

# Signetik

## TEST REPORT FOR

**Bluetooth to Cellular Hub / At-home patient monitoring  
Model: M1-B1-USB-SIG-CSTM**

### Tested to The Following Standards:

**FCC Part 15 Subpart C Section(s)**

**15.207 & 15.247  
(DTS 2400-2483.5 MHz)**

**Report No.: 107284-4**

**Date of issue: August 15, 2022**



**Test Certificate # 803.01**

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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## ADMINISTRATIVE INFORMATION

### Test Report Information

**REPORT PREPARED FOR:**

Signetik  
3833 S 14th St  
Lincoln, NE 68502

Representative: Steve Poulsen  
Customer Reference Number: 188

**DATE OF EQUIPMENT RECEIPT:****DATE(S) OF TESTING:****REPORT PREPARED BY:**

Viviana Prado  
CKC Laboratories, Inc.  
5046 Sierra Pines Drive  
Mariposa, CA 95338

Project Number: 107284

August 2, 2022

August 2, 3, and 10, 2022

### Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

A handwritten signature in black ink, reading "Steve Behm", is written over a horizontal line.

**Steve Behm**  
**Director of Quality Assurance & Engineering Services**  
**CKC Laboratories, Inc.**

## Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):  
CKC Laboratories, Inc.  
110 Olinda Place  
Brea, CA 92823

## Software Versions

| CKC Laboratories Proprietary Software | Version |
|---------------------------------------|---------|
| EMITest Emissions                     | 5.03.20 |

## Site Registration & Accreditation Information

| Location                 | *NIST CB # | FCC    | Canada | Japan  |
|--------------------------|------------|--------|--------|--------|
| Canyon Park, Bothell, WA | US0103     | US1024 | 3082C  | A-0136 |
| Brea, CA                 | US0103     | US1024 | 3082D  | A-0136 |
| Fremont, CA              | US0103     | US1024 | 3082B  | A-0136 |
| Mariposa, CA             | US0103     | US1024 | 3082A  | A-0136 |

\*CKC's list of NIST designated countries can be found at: <https://standards.gov/cabs/designations.html>

## SUMMARY OF RESULTS

### Standard / Specification: FCC Part 15 Subpart C - 15.247 (DTS)

| Test Procedure | Description                        | Modifications | Results |
|----------------|------------------------------------|---------------|---------|
| 15.247(a)(2)   | 6dB Bandwidth                      | NA            | Pass    |
| 15.247(b)(3)   | Output Power                       | NA            | Pass    |
| 15.247(e)      | Power Spectral Density             | NA            | Pass    |
| 15.247(d)      | RF Conducted Emissions & Band Edge | NA            | NA1     |
| 15.247(d)      | Radiated Emissions & Band Edge     | NA            | Pass    |
| 15.207         | AC Conducted Emissions             | NA            | Pass    |

NA = Not Applicable

NA1 = Not applicable because the EUT has an integral antenna and no antenna port/connector.

#### ISO/IEC 17025 Decision Rule

The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

## Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

#### Summary of Conditions

No modifications were made during testing.

**Modifications listed above must be incorporated into all production units.**

## Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

#### Summary of Conditions

None

## EQUIPMENT UNDER TEST (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

### Configuration 1

#### Equipment Tested:

| Device  | Manufacturer | Model #            | S/N             |
|---|--------------|--------------------|-----------------|
| Bluetooth to Cellular Hub /<br>At-home patient monitoring | Signetik     | M1-B1-USB-SIG-CSTM | 356726101284297 |

#### Support Equipment:

| Device            | Manufacturer | Model #           | S/N                     |
|-------------------|--------------|-------------------|-------------------------|
| Laptop AC Adapter | Lenovo       | ADP-450W B        | 8SSA10M42785D1SG81F0JBL |
| Laptop Computer   | Lenovo       | Ideapad 130-15AST | MP1EVRJ                 |

### Configuration 2

#### Equipment Tested:

| Device  | Manufacturer | Model #            | S/N             |
|---|--------------|--------------------|-----------------|
| Bluetooth to Cellular Hub /<br>At-home patient monitoring | Signetik     | M1-B1-USB-SIG-CSTM | 356726101284297 |

#### Support Equipment:

| Device                  | Manufacturer  | Model #              | S/N  |
|-------------------------|---------------|----------------------|------|
| AC to USB Power Adapter | GlobTek, Inc. | GT-83083-0505-USB-W2 | None |

## General Product Information:

| Product Information   | Manufacturer-Provided Details            |
|---|--|
| Equipment Type:   | Stand-Alone Equipment                    |
| Type of Wideband System:  | DTS                                      |
| Operating Frequency Range:  | 2402MHz to 2480MHz                       |
| Modulation Type(s):   | GFSK                                     |
| Maximum Duty Cycle:   | 50%                                      |
| Number of TX Chains:  | 1  |
| Antenna Type and Gain:  | Surface Mount 3.2dBi<br>(See Appendix B) |
| Beamforming Type:   | N/A                                      |
| Antenna Connection Type:  | Integral                                 |
| Nominal Input Voltage:  | 5.0Vdc                                   |
| Firmware used for Test:   | nRF "Radio Test" version 1.5.0           |
| The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility. |  |

EUT Photo(s)



Front View



Back View





Left View



Right View





Top View



Bottom View

**Support Equipment Photo(s)**



Laptop Computer



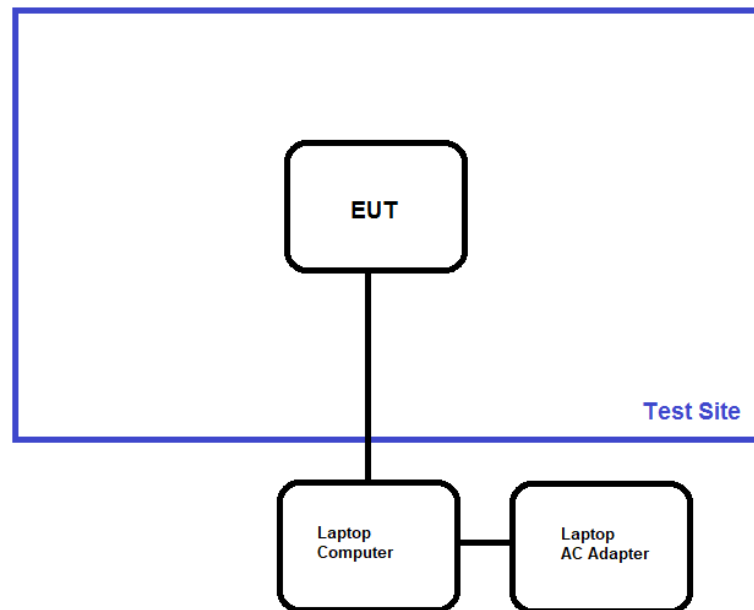
AC to USB Power Adapter



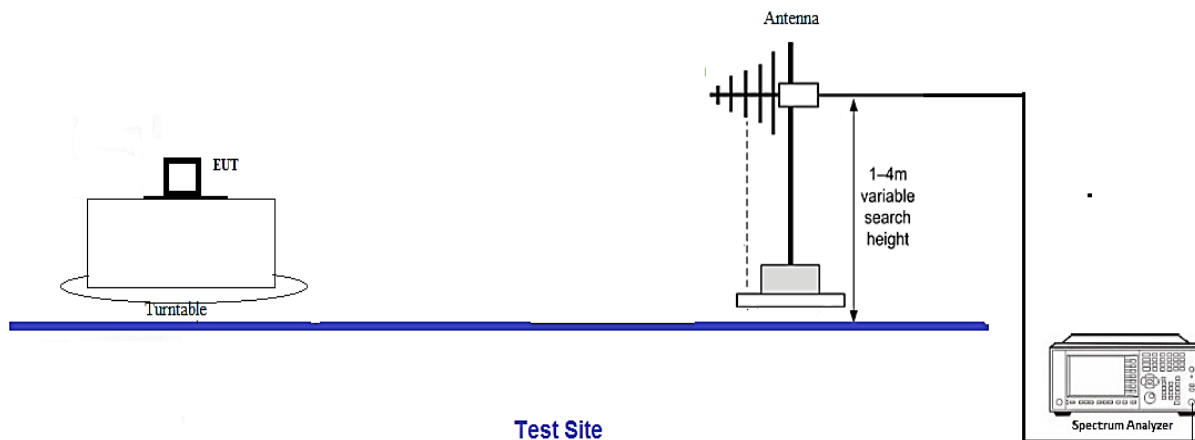
USB Cable

## Block Diagram of Test Setup(s)

### Test Setup Block Diagram



Radiated test setup



## FCC Part 15 Subpart C

### 15.247(a)(2) 6dB Bandwidth

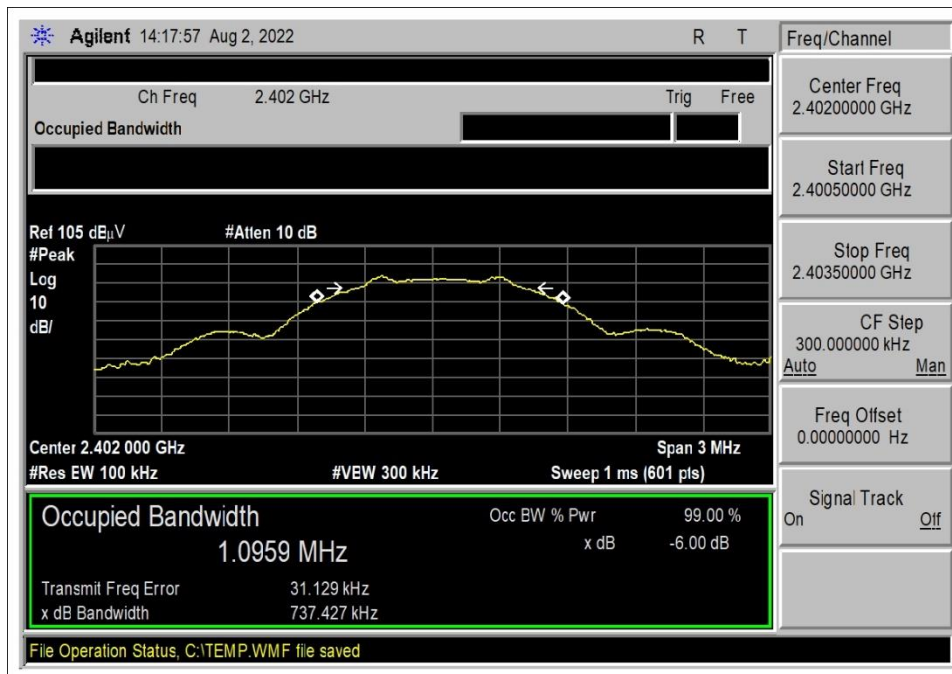
| Test Setup/Conditions |  |                |             |
|-----------------------|--|----------------|-------------|
| Test Location:        | Brea Lab D   | Test Engineer: | S. Yamamoto |
| Test Method:          | ANSI C63.10 (2013), KDB 558074   | Test Date(s):  | 8/2/2022    |
| Configuration:        | 1  |                |             |
| Test Setup:           | The equipment under test (EUT) is stand alone on the Styrofoam tabletop. The EUT is connected to a laptop computer via USB cable. The laptop is running the PUTTY application, which is being used to command the EUT to transmit. The EUT is powered from the laptop USB port. Low channel 2402MHz, Mid channel 2442MHz, High channel 2480MHz. The EUT is set at the output power level of +8dBm. |                |             |

| Environmental Conditions <sup>43</sup> |    |                        |    |
|--|----|------------------------|----|
| Temperature (°C)                       | 27 | Relative Humidity (%): | 43 |

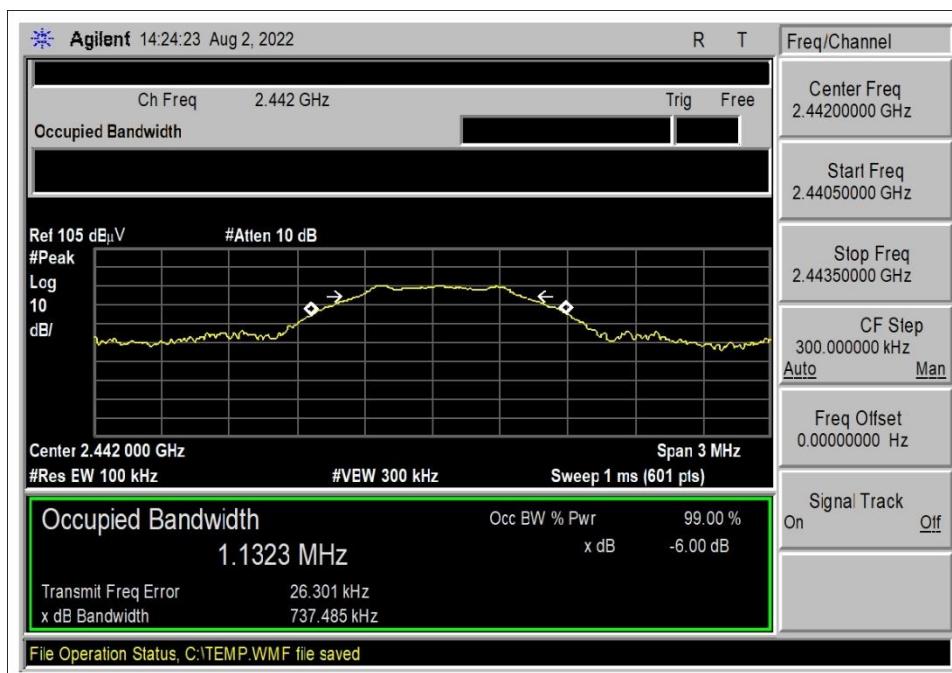
| Test Equipment |                   |                |                          |           |           |
|----------------|-------------------|----------------|--------------------------|-----------|-----------|
| Asset#         | Description       | Manufacturer   | Model                    | Cal Date  | Cal Due   |
| 02672          | Spectrum Analyzer | Agilent        | E4446A                   | 5/9/2022  | 5/9/2024  |
| P04382         | Cable             | Andrew         | LDF-50                   | 5/18/2022 | 5/18/2024 |
| P07138         | Andrew            | Andrew         | ANDL1-PNMNM-60           | 3/30/2021 | 3/30/2023 |
| 00787          | Preamp            | HP             | 83017A                   | 6/23/2021 | 6/23/2023 |
| P07657         | Cable             | Astrolab, Inc. | 32022-29094K-29094K-24TC | 6/22/2022 | 6/22/2024 |
| 01646          | Antenna           | Emco           | 3115                     | 3/21/2022 | 3/21/2024 |

| Test Data Summary |                  |            |                |             |         |
|-------------------|------------------|------------|----------------|-------------|---------|
| Frequency (MHz)   | Antenna Port     | Modulation | Measured (kHz) | Limit (kHz) | Results |
| 2402              | Integral Antenna | GFSK       | 737.427        | ≥500        | Pass    |
| 2442              | Integral Antenna | GFSK       | 737.485        | ≥500        | Pass    |
| 2480              | Integral Antenna | GFSK       | 737.489        | ≥500        | Pass    |

## Plot(s)

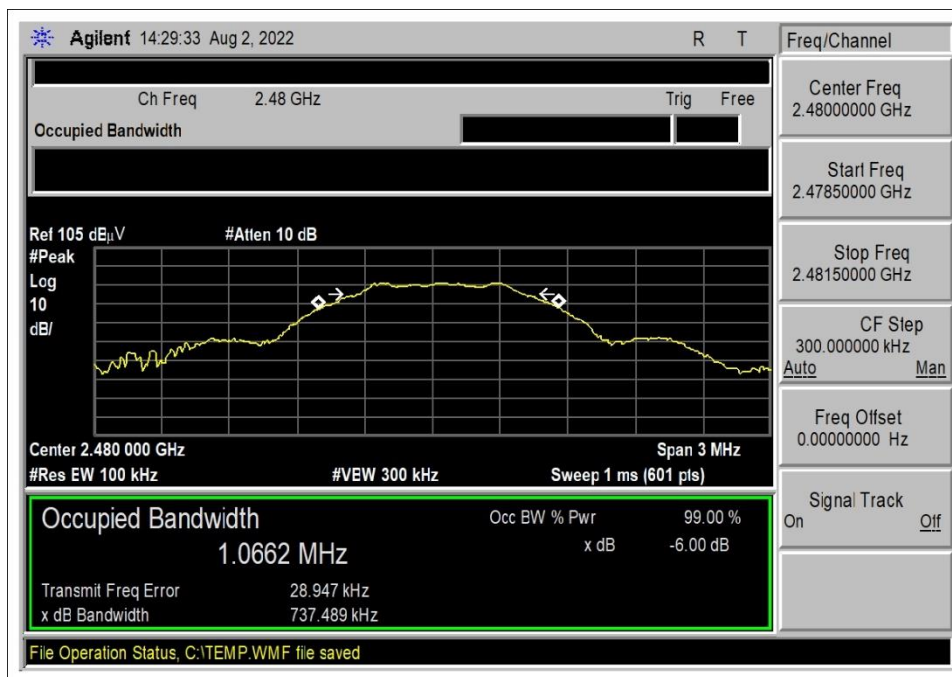


Low Channel



Middle Channel





High Channel



Test Setup Photo(s)



Test Setup

## 15.247(b)(3) Output Power

| Test Setup/Conditions |  |                |             |
|-----------------------|--|----------------|-------------|
| Test Location:        | Brea Lab D   | Test Engineer: | S. Yamamoto |
| Test Method:          | ANSI C63.10 (2013), KDB 558074   | Test Date(s):  | 8/2/2022    |
| Configuration:        | 1  |                |             |
| Test Setup:           | The equipment under test (EUT) is stand alone on the Styrofoam tabletop. The EUT is connected to a laptop computer via USB cable. The laptop is running the PUTTY application, which is being used to command the EUT to transmit. The EUT is powered from the laptop USB port. Low channel 2402MHz, Mid channel 2442MHz, High channel 2480MHz. The EUT is set at the output power level of +8dBm. |                |             |

| Environmental Conditions |    |                        |    |
|--------------------------|----|------------------------|----|
| Temperature (°C)         | 27 | Relative Humidity (%): | 43 |

| Test Equipment |                   |                |                          |           |           |
|----------------|-------------------|----------------|--------------------------|-----------|-----------|
| Asset#         | Description       | Manufacturer   | Model                    | Cal Date  | Cal Due   |
| 02672          | Spectrum Analyzer | Agilent        | E4446A                   | 5/9/2022  | 5/9/2024  |
| P04382         | Cable             | Andrew         | LDF-50                   | 5/18/2022 | 5/18/2024 |
| P07138         | Andrew            | Andrew         | ANDL1-PNMNM-60           | 3/30/2021 | 3/30/2023 |
| 00787          | Preamp            | HP             | 83017A                   | 6/23/2021 | 6/23/2023 |
| P07657         | Cable             | Astrolab, Inc. | 32022-29094K-29094K-24TC | 6/22/2022 | 6/22/2024 |
| 01646          | Antenna           | Emco           | 3115                     | 3/21/2022 | 3/21/2024 |
| 07567          | Power Supply      | Leader         | LPS 152                  | 8/4/2021  | 8/4/2023  |
| P07164         | Multimeter        | Fluke          | 8845A/G                  | 8/13/2021 | 8/13/2023 |

| Test Data Summary - Radiated Measurement |            |                        |                             |                  |             |         |
|--|------------|------------------------|-----------------------------|------------------|-------------|---------|
| Measurement Option: RBW > DTS Bandwidth  |            |                        |                             |                  |             |         |
| Frequency (MHz)                          | Modulation | Ant. Type / Gain (dBi) | Field Strength (dBuV/m @3m) | Calculated (dBm) | Limit (dBm) | Results |
| 2402                                     | GFSK       | Surface Mount / 3.2    | 98.6                        | 0.17             | ≤ 30        | Pass    |
| 2442                                     | GFSK       | Surface Mount / 3.2    | 99.6                        | 1.17             | ≤ 30        | Pass    |
| 2480                                     | GFSK       | Surface Mount / 3.2    | 99.1                        | 0.67             | ≤ 30        | Pass    |

| Test Data Summary - Voltage Variations |                         |                            |                            |                            |  |
|--|-------------------------|----------------------------|----------------------------|----------------------------|--|
| Frequency (MHz)                        | Modulation / Ant Port   | V <sub>Minimum</sub> (dBm) | V <sub>Nominal</sub> (dBm) | V <sub>Maximum</sub> (dBm) | Max Deviation from V <sub>Nominal</sub> (dB) |
| 2402                                   | GFSK / Integral Antenna | 0.17                       | 0.17                       | 0.17                       | 0.0  |
| 2442                                   | GFSK / Integral Antenna | 1.17                       | 1.17                       | 1.17                       | 0.0  |
| 2480                                   | GFSK / Integral Antenna | 0.67                       | 0.67                       | 0.67                       | 0.0  |

**Parameter Definitions:**

Measurements performed at input voltage V<sub>nominal</sub> ± 15%.

| Parameter              | Value   |
|------------------------|---------|
| V <sub>Nominal</sub> : | 5.0Vdc  |
| V <sub>Minimum</sub> : | 5.75Vdc |
| V <sub>Maximum</sub> : | 4.25Vdc |

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112  
 Customer: **Signetik**  
 Specification: **15.247(b) Power Output (2400-2483.5 MHz DTS)**  
 Work Order #: **107284** Date: 8/2/2022  
 Test Type: **Maximized Emissions** Time: 16:01:05  
 Tested By: S. Yamamoto Sequence#: 1  
 Software: EMITest 5.03.20

#### Equipment Tested:

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

#### Support Equipment:

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

#### Test Conditions / Notes:

The equipment under test (EUT) is stand alone on the Styrofoam tabletop. The EUT is connected to a laptop computer via USB cable. The laptop is running the PUTTY application, which is being used to set the transmitter parameters. The EUT is powered from the USB port.  
 Low channel 2402MHz, Mid channel 2442MHz, High channel 2480MHz. The EUT is set at the output power level of +8dBm.

Frequency range of data sheet 2402MHz to 2480MHz.  
 RBW=1MHz  
 VBW=3MHz

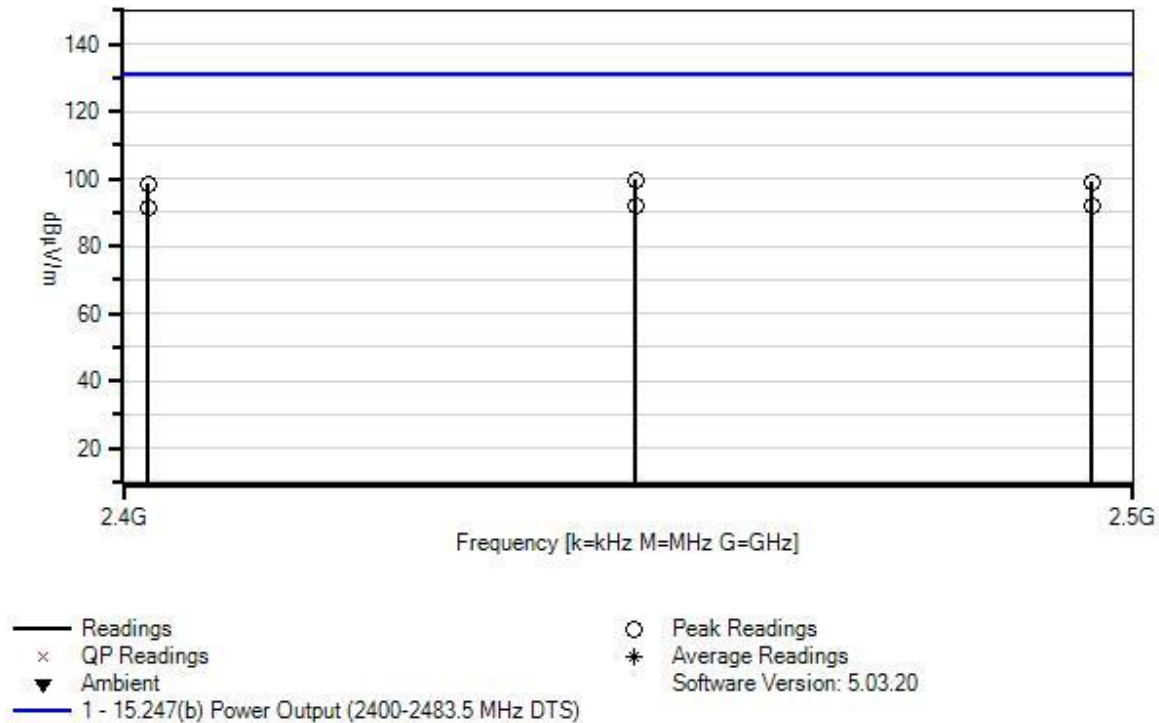
Measurement of Fundamental Output Power

Test Environment Conditions:  
 Temperature: 27°C  
 Humidity: 43%  
 Pressure: 100kPa

Site D

Test method ANSI C63.10 (2013)

Signetik W/O#: 107284 Sequence#: 1 Date: 8/2/2022  
15.247(b) Power Output (2400-2483.5 MHz DTS) Test Distance: 3 Meters Horiz



**Test Equipment:**

| ID | Asset #  | Description       | Model                        | Calibration Date | Cal Due Date |
|----|----------|-------------------|------------------------------|------------------|--------------|
|    | AN02672  | Spectrum Analyzer | E4446A                       | 5/9/2022         | 5/9/2024     |
| T1 | ANP04382 | Cable             | LDF-50                       | 5/18/2022        | 5/18/2024    |
| T2 | ANP07138 | Cable             | ANDL1-<br>PNMNM-60           | 3/30/2021        | 3/30/2023    |
| T3 | AN00787  | Preamp            | 83017A                       | 6/23/2021        | 6/23/2023    |
| T4 | AN01646  | Horn Antenna      | 3115                         | 3/21/2022        | 3/21/2024    |
| T5 | ANP07657 | Cable             | 32022-29094K-<br>29094K-24TC | 6/22/2022        | 6/22/2024    |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| # | Freq<br>MHz | Rdng<br>dB $\mu$ V | T1<br>T5<br>dB | T2<br>dB | T3<br>dB | T4<br>dB | Dist<br>Table | Corr<br>dB $\mu$ V/m | Spec<br>dB $\mu$ V/m | Margin<br>dB | Polar<br>Ant |
|---|-------------|--------------------|----------------|----------|----------|----------|---------------|----------------------|----------------------|--------------|--------------|
| 1 | 2442.000M   | 100.3              | +5.6<br>+0.4   | +4.1     | -39.2    | +28.4    | +0.0          | 99.6                 | 131.2                | -31.6        | Horiz        |
| 2 | 2480.000M   | 99.6               | +5.7<br>+0.4   | +4.2     | -39.2    | +28.4    | +0.0          | 99.1                 | 131.2                | -32.1        | Horiz        |
| 3 | 2402.000M   | 99.3               | +5.6<br>+0.4   | +4.0     | -39.2    | +28.5    | +0.0          | 98.6                 | 131.2                | -32.6        | Horiz        |
| 4 | 2442.000M   | 92.7               | +5.6<br>+0.4   | +4.1     | -39.2    | +28.4    | +0.0          | 92.0                 | 131.2                | -39.2        | Vert         |
| 5 | 2480.000M   | 92.2               | +5.7<br>+0.4   | +4.2     | -39.2    | +28.4    | +0.0          | 91.7                 | 131.2                | -39.5        | Vert         |
| 6 | 2402.000M   | 91.9               | +5.6<br>+0.4   | +4.0     | -39.2    | +28.5    | +0.0          | 91.2                 | 131.2                | -40.0        | Vert         |

Test Setup Photo(s)





## 15.247(e) Power Spectral Density

| Test Setup/Conditions |  |                |             |
|-----------------------|--|----------------|-------------|
| Test Location:        | Brea Lab D   | Test Engineer: | S. Yamamoto |
| Test Method:          | ANSI C63.10 (2013), KDB 558074   | Test Date(s):  | 8/2/2022    |
| Configuration:        | 1  |                |             |
| Test Setup:           | The equipment under test (EUT) is stand alone on the Styrofoam tabletop. The EUT is connected to a laptop computer via USB cable. The laptop is running the PUTTY application, which is being used to command the EUT to transmit. The EUT is powered from the laptop USB port. Low channel 2402MHz, Mid channel 2442MHz, High channel 2480MHz. The EUT is set at the output power level of +8dBm. |                |             |

| Environmental Conditions |    |                        |    |
|--------------------------|----|------------------------|----|
| Temperature (°C)         | 27 | Relative Humidity (%): | 43 |

| Test Data Summary - Radiated Measurement |            |                        |                             |                       |                  |         |
|--|------------|------------------------|-----------------------------|-----------------------|------------------|---------|
| Measurement Method: PKPSD                |            |                        |                             |                       |                  |         |
| Frequency (MHz)                          | Modulation | Ant. Type / Gain (dBi) | Field Strength (dBuV/m @3m) | Calculated (dBm/3kHz) | Limit (dBm/3kHz) | Results |
| 2402                                     | GFSK       | Surface Mount / 3.2    | 85.9                        | -12.5                 | ≤ 8              | Pass    |
| 2442                                     | GFSK       | Surface Mount / 3.2    | 87.0                        | -11.4                 | ≤ 8              | Pass    |
| 2480                                     | GFSK       | Surface Mount / 3.2    | 87.2                        | -11.2                 | ≤ 8              | Pass    |

## Test Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112  
 Customer: **Signetik**  
 Specification: **15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)**  
 Work Order #: **107284** Date: 8/2/2022  
 Test Type: **Maximized Emissions** Time: 16:30:47  
 Tested By: S. Yamamoto Sequence#: 2  
 Software: EMITest 5.03.20

### Equipment Tested:

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

### Support Equipment:

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

### Test Conditions / Notes:

The equipment under test (EUT) is stand alone on the Styrofoam tabletop. The EUT is connected to a laptop computer via USB cable. The laptop is running the PUTTY application, which is being used to set the transmitter parameters. The EUT is powered from the USB port.  
 Low channel 2402MHz, Mid channel 2442MHz, High channel 2480MHz. The EUT is set at the output power level of +8dBm.

Frequency range of data sheet 2402MHz to 2480MHz.  
 RBW=3kHz  
 VBW=10kHz

Measurement of Power Spectral Density

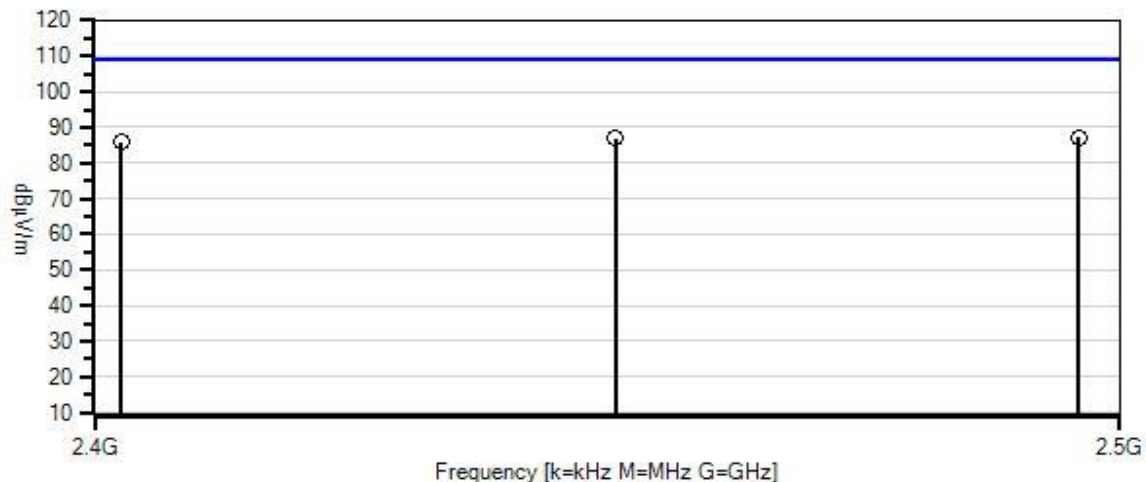
Test Environment Conditions:

Temperature: 27°C  
 Humidity: 43%  
 Pressure: 100kPa

Site D

Test method ANSI C63.10 (2013)

Signetik WO#: 107284 Sequence#: 2 Date: 8/2/2022  
15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS) Test Distance: 3 Meters Horiz



— Readings  
○ Peak Readings  
× QP Readings  
\* Average Readings  
▼ Ambient  
Software Version: 5.03.20  
— 1 - 15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)

**Test Equipment:**

| ID | Asset #  | Description       | Model                        | Calibration Date | Cal Due Date |
|----|----------|-------------------|------------------------------|------------------|--------------|
|    | AN02672  | Spectrum Analyzer | E4446A                       | 5/9/2022         | 5/9/2024     |
| T1 | ANP04382 | Cable             | LDF-50                       | 5/18/2022        | 5/18/2024    |
| T2 | ANP07138 | Cable             | ANDL1-<br>PNMNM-60           | 3/30/2021        | 3/30/2023    |
| T3 | AN00787  | Preamp            | 83017A                       | 6/23/2021        | 6/23/2023    |
| T4 | AN01646  | Horn Antenna      | 3115                         | 3/21/2022        | 3/21/2024    |
| T5 | ANP07657 | Cable             | 32022-29094K-<br>29094K-24TC | 6/22/2022        | 6/22/2024    |

**Measurement Data:** Reading listed by margin. Test Distance: 3 Meters

| # | Freq<br>MHz | Rdng<br>dBμV | T1<br>T5<br>dB | T2<br>dB | T3<br>dB | T4<br>dB | Dist<br>Table | Corr<br>dBμV/m | Spec<br>dBμV/m | Margin<br>dB | Polar<br>Ant |
|---|-------------|--------------|----------------|----------|----------|----------|---------------|----------------|----------------|--------------|--------------|
| 1 | 2480.091M   | 87.7         | +5.7<br>+0.4   | +4.2     | -39.2    | +28.4    | +0.0          | 87.2           | 109.2          | -22.0        | Horiz        |
| 2 | 2442.106M   | 87.7         | +5.6<br>+0.4   | +4.1     | -39.2    | +28.4    | +0.0          | 87.0           | 109.2          | -22.2        | Horiz        |
| 3 | 2402.120M   | 86.6         | +5.6<br>+0.4   | +4.0     | -39.2    | +28.5    | +0.0          | 85.9           | 109.2          | -23.3        | Horiz        |

Test Setup Photo(s)



## 15.247(d) Radiated Emissions & Band Edge

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112  
 Customer: **Signetik**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **107284** Date: 8/3/2022  
 Test Type: **Maximized Emissions** Time: 10:40:29  
 Tested By: S. Yamamoto Sequence#: 4  
 Software: EMITest 5.03.20

#### Equipment Tested:

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

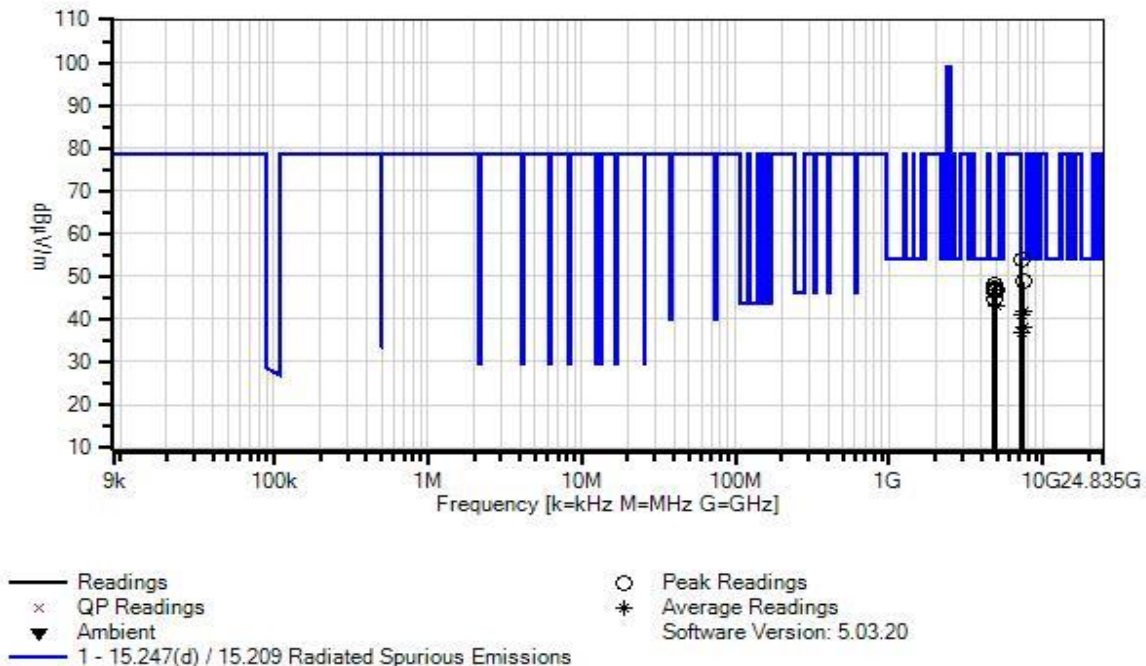
#### Support Equipment:

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

#### Test Conditions / Notes:

The equipment under test (EUT) is stand alone on the Styrofoam tabletop. The EUT is connected to a laptop computer via USB cable. The laptop is running the PUTTY application, which is being used to set the transmitter parameters. The EUT is powered from the USB port.  
 Low channel 2402MHz, Mid channel 2442MHz, High channel 2480MHz. The EUT is set at the output power level of +8dBm.  
  
 Frequency range of data sheet 9kHz to 25GHz.  
  
 1GHz to 25GHz, RBW=1MHz, VBW=3MHz  
  
 Measurement of Radiated Spurious Emissions  
  
 Test Environment Conditions:  
 Temperature: 27°C  
 Humidity: 50%  
 Pressure: 100kPa  
  
 Site D  
  
 Test method ANSI C63.10 (2013)

Signetik WO#: 107284 Sequence#: 4 Date: 8/3/2022  
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



#### Test Equipment:

| ID | Asset #  | Description                          | Model                          | Calibration Date | Cal Due Date |
|----|----------|--------------------------------------|--------------------------------|------------------|--------------|
|    | AN02672  | Spectrum Analyzer                    | E4446A                         | 5/9/2022         | 5/9/2024     |
| T1 | ANP04382 | Cable                                | LDF-50                         | 5/18/2022        | 5/18/2024    |
| T2 | ANP07138 | Cable                                | ANDL1-<br>PNMNM-60             | 3/30/2021        | 3/30/2023    |
| T3 | AN00787  | Preamp                               | 83017A                         | 6/23/2021        | 6/23/2023    |
| T4 | AN01646  | Horn Antenna                         | 3115                           | 3/21/2022        | 3/21/2024    |
| T5 | AN03385  | High Pass Filter                     | 11SH10-<br>3000/T10000-<br>O/O | 5/17/2021        | 5/17/2023    |
|    | AN03367  | Horn Antenna                         | 62-GH-62-25.                   | 8/3/2021         | 8/3/2023     |
|    | AN01413  | Horn Antenna                         | 84125-80008                    | 10/19/2020       | 10/19/2022   |
|    | AN02746  | Low Pass Filter                      | 11SL10-<br>2000/U6000-<br>O/O  | 8/4/2021         | 8/4/2023     |
|    | AN00314  | Loop Antenna                         | 6502                           | 3/29/2022        | 3/29/2024    |
|    | AN00010  | Preamp                               | 8447D                          | 1/3/2022         | 1/3/2024     |
|    | AN00851  | Biconilog Antenna                    | CBL6111C                       | 4/21/2022        | 4/21/2024    |
|    | ANP05569 | Cable-Amplitude<br>+15C to +45C (dB) | RG-214/U                       | 12/14/2020       | 12/14/2022   |
| T6 | ANP07657 | Cable                                | 32022-29094K-<br>29094K-24TC   | 6/22/2022        | 6/22/2024    |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| #  | Freq<br>MHz      | Rdng<br>dB $\mu$ V | T1<br>T5<br>dB | T2<br>T6<br>dB | T3<br>dB | T4<br>dB | Dist<br>Table | Corr<br>dB $\mu$ V/m | Spec<br>dB $\mu$ V/m | Margin<br>dB | Polar<br>Ant |
|----|------------------|--------------------|----------------|----------------|----------|----------|---------------|----------------------|----------------------|--------------|--------------|
| 1  | 7440.833M        | 31.9               | +11.2<br>+0.2  | +7.0<br>+1.0   | -38.9    | +36.5    | +0.0          | 48.9                 | 54.0                 | -5.1         | Horiz        |
| 2  | 4884.533M        | 38.3               | +8.4<br>+0.3   | +5.8<br>+1.2   | -39.1    | +33.2    | +0.0          | 48.1                 | 54.0                 | -5.9         | Horiz        |
| 3  | 4804.033M        | 38.2               | +8.3<br>+0.3   | +5.7<br>+1.0   | -39.2    | +33.0    | +0.0          | 47.3                 | 54.0                 | -6.7         | Horiz        |
| 4  | 4804.033M        | 37.8               | +8.3<br>+0.3   | +5.7<br>+1.0   | -39.2    | +33.0    | +0.0          | 46.9                 | 54.0                 | -7.1         | Horiz        |
| 5  | 4959.560M        | 37.0               | +8.5<br>+0.3   | +5.9<br>+1.1   | -39.1    | +33.2    | +0.0          | 46.9                 | 54.0                 | -7.1         | Vert         |
| 6  | 4884.458M        | 36.4               | +8.4<br>+0.3   | +5.8<br>+1.2   | -39.1    | +33.2    | +0.0          | 46.2                 | 54.0                 | -7.8         | Vert         |
| 7  | 4804.075M        | 35.7               | +8.3<br>+0.3   | +5.7<br>+1.0   | -39.2    | +33.0    | +0.0          | 44.8                 | 54.0                 | -9.2         | Vert         |
| 8  | 4960.600M<br>Ave | 33.2               | +8.5<br>+0.3   | +5.9<br>+1.1   | -39.1    | +33.2    | +0.0          | 43.1                 | 54.0                 | -10.9        | Horiz        |
| ^  | 4960.600M        | 41.4               | +8.5<br>+0.3   | +5.9<br>+1.1   | -39.1    | +33.2    | +0.0          | 51.3                 | 54.0                 | -2.7         | Horiz        |
| 10 | 7440.883M<br>Ave | 24.7               | +11.2<br>+0.2  | +7.0<br>+1.0   | -38.9    | +36.5    | +0.0          | 41.7                 | 54.0                 | -12.3        | Vert         |
| ^  | 7440.883M        | 35.1               | +11.2<br>+0.2  | +7.0<br>+1.0   | -38.9    | +36.5    | +0.0          | 52.1                 | 54.0                 | -1.9         | Vert         |
| 12 | 7325.533M<br>Ave | 24.4               | +11.1<br>+0.2  | +6.9<br>+0.9   | -39.0    | +36.4    | +0.0          | 40.9                 | 54.0                 | -13.1        | Vert         |
| ^  | 7325.533M        | 34.6               | +11.1<br>+0.2  | +6.9<br>+0.9   | -39.0    | +36.4    | +0.0          | 51.1                 | 54.0                 | -2.9         | Vert         |
| 14 | 7440.417M<br>Ave | 21.1               | +11.2<br>+0.2  | +7.0<br>+1.0   | -38.9    | +36.5    | +0.0          | 38.1                 | 54.0                 | -15.9        | Horiz        |
| 15 | 7326.608M<br>Ave | 20.4               | +11.1<br>+0.2  | +6.9<br>+0.9   | -39.0    | +36.4    | +0.0          | 36.9                 | 54.0                 | -17.1        | Horiz        |
| ^  | 7326.608M        | 33.0               | +11.1<br>+0.2  | +6.9<br>+0.9   | -39.0    | +36.4    | +0.0          | 49.5                 | 54.0                 | -4.5         | Horiz        |
| 17 | 7205.275M        | 38.2               | +11.0<br>+0.2  | +6.8<br>+0.8   | -39.0    | +35.9    | +0.0          | 53.9                 | 78.8                 | -24.9        | Vert         |

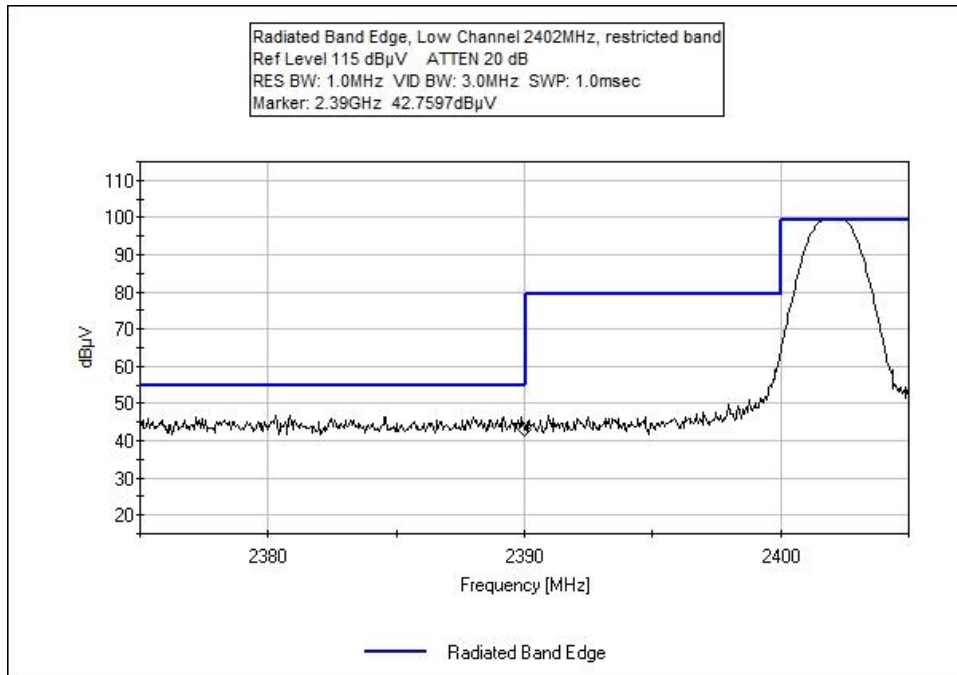


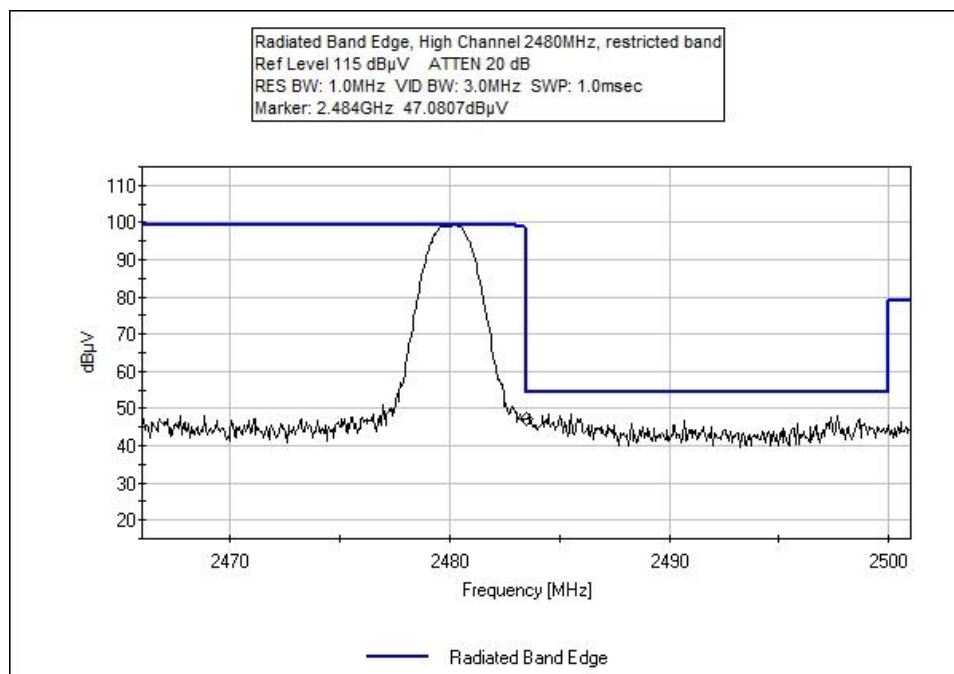
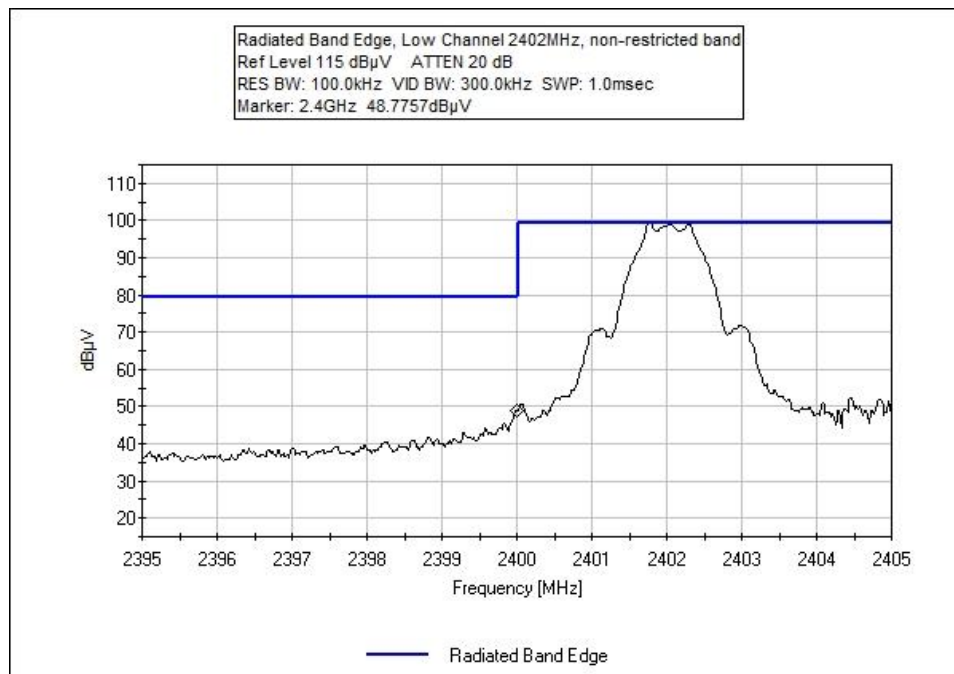
## Band Edge

### Band Edge Summary

| Frequency (MHz) | Modulation | Ant. Type     | Field Strength (dBuV/m @3m) | Limit (dBuV/m @3m) | Results |
|-----------------|------------|---------------|-----------------------------|--------------------|---------|
| 2390.0          | GFSK       | Surface Mount | 41.7                        | < 54               | Pass    |
| 2400.0          | GFSK       | Surface Mount | 47.7                        | < 78.8             | Pass    |
| 2483.5          | GFSK       | Surface Mount | 46.7                        | < 54               | Pass    |

### Band Edge Plots





### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112  
 Customer: **Signetik**  
 Specification: **Radiated Band Edge**  
 Work Order #: **107284** Date: 8/2/2022  
 Test Type: **Maximized Emissions** Time: 17:13:29  
 Tested By: S. Yamamoto Sequence#: 3  
 Software: EMITest 5.03.20

#### Equipment Tested:

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

#### Support Equipment:

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

#### Test Conditions / Notes:

The equipment under test (EUT) is stand alone on the Styrofoam tabletop. The EUT is connected to a laptop computer via USB cable. The laptop is running the PUTTY application, which is being used to set the transmitter parameters. The EUT is powered from the USB port.  
 Low channel 2402MHz, Mid channel 2442MHz, High channel 2480MHz. The EUT is set at the output power level of +8dBm.  
  
 Frequency range of data sheet 2390MHz to 2483.5MHz.  
 Restricted band RBW=1MHz, VBW=3MHz  
 Non restricted band RBW=100kHz, VBW=300kHz  
  
 Measurement of Band Edge Emissions  
  
 Test Environment Conditions:  
 Temperature: 27°C  
 Humidity: 43%  
 Pressure: 100kPa  
  
 Site D  
  
 Test method ANSI C63.10 (2013)

**Test Equipment:**

| ID | Asset #  | Description       | Model                    | Calibration Date | Cal Due Date |
|----|----------|-------------------|--------------------------|------------------|--------------|
|    | AN02672  | Spectrum Analyzer | E4446A                   | 5/9/2022         | 5/9/2024     |
| T1 | ANP04382 | Cable             | LDF-50                   | 5/18/2022        | 5/18/2024    |
| T2 | ANP07138 | Cable             | ANDL1-PNMNM-60           | 3/30/2021        | 3/30/2023    |
| T3 | AN00787  | Preamp            | 83017A                   | 6/23/2021        | 6/23/2023    |
| T4 | AN01646  | Horn Antenna      | 3115                     | 3/21/2022        | 3/21/2024    |
| T5 | ANP07657 | Cable             | 32022-29094K-29094K-24TC | 6/22/2022        | 6/22/2024    |

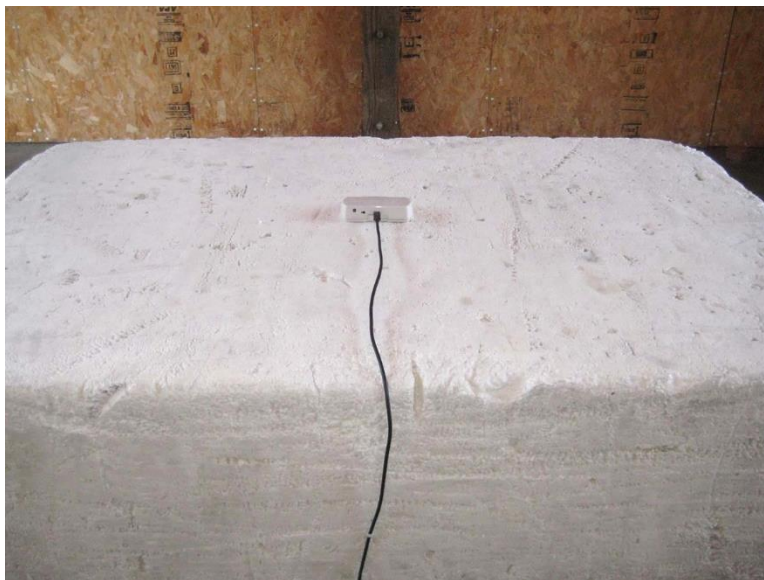
**Measurement Data:** Reading listed by margin. Test Distance: 3 Meters

| # | 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/m | dB $\mu$ V/m | dB     | Ant   |
| 1 | 2483.500M | 47.5       | +5.7<br>+0.4 | +4.3 | -39.2 | +28.4 | +0.0  | 47.1         | 54.0         | -6.9   | Horiz |
| 2 | 2390.000M | 42.8       | +5.6<br>+0.4 | +4.0 | -39.2 | +28.5 | +0.0  | 42.1         | 54.0         | -11.9  | Horiz |
| 3 | 2400.000M | 48.8       | +5.6<br>+0.4 | +4.0 | -39.2 | +28.5 | +0.0  | 48.1         | 78.8         | -30.7  | Horiz |

**Test Setup Photo(s)**



Front View



Back View



Above 1GHz

## 15.207 AC Conducted Emissions

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714)-993-6112  
 Customer: **Signetik**  
 Specification: **15.207 AC Mains - Average**  
 Work Order #: **107284** Date: 8/10/2022  
 Test Type: **Conducted Emissions** Time: 3:18:16 PM  
 Tested By: S. Yamamoto Sequence#: 7  
 Software: EMITest 5.03.20 120V 60Hz

#### Equipment Tested:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 2 |              |         |     |

#### Support Equipment:

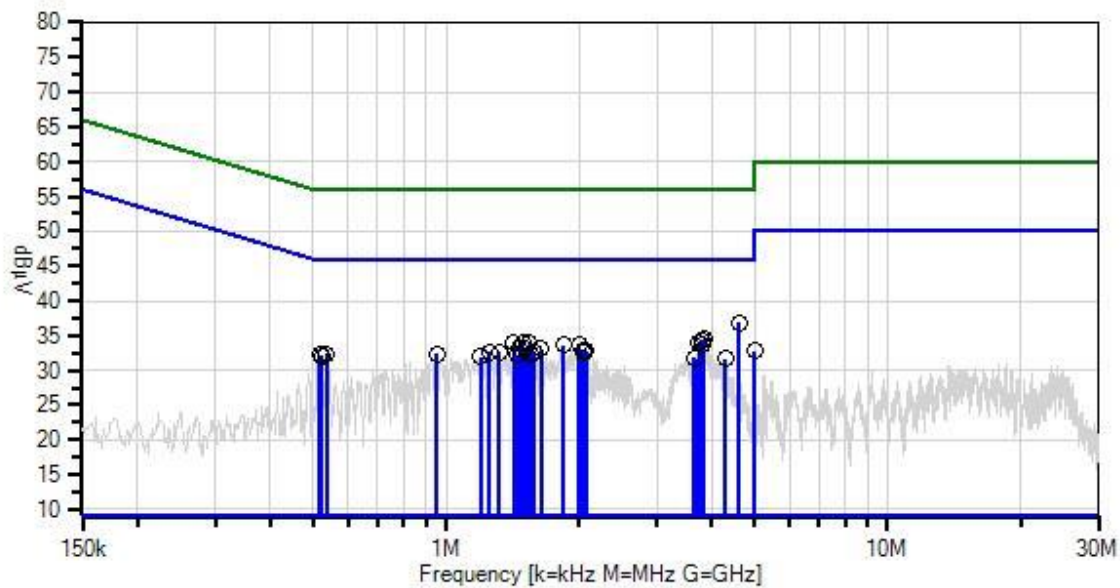
| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 2 |              |         |     |

#### Test Conditions / Notes:

The equipment under test (EUT) is stand alone on the tabletop. The EUT is connected to an AC to USB power adapter via USB cable.  
 The EUT has been configured to transmit continuously at the output power level of +8dBm.  
 Low channel 2402MHz, Mid channel 2442MHz, High channel 2480MHz.  
  
 Frequency range of data sheet 150kHz to 30MHz.  
 RBW=9kHz  
 VBW=30kHz  
  
 Test Environment Conditions:  
 Temperature: 23°C  
 Humidity: 40%  
 Pressure: 99kPa  
  
 Site D  
  
 Test method ANSI C63.10 (2013)



Signetik WO#: 107284 Sequence#: 7 Date: 8/10/2022  
15.207 AC Mains - Average Test Lead: 120V 60Hz Line



— Sweep Data  
× QP Readings  
Software Version: 5.03.20  
— 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 |
|----|-----------|----------------------|---------------------|------------------|--------------|
|    | AN02869   | Spectrum Analyzer    | E4440A              | 8/16/2021        | 8/16/2022    |
| T1 | AN02610   | High Pass Filter     | HE9615-150K-50-720B | 9/8/2021         | 9/8/2023     |
| T2 | ANP07338  | Cable                | 2249-Y-240          | 1/3/2022         | 1/3/2024     |
| T3 | ANP07545  | Attenuator           | SA18N10W-06         | 1/4/2021         | 1/4/2023     |
| T4 | ANP07738  | Cable-Line L1(dB)    | 90cm-extcord        | 12/9/2020        | 12/9/2022    |
|    | ANP07738  | Cable-Neutral L2(dB) | 90cm-extcord        | 12/9/2020        | 12/9/2022    |
| T5 | AN00847.1 | 50uH LISN-(L) Line 1 | 3816/2NM            | 3/18/2022        | 3/18/2023    |
|    | AN00847.1 | 50uH LISN-(N) Line 2 | 3816/2NM            | 3/18/2022        | 3/18/2023    |

**Measurement Data:**

Reading listed by margin.

Test Lead: Line

| #  | Freq<br>MHz | Rdng<br>dBμV | T1<br>T5<br>dB | T2<br>dB | T3<br>dB | T4<br>dB | Dist<br>Table | Corr<br>dBμV | Spec<br>dBμV | Margin<br>dB | Polar<br>Ant |
|----|-------------|--------------|----------------|----------|----------|----------|---------------|--------------|--------------|--------------|--------------|
| 1  | 4.615M      | 30.6         | +0.1<br>+0.0   | +0.2     | +5.7     | +0.2     | +0.0          | 36.8         | 46.0         | -9.2         | Line         |
| 2  | 3.841M      | 28.4         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.2     | +0.0          | 34.5         | 46.0         | -11.5        | Line         |
| 3  | 3.790M      | 28.2         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.2     | +0.0          | 34.3         | 46.0         | -11.7        | Line         |
| 4  | 3.744M      | 28.0         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.2     | +0.0          | 34.1         | 46.0         | -11.9        | Line         |
| 5  | 1.490M      | 27.9         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 34.0         | 46.0         | -12.0        | Line         |
| 6  | 1.422M      | 27.8         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 33.9         | 46.0         | -12.1        | Line         |
| 7  | 1.541M      | 27.8         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 33.9         | 46.0         | -12.1        | Line         |
| 8  | 3.812M      | 27.6         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.2     | +0.0          | 33.7         | 46.0         | -12.3        | Line         |
| 9  | 1.843M      | 27.5         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 33.6         | 46.0         | -12.4        | Line         |
| 10 | 2.004M      | 27.6         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 33.6         | 46.0         | -12.4        | Line         |
| 11 | 1.468M      | 27.1         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 33.2         | 46.0         | -12.8        | Line         |
| 12 | 1.515M      | 26.9         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 33.0         | 46.0         | -13.0        | Line         |
| 13 | 1.638M      | 26.9         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 33.0         | 46.0         | -13.0        | Line         |
| 14 | 2.038M      | 26.9         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 32.9         | 46.0         | -13.1        | Line         |
| 15 | 4.994M      | 26.6         | +0.1<br>+0.0   | +0.2     | +5.7     | +0.2     | +0.0          | 32.8         | 46.0         | -13.2        | Line         |
| 16 | 2.076M      | 26.8         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 32.8         | 46.0         | -13.2        | Line         |
| 17 | 1.251M      | 26.5         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 32.6         | 46.0         | -13.4        | Line         |
| 18 | 1.319M      | 26.5         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 32.6         | 46.0         | -13.4        | Line         |
| 19 | 1.587M      | 26.5         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 32.6         | 46.0         | -13.4        | Line         |
| 20 | 2.051M      | 26.5         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 32.5         | 46.0         | -13.5        | Line         |
| 21 | 953.754k    | 26.3         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 32.4         | 46.0         | -13.6        | Line         |
| 22 | 536.146k    | 26.2         | +0.3<br>+0.0   | +0.0     | +5.7     | +0.1     | +0.0          | 32.3         | 46.0         | -13.7        | Line         |
| 23 | 1.562M      | 26.2         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 32.3         | 46.0         | -13.7        | Line         |

|    |          |      |              |      |      |      |      |      |      |       |      |
|----|----------|------|--------------|------|------|------|------|------|------|-------|------|
| 24 | 516.511k | 26.1 | +0.3<br>+0.0 | +0.0 | +5.7 | +0.1 | +0.0 | 32.2 | 46.0 | -13.8 | Line |
| 25 | 1.443M   | 26.1 | +0.2<br>+0.0 | +0.1 | +5.7 | +0.1 | +0.0 | 32.2 | 46.0 | -13.8 | Line |
| 26 | 522.329k | 26.0 | +0.3<br>+0.0 | +0.0 | +5.7 | +0.1 | +0.0 | 32.1 | 46.0 | -13.9 | Line |
| 27 | 1.196M   | 25.8 | +0.2<br>+0.0 | +0.1 | +5.7 | +0.1 | +0.0 | 31.9 | 46.0 | -14.1 | Line |
| 28 | 3.646M   | 25.7 | +0.1<br>+0.0 | +0.1 | +5.7 | +0.2 | +0.0 | 31.8 | 46.0 | -14.2 | Line |
| 29 | 3.671M   | 25.6 | +0.1<br>+0.0 | +0.1 | +5.7 | +0.2 | +0.0 | 31.7 | 46.0 | -14.3 | Line |
| 30 | 4.279M   | 25.5 | +0.1<br>+0.0 | +0.2 | +5.7 | +0.2 | +0.0 | 31.7 | 46.0 | -14.3 | Line |

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714)-993-6112  
 Customer: **Signetik**  
 Specification: **15.207 AC Mains - Average**  
 Work Order #: **107284** Date: 8/10/2022  
 Test Type: **Conducted Emissions** Time: 3:23:01 PM  
 Tested By: S. Yamamoto Sequence#: 8  
 Software: EMITest 5.03.20 120V 60Hz

***Equipment Tested:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 2 |              |         |     |

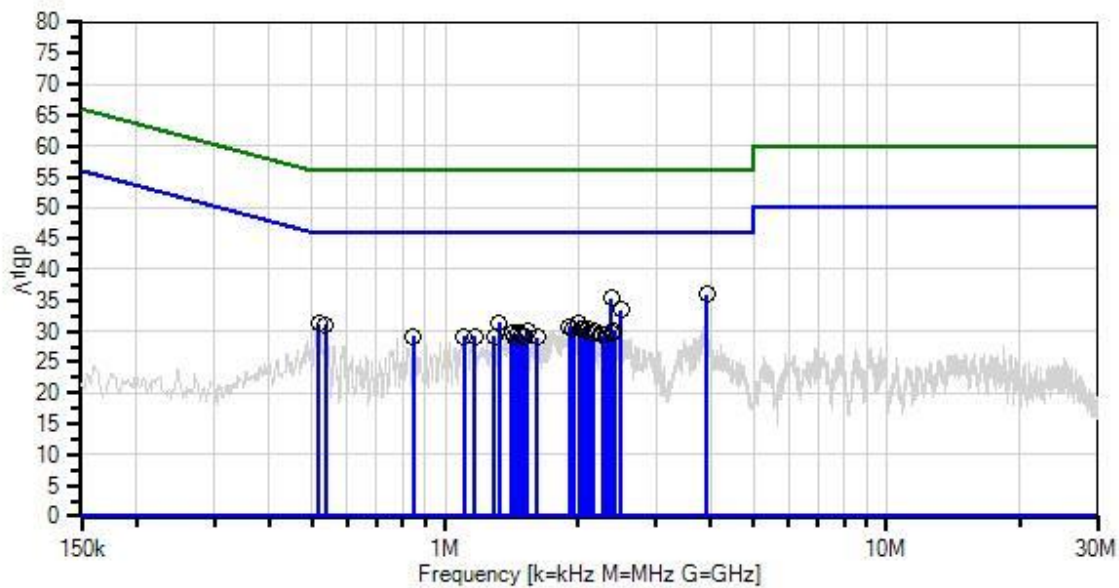
***Support Equipment:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 2 |              |         |     |

***Test Conditions / Notes:***

|   |
|---|
| <p>The equipment under test (EUT) is stand alone on the tabletop. The EUT is connected to an AC to USB power adapter via USB cable.</p> <p>The EUT has been configured to transmit continuously at the output power level of +8dBm.</p> <p>Low channel 2402MHz, Mid channel 2442MHz, High channel 2480MHz.</p> <p>Frequency range of data sheet 150kHz to 30MHz.</p> <p>RBW=9kHz</p> <p>VBW=30kHz</p> <p>Test Environment Conditions:</p> <p>Temperature: 23C</p> <p>Humidity: 40%</p> <p>Pressure: 99kPa</p> <p>Site D</p> <p>Test method ANSI C63.10 (2013)</p> |
|---|

Signetik WO#: 107284 Sequence#: 8 Date: 8/10/2022  
15.207 AC Mains - Average Test Lead: 120V 60Hz Neutral



— Sweep Data  
× QP Readings  
Software Version: 5.03.20  
— 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 |
|----|-----------|----------------------|---------------------|------------------|--------------|
|    | AN02869   | Spectrum Analyzer    | E4440A              | 8/16/2021        | 8/16/2022    |
| T1 | AN02610   | High Pass Filter     | HE9615-150K-50-720B | 9/8/2021         | 9/8/2023     |
| T2 | ANP07338  | Cable                | 2249-Y-240          | 1/3/2022         | 1/3/2024     |
| T3 | ANP07545  | Attenuator           | SA18N10W-06         | 1/4/2021         | 1/4/2023     |
|    | ANP07738  | Cable-Line L1(dB)    | 90cm-extcord        | 12/9/2020        | 12/9/2022    |
| T4 | ANP07738  | Cable-Neutral L2(dB) | 90cm-extcord        | 12/9/2020        | 12/9/2022    |
|    | AN00847.1 | 50uH LISN-(L) Line 1 | 3816/2NM            | 3/18/2022        | 3/18/2023    |
| T5 | AN00847.1 | 50uH LISN-(N) Line 2 | 3816/2NM            | 3/18/2022        | 3/18/2023    |

**Measurement Data:**

Reading listed by margin.

Test Lead: Neutral

| #  | Freq<br>MHz | Rdng<br>dBμV | T1<br>T5<br>dB | T2<br>dB | T3<br>dB | T4<br>dB | Dist<br>Table | Corr<br>dBμV | Spec<br>dBμV | Margin<br>dB | Polar<br>Ant |
|----|-------------|--------------|----------------|----------|----------|----------|---------------|--------------|--------------|--------------|--------------|
| 1  | 3.905M      | 29.8         | +0.1<br>+0.0   | +0.2     | +5.7     | +0.2     | +0.0          | 36.0         | 46.0         | -10.0        | Neutr        |
| 2  | 2.378M      | 29.4         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 35.4         | 46.0         | -10.6        | Neutr        |
| 3  | 2.506M      | 27.5         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 33.5         | 46.0         | -12.5        | Neutr        |
| 4  | 1.324M      | 25.3         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 31.4         | 46.0         | -14.6        | Neutr        |
| 5  | 2.008M      | 25.3         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 31.3         | 46.0         | -14.7        | Neutr        |
| 6  | 517.966k    | 25.1         | +0.3<br>+0.0   | +0.0     | +5.7     | +0.1     | +0.0          | 31.2         | 46.0         | -14.8        | Neutr        |
| 7  | 536.146k    | 25.0         | +0.3<br>+0.0   | +0.0     | +5.7     | +0.1     | +0.0          | 31.1         | 46.0         | -14.9        | Neutr        |
| 8  | 1.911M      | 24.7         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 30.7         | 46.0         | -15.3        | Neutr        |
| 9  | 1.953M      | 24.5         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 30.5         | 46.0         | -15.5        | Neutr        |
| 10 | 2.034M      | 24.5         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 30.5         | 46.0         | -15.5        | Neutr        |
| 11 | 2.051M      | 24.5         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 30.5         | 46.0         | -15.5        | Neutr        |
| 12 | 2.102M      | 24.4         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 30.4         | 46.0         | -15.6        | Neutr        |
| 13 | 2.081M      | 24.1         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 30.1         | 46.0         | -15.9        | Neutr        |
| 14 | 2.421M      | 24.1         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 30.1         | 46.0         | -15.9        | Neutr        |
| 15 | 1.536M      | 23.9         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 30.0         | 46.0         | -16.0        | Neutr        |
| 16 | 2.174M      | 23.9         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 29.9         | 46.0         | -16.1        | Neutr        |
| 17 | 2.391M      | 23.8         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 29.8         | 46.0         | -16.2        | Neutr        |
| 18 | 1.468M      | 23.6         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 29.7         | 46.0         | -16.3        | Neutr        |
| 19 | 1.417M      | 23.5         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 29.6         | 46.0         | -16.4        | Neutr        |
| 20 | 2.149M      | 23.6         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 29.6         | 46.0         | -16.4        | Neutr        |
| 21 | 2.319M      | 23.5         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 29.5         | 46.0         | -16.5        | Neutr        |
| 22 | 2.272M      | 23.4         | +0.1<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 29.4         | 46.0         | -16.6        | Neutr        |
| 23 | 1.490M      | 23.2         | +0.2<br>+0.0   | +0.1     | +5.7     | +0.1     | +0.0          | 29.3         | 46.0         | -16.7        | Neutr        |

|    |          |      |              |      |      |      |      |      |      |       |       |
|----|----------|------|--------------|------|------|------|------|------|------|-------|-------|
| 24 | 1.103M   | 23.1 | +0.2<br>+0.0 | +0.1 | +5.7 | +0.1 | +0.0 | 29.2 | 46.0 | -16.8 | Neutr |
| 25 | 1.439M   | 23.1 | +0.2<br>+0.0 | +0.1 | +5.7 | +0.1 | +0.0 | 29.2 | 46.0 | -16.8 | Neutr |
| 26 | 1.515M   | 23.1 | +0.2<br>+0.0 | +0.1 | +5.7 | +0.1 | +0.0 | 29.2 | 46.0 | -16.8 | Neutr |
| 27 | 848.844k | 23.0 | +0.3<br>+0.0 | +0.0 | +5.7 | +0.1 | +0.0 | 29.1 | 46.0 | -16.9 | Neutr |
| 28 | 1.166M   | 23.0 | +0.2<br>+0.0 | +0.1 | +5.7 | +0.1 | +0.0 | 29.1 | 46.0 | -16.9 | Neutr |
| 29 | 1.294M   | 23.0 | +0.2<br>+0.0 | +0.1 | +5.7 | +0.1 | +0.0 | 29.1 | 46.0 | -16.9 | Neutr |
| 30 | 1.613M   | 22.9 | +0.2<br>+0.0 | +0.1 | +5.7 | +0.1 | +0.0 | 29.0 | 46.0 | -17.0 | Neutr |

**Test Setup Photo(s)**



Front View



Back View



## APPENDIX B: ANTENNA SPECIFICATIONS

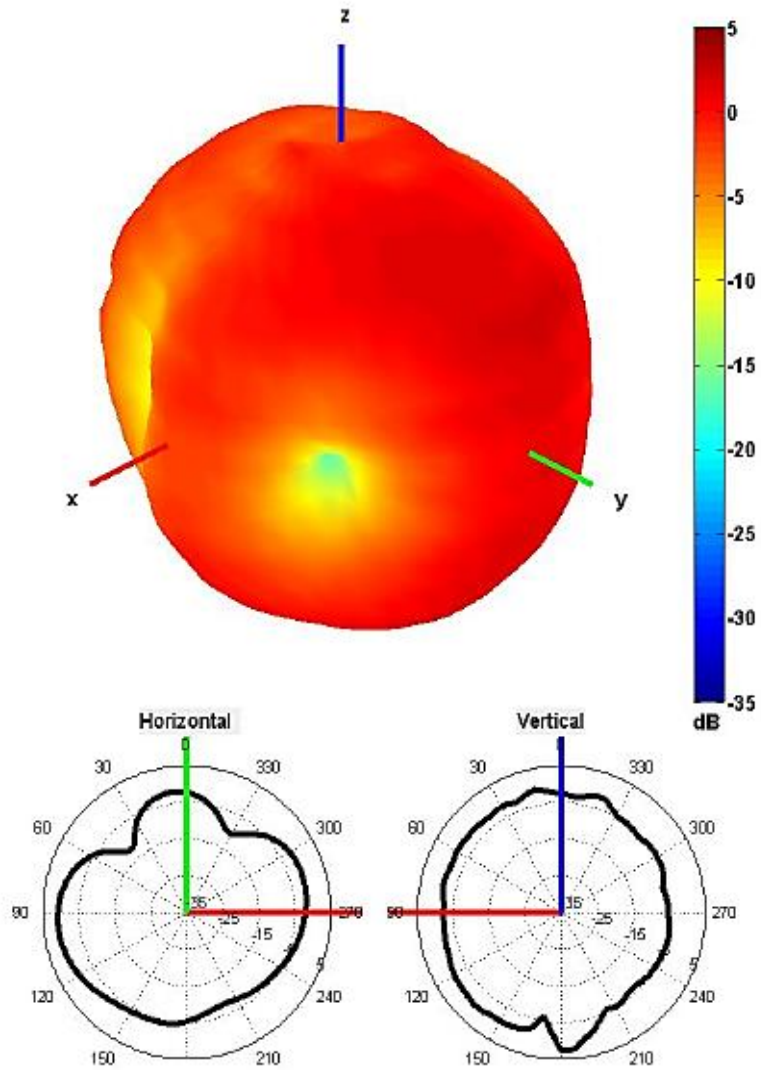
# 2JE07g

### 2.4 GHz ISM Surface Mount



### 1. Antenna and electrical specifications

| Parameters           | 2.4 GHz ISM Antenna    |
|----------------------|------------------------|
| Standards            | WiFi, BT, ZigBee, ISM, |
| Band (MHz)           | 2.4 GHz                |
| Frequency (MHz)      | 2410-2490              |
| Return Loss (dB)     | ~20.3                  |
| VSWR                 | ~1.2:1                 |
| Efficiency (%)       | ~67                    |
| Peak Gain (dBi)      | ~3.2                   |
| Average Gain (dB)    | ~-1.8                  |
| Impedance (Ohm)      | 50                     |
| Polarisation         | Linear                 |
| Radiation Pattern    | Omni-Directional       |
| Max. Input Power (W) | 25                     |



2450 MHz Radiation pattern

## 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.