |      | +0.2           |          |          |          |               |                    |                    |              |              |
| ^  | 15.049M  | 21.2 | +9.1           | +0.2     | +0.1     | -0.6     | +0.0          | 30.2               | 50.0               | -19.8        | Line         |
|    |          |      | +0.2           |          |          |          |               |                    |                    |              |              |
| 11 | 14.797M  | 9.1  | +9.1           | +0.2     | +0.1     | -0.6     | +0.0          | 18.1               | 50.0               | -31.9        | Line         |
|    | Ave      |      | +0.2           |          |          |          |               |                    |                    |              |              |
| ^  | 14.797M  | 21.1 | +9.1           | +0.2     | +0.1     | -0.6     | +0.0          | 30.1               | 50.0               | -19.9        | Line         |
|    |          |      | +0.2           |          |          |          |               |                    |                    |              |              |
| 13 | 508.513k | 4.4  | +9.1           | +0.0     | +0.0     | -0.4     | +0.0          | 13.3               | 46.0               | -32.7        | Line         |
|    | Ave      |      | +0.2           |          |          |          |               |                    |                    |              |              |
| ^  | 508.512k | 17.2 | +9.1           | +0.0     | +0.0     | -0.4     | +0.0          | 26.1               | 46.0               | -19.9        | Line         |
|    |          |      | +0.2           |          |          |          |               |                    |                    |              |              |
| 15 | 550.691k | 4.2  | +9.1           | +0.0     | +0.0     | -0.4     | +0.0          | 13.2               | 46.0               | -32.8        | Line         |
|    | Ave      |      | +0.3           |          |          |          |               |                    |                    |              |              |
| ^  | 550.690k | 17.4 | +9.1           | +0.0     | +0.0     | -0.4     | +0.0          | 26.4               | 46.0               | -19.6        | Line         |
|    |          |      | +0.3           |          |          |          |               |                    |                    |              |              |
| 17 | 518.693k | 4.0  | +9.1           | +0.0     | +0.0     | -0.4     | +0.0          | 12.9               | 46.0               | -33.1        | Line         |
|    | Ave      |      | +0.2           |          |          |          |               |                    |                    |              |              |
| ^  | 518.693k | 16.9 | +9.1           | +0.0     | +0.0     | -0.4     | +0.0          | 25.8               | 46.0               | -20.2        | Line         |
|    |          |      | +0.2           |          |          |          |               |                    |                    |              |              |
| 19 | 442.337k | 4.5  | +9.1           | +0.1     | +0.0     | -0.5     | +0.0          | 13.4               | 47.0               | -33.6        | Line         |
|    | Ave      |      | +0.2           |          |          |          |               |                    |                    |              |              |
| ^  | 442.336k | 17.5 | +9.1           | +0.1     | +0.0     | -0.5     | +0.0          | 26.4               | 47.0               | -20.6        | Line         |
|    |          |      | +0.2           |          |          |          |               |                    |                    |              |              |

|    |                 |      |              |      |      |      |      |      |      |       |      |
|----|-----------------|------|--------------|------|------|------|------|------|------|-------|------|
| 21 | 455.427k<br>Ave | 4.0  | +9.1<br>+0.2 | +0.1 | +0.0 | -0.5 | +0.0 | 12.9 | 46.8 | -33.9 | Line |
| 22 | 451.790k<br>Ave | 4.0  | +9.1<br>+0.2 | +0.1 | +0.0 | -0.5 | +0.0 | 12.9 | 46.8 | -33.9 | Line |
| ^  | 455.426k        | 17.5 | +9.1<br>+0.2 | +0.1 | +0.0 | -0.5 | +0.0 | 26.4 | 46.8 | -20.4 | Line |
| ^  | 451.790k        | 17.4 | +9.1<br>+0.2 | +0.1 | +0.0 | -0.5 | +0.0 | 26.3 | 46.8 | -20.5 | Line |
| 25 | 14.616M<br>Ave  | 7.0  | +9.1<br>+0.2 | +0.2 | +0.1 | -0.6 | +0.0 | 16.0 | 50.0 | -34.0 | Line |
| ^  | 14.616M         | 20.7 | +9.1<br>+0.2 | +0.2 | +0.1 | -0.6 | +0.0 | 29.7 | 50.0 | -20.3 | Line |
| 27 | 229.265k<br>Ave | 9.5  | +9.1<br>+0.3 | +0.0 | +0.0 | -1.0 | +0.0 | 17.9 | 52.5 | -34.6 | Line |
| ^  | 229.265k        | 30.5 | +9.1<br>+0.3 | +0.0 | +0.0 | -1.0 | +0.0 | 38.9 | 52.5 | -13.6 | Line |
| 29 | 244.537k<br>Ave | 8.2  | +9.1<br>+0.2 | +0.0 | +0.0 | -0.9 | +0.0 | 16.6 | 51.9 | -35.3 | Line |
| ^  | 244.536k        | 29.4 | +9.1<br>+0.2 | +0.0 | +0.0 | -0.9 | +0.0 | 37.8 | 51.9 | -14.1 | Line |

Test Location: CKC Laboratories, Inc. • 22116 23rd Dr SE • Bothell, WA 98021 • 800-500-4362  
 Customer: **Nalloy, LLC.**  
 Specification: **15.207 AC Mains - Average**  
 Work Order #: **102802** Date: 4/1/2020  
 Test Type: **Conducted Emissions** Time: 07:42:20  
 Tested By: Matthew Harrison Sequence#: 85  
 Software: EMITest 5.03.12 120V 60Hz

***Equipment Tested:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

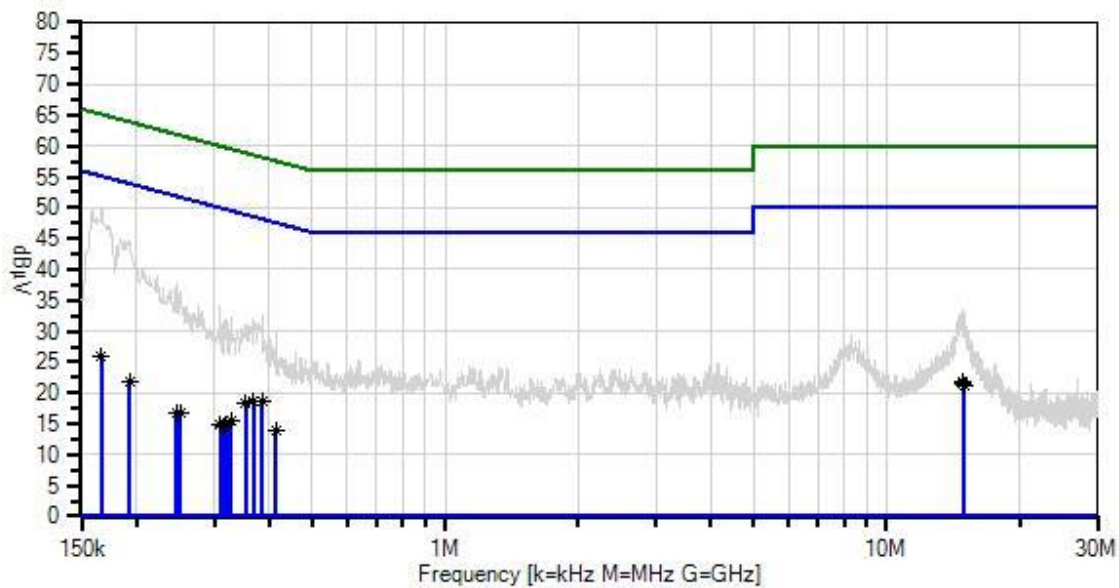
***Support Equipment:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

***Test Conditions / Notes:***

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Conditions:<br>Temperature: 22° C<br>Humidity: 28%<br>Pressure: 101.3 kPa<br><br>Frequency Range: 150kHz-30MHz<br>Frequency tested: Hopping<br>Firmware power setting: 9<br>EUT Firmware:<br>Protocol /MCS/Modulation: BT, GFSK, DH1 (Worst-Case)<br><br>Antenna type: Linear Polarized<br>Antenna Gain: 3.7 dBi.<br><br>Duty Cycle: 100% Modulated<br><br>Test Method: ANSI C63.10: 2013<br>Test Mode: Transmitting<br>Test Setup: EUT is setup for conducted measurements.<br>Setup: EUT is connected to a Laptop via USB and Audio cable.<br><br>All modes, channels, and data rates investigated, worst-case provided. |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Nalloy, LLC. WO#: 102802 Sequence#: 85 Date: 4/1/2020  
15.207 AC Mains - Average Test Lead: 120V 60Hz Neutral



**Test Equipment:**

| ID | Asset #  | Description         | Model               | Calibration Date | Cal Due Date |
|----|----------|---------------------|---------------------|------------------|--------------|
|    | AN02872  | Spectrum Analyzer   | E4440A              | 11/18/2019       | 11/18/2021   |
| T1 | ANP06219 | Attenuator          | 768-10              | 4/13/2018        | 4/13/2020    |
| T2 | ANP06515 | Cable               | Heliac              | 6/29/2018        | 6/29/2020    |
| T3 | ANP06540 | Cable               | Heliac              | 8/23/2019        | 8/23/2021    |
|    | AN01311  | 50uH LISN-Line1 (L) | 3816/2              | 2/24/2020        | 2/24/2022    |
| T4 | AN01311  | 50uH LISN-Line2 (N) | 3816/2              | 2/24/2020        | 2/24/2022    |
| T5 | AN02611  | High Pass Filter    | HE9615-150K-50-720B | 1/10/2020        | 1/10/2022    |

**Measurement Data:**

Reading listed by margin.

Test Lead: Neutral

| #  | Freq     | Rdng       | T1<br>T5 | T2   | T3   | T4   | Dist  | Corr       | Spec       | Margin | Polar |
|----|----------|------------|----------|------|------|------|-------|------------|------------|--------|-------|
|    | MHz      | dB $\mu$ V | dB       | dB   | dB   | dB   | Table | dB $\mu$ V | dB $\mu$ V | dB     | Ant   |
| 1  | 14.887M  | 12.9       | +9.1     | +0.2 | +0.1 | -0.6 | +0.0  | 21.9       | 50.0       | -28.1  | Neutr |
|    | Ave      |            | +0.2     |      |      |      |       |            |            |        |       |
| ^  | 14.887M  | 24.5       | +9.1     | +0.2 | +0.1 | -0.6 | +0.0  | 33.5       | 50.0       | -16.5  | Neutr |
|    |          |            | +0.2     |      |      |      |       |            |            |        |       |
| 3  | 14.932M  | 12.5       | +9.1     | +0.2 | +0.1 | -0.6 | +0.0  | 21.5       | 50.0       | -28.5  | Neutr |
|    | Ave      |            | +0.2     |      |      |      |       |            |            |        |       |
| ^  | 14.932M  | 23.9       | +9.1     | +0.2 | +0.1 | -0.6 | +0.0  | 32.9       | 50.0       | -17.1  | Neutr |
|    |          |            | +0.2     |      |      |      |       |            |            |        |       |
| 5  | 14.995M  | 12.2       | +9.1     | +0.2 | +0.1 | -0.6 | +0.0  | 21.2       | 50.0       | -28.8  | Neutr |
|    | Ave      |            | +0.2     |      |      |      |       |            |            |        |       |
| ^  | 14.995M  | 23.9       | +9.1     | +0.2 | +0.1 | -0.6 | +0.0  | 32.9       | 50.0       | -17.1  | Neutr |
|    |          |            | +0.2     |      |      |      |       |            |            |        |       |
| 7  | 166.725k | 17.8       | +9.1     | +0.0 | +0.0 | -1.5 | +0.0  | 25.9       | 55.1       | -29.2  | Neutr |
|    | Ave      |            | +0.5     |      |      |      |       |            |            |        |       |
| ^  | 166.724k | 41.6       | +9.1     | +0.0 | +0.0 | -1.5 | +0.0  | 49.7       | 55.1       | -5.4   | Neutr |
|    |          |            | +0.5     |      |      |      |       |            |            |        |       |
| 9  | 385.614k | 10.0       | +9.1     | +0.0 | +0.0 | -0.5 | +0.0  | 18.8       | 48.2       | -29.4  | Neutr |
|    | Ave      |            | +0.2     |      |      |      |       |            |            |        |       |
| ^  | 385.613k | 23.9       | +9.1     | +0.0 | +0.0 | -0.5 | +0.0  | 32.7       | 48.2       | -15.5  | Neutr |
|    |          |            | +0.2     |      |      |      |       |            |            |        |       |
| 11 | 368.161k | 9.9        | +9.1     | +0.0 | +0.0 | -0.6 | +0.0  | 18.5       | 48.5       | -30.0  | Neutr |
|    | Ave      |            | +0.1     |      |      |      |       |            |            |        |       |
| ^  | 368.160k | 23.6       | +9.1     | +0.0 | +0.0 | -0.6 | +0.0  | 32.2       | 48.5       | -16.3  | Neutr |
|    |          |            | +0.1     |      |      |      |       |            |            |        |       |
| 13 | 353.617k | 9.6        | +9.1     | +0.0 | +0.0 | -0.6 | +0.0  | 18.2       | 48.9       | -30.7  | Neutr |
|    | Ave      |            | +0.1     |      |      |      |       |            |            |        |       |
| ^  | 353.616k | 22.6       | +9.1     | +0.0 | +0.0 | -0.6 | +0.0  | 31.2       | 48.9       | -17.7  | Neutr |
|    |          |            | +0.1     |      |      |      |       |            |            |        |       |
| 15 | 192.904k | 13.7       | +9.1     | +0.0 | +0.0 | -1.2 | +0.0  | 21.9       | 53.9       | -32.0  | Neutr |
|    | Ave      |            | +0.3     |      |      |      |       |            |            |        |       |
| ^  | 192.904k | 36.6       | +9.1     | +0.0 | +0.0 | -1.2 | +0.0  | 44.8       | 53.9       | -9.1   | Neutr |
|    |          |            | +0.3     |      |      |      |       |            |            |        |       |
| 17 | 414.702k | 5.1        | +9.1     | +0.0 | +0.0 | -0.5 | +0.0  | 13.9       | 47.6       | -33.7  | Neutr |
|    | Ave      |            | +0.2     |      |      |      |       |            |            |        |       |
| ^  | 414.701k | 21.2       | +9.1     | +0.0 | +0.0 | -0.5 | +0.0  | 30.0       | 47.6       | -17.6  | Neutr |
|    |          |            | +0.2     |      |      |      |       |            |            |        |       |
| 19 | 327.437k | 6.9        | +9.1     | +0.0 | +0.0 | -0.6 | +0.0  | 15.5       | 49.5       | -34.0  | Neutr |
|    | Ave      |            | +0.1     |      |      |      |       |            |            |        |       |
| ^  | 327.437k | 23.6       | +9.1     | +0.0 | +0.0 | -0.6 | +0.0  | 32.2       | 49.5       | -17.3  | Neutr |
|    |          |            | +0.1     |      |      |      |       |            |            |        |       |

|    |                 |      |              |      |      |      |      |      |      |       |       |
|----|-----------------|------|--------------|------|------|------|------|------|------|-------|-------|
| 21 | 319.438k<br>Ave | 6.3  | +9.1<br>+0.1 | +0.0 | +0.0 | -0.7 | +0.0 | 14.8 | 49.7 | -34.9 | Neutr |
| 22 | 251.081k<br>Ave | 8.4  | +9.1<br>+0.2 | +0.0 | +0.0 | -0.9 | +0.0 | 16.8 | 51.7 | -34.9 | Neutr |
| ^  | 251.080k        | 28.0 | +9.1<br>+0.2 | +0.0 | +0.0 | -0.9 | +0.0 | 36.4 | 51.7 | -15.3 | Neutr |
| 24 | 245.990k<br>Ave | 8.5  | +9.1<br>+0.2 | +0.0 | +0.0 | -0.9 | +0.0 | 16.9 | 51.9 | -35.0 | Neutr |
| ^  | 245.990k        | 29.2 | +9.1<br>+0.2 | +0.0 | +0.0 | -0.9 | +0.0 | 37.6 | 51.9 | -14.3 | Neutr |
| 26 | 315.075k<br>Ave | 6.1  | +9.1<br>+0.1 | +0.0 | +0.0 | -0.7 | +0.0 | 14.6 | 49.8 | -35.2 | Neutr |
| ^  | 319.437k        | 23.5 | +9.1<br>+0.1 | +0.0 | +0.0 | -0.7 | +0.0 | 32.0 | 49.7 | -17.7 | Neutr |
| ^  | 315.074k        | 23.2 | +9.1<br>+0.1 | +0.0 | +0.0 | -0.7 | +0.0 | 31.7 | 49.8 | -18.1 | Neutr |
| 29 | 309.257k<br>Ave | 6.3  | +9.1<br>+0.1 | +0.0 | +0.0 | -0.7 | +0.0 | 14.8 | 50.0 | -35.2 | Neutr |
| ^  | 309.257k        | 25.8 | +9.1<br>+0.1 | +0.0 | +0.0 | -0.7 | +0.0 | 34.3 | 50.0 | -15.7 | Neutr |

**Test Setup Photo(s)**



## SUPPLEMENTAL INFORMATION

### Measurement Uncertainty

| Uncertainty Value | Parameter                 |
|-------------------|---------------------------|
| 4.73 dB           | Radiated Emissions        |
| 3.34 dB           | Mains Conducted Emissions |
| 3.30 dB           | Disturbance Power         |

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ . Compliance is deemed to occur provided measurements are below the specified limits.

### Emissions Test Details

#### TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

#### CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in  $\text{dB}\mu\text{V}/\text{m}$ , the spectrum analyzer reading in  $\text{dB}\mu\text{V}$  was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

| SAMPLE CALCULATIONS |                     |                                     |
|---------------------|---------------------|-------------------------------------|
|                     | Meter reading       | ( $\text{dB}\mu\text{V}$ )          |
| +                   | Antenna Factor      | ( $\text{dB}/\text{m}$ )            |
| +                   | Cable Loss          | ( $\text{dB}$ )                     |
| -                   | Distance Correction | ( $\text{dB}$ )                     |
| -                   | Preamplifier Gain   | ( $\text{dB}$ )                     |
| =                   | Corrected Reading   | ( $\text{dB}\mu\text{V}/\text{m}$ ) |

#### TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

| MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE |                     |                  |                   |
|------------------------------------------------------------|---------------------|------------------|-------------------|
| TEST                                                       | BEGINNING FREQUENCY | ENDING FREQUENCY | BANDWIDTH SETTING |
| CONDUCTED EMISSIONS                                        | 150 kHz             | 30 MHz           | 9 kHz             |
| RADIATED EMISSIONS                                         | 9 kHz               | 150 kHz          | 200 Hz            |
| RADIATED EMISSIONS                                         | 150 kHz             | 30 MHz           | 9 kHz             |
| RADIATED EMISSIONS                                         | 30 MHz              | 1000 MHz         | 120 kHz           |
| RADIATED EMISSIONS                                         | 1000 MHz            | >1 GHz           | 1 MHz             |

#### SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

##### Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

##### Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

##### Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point, the measuring device is set into the linear mode and the scan time is reduced.