

## DATA REFERENCE REPORT PART 24

**Applicant Name:**

Apple Inc.  
One Apple Park Way  
Cupertino, CA 95014  
United States

**Date of Testing:**

6/7/2022 - 8/12/2022

**Test Site/Location:**

Element Washington DC LLC, Morgan Hill, CA,  
USA

**Test Report Serial No.:**

1C2205090039-02.BCG

**FCC ID:**

**BCG-A2773**

**Applicant Name:**

**Apple Inc.**

**Reference Model:**

A2772

**Variant Model:**

A2773 (A2857)

**EUT Type:**

Watch

**FCC Classification:**

PCS Licensed Transmitter Worn on Body (PCT)

**FCC Rule Part:**

24

**Test Procedure(s):**

ANSI C63.26-2015, TIA-603-E-2016, KDB 971168 D01 v03r01


This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.



RJ Ortanez  
Executive Vice President




|  |   |                                      |  |
|--|---|--------------------------------------|--|
| <b>FCC ID:</b> BCG-A2773                       |  | <b>PART 22 DATA REFERENCE REPORT</b> | <b>Approved by:</b><br>Technical Manager |
| <b>Test Report S/N:</b><br>1C2205090039-02.BCG | <b>Test Dates:</b><br>5/4/2022 - 8/10/2022  | <b>EUT Type:</b><br>Watch            | Page 1 of 15                             |

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## 1.0 INTRODUCTION

### 1.1 Scope

Per manufacturer declaration, there are two watch device models, A2772 and A2773 (2857), with high degree of similarity, reference model FCC ID: BCG-A2772 and variant model **FCC ID: BCG-A2773**. Both models share the same material, form factor, circuit design, and components, including antennas and their locations. The reference and variant models use the same power tables and have same tune-up tolerances.

Per FCC approved Data Referencing Test Plan, testing was done fully on the reference model FCC ID: BCG-A2772, while radiated and conducted spot-check verification has been performed on variant model FCC ID: BCG-A2773. Spot-check measurements were conducted, all measurements were investigated and found to be within acceptable tolerance.

| Equipment Class | Reference Model FCC ID | Reference Report    | Report Title           |
|-----------------|------------------------|---------------------|------------------------|
| PCB             | BCGA2772               | 1C2205090038-02.BCG | RF Part 24 Test Report |

Table 1-1. Reference Model Details


Reference model FCC ID: BCG-A2772 test report has been included in Appendix A

### 1.2 Element Washington DC LLC Test Location

These measurement tests were conducted at the Element Washington DC LLC facility located at 18855 Adams Court, Morgan Hill, CA 95037. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014 and KDB 414788 D01 v01r01.

### 1.3 Test Facility / Accreditations

- Element Washington DC LLC is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- Element Washington DC LLC TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISSED Standards (RSS).
- Element Washington DC LLC facility is a registered (22831) test laboratory with the site description on file with ISSED.

|   |   |                               |                                   |
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## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Watch FCC ID: BCG-A2773**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 24.

**Test Device Serial No.:** TJFKGJC903, D3FRX404K1, DLCHD00F1V5X

### 2.2 Device Capabilities

This device contains the following capabilities:

850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 802.11a/n UNII, Bluetooth (1x, EDR, HDR4, HDR8, LE1M, LE2M), NFC, UWB, 60.5GHz Transmitter.

### 2.3 Antenna Description

Following antenna gains provided by manufacturer were used for testing.


| Band          | Antenna Gain (dBi) |
|---------------|--------------------|
|               | Antenna FCM        |
| LTE Band 25/2 | -10.8              |
| WCDMA 1900    | -10.8              |

**Table 2-1. Highest Antenna Gain**

### 2.4 Test Support Equipment

|   |                        |        |               |      |                   |
|---|------------------------|--------|---------------|------|-------------------|
| 1 | Apple Macbook          | Model: | A1398         | S/N: | C2QKP008F6F3      |
|   | w/AC/DC Adapter        | Model: | A1435         | S/N: | N/A               |
| 2 | Apple USB-C cable      | Model: | N/A           | S/N: | N/A               |
|   | w/ Charging Dock       | Model: | N/A           | S/N: | DQ812910BBG08V22H |
|   | w/ Cradle              | Model: | LA2-AC-SM-P1  | S/N: | FV40423073CMW6M3J |
| 3 | Apple Magnetic Charger | Model: | A2515         | S/N: | DLC035200UJMFROAJ |
|   | Apple Magnetic Charger | Model: | A2515         | S/N: | DLC035202KRMFROA2 |
| 4 | Pathfinder Falcon      | Model: | 920-098626-01 | S/N: | DLC03770065Q6PM1W |
|   | SiP Socket             | Model: | N/A           | S/N: | P1 X2539S PF 101  |
| 5 | DC Power Supply        | Model: | KPS3010D      | S/N: | N/A               |
| 6 | Store Sample Wristband | Model: | N/A           | S/N: | DLC219400361YDQ2W |

**Table 2-2. Test Support Equipment**

|   |   |                               |  |                                   |
|---|---|-------------------------------|--|-----------------------------------|
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## 2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.26 2015, TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated emissions tests.

The worst case configuration was investigated for all combinations of the two materials, aluminum, and stainless steel, and various types of wristbands, metal and non-metal wristbands. The EUT was also investigated with and without wireless charger. The worst case configuration found was used for all testing.

For emissions from 1GHz – 18GHz, low, mid, and high channels were tested with highest power and worst case configuration.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

This device only supports 27RBs or less for 16-QAM uplink.

Per FCC Approved Data Referencing Test Plan, Antenna C spot-check measurements have been conducted and reported. Spot-check Test Plan can be referred to below Table 2-3.

| Technology | Test Case                           | FCC ID: BCG-A2773  |                |
|------------|-------------------------------------|--|----------------|
|            |                                     | Mode   | Channel        |
| WCDMA, LTE | Radiated Spurious Emissions (>1GHz) | LTE Band 5, 2, 7<br>Max BW, 1RB, QPSK  | Low, Mid, High |
| WCDMA, LTE | Conducted Power                     | ALL Certified Bands:<br>Highest BW only, 1 RB,<br>Modulation<br>with the highest power | Mid            |

**Table 2-3. FCC Approved Spot-Check Test Plan**


Output powers were measured and confirmed to be consistent between Reference and Variant models prior to testing.

## 2.6 Software and Firmware

The test was conducted with firmware version watchOS 9.0 installed on the EUT.

## 2.7 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

|   |   |                               |                                   |
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## 3.0 DESCRIPTION OF TESTS

### 3.1 Measurement Procedure

The measurement procedures described in the document titled "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI C63.26-2015/TIA-603-E-2016) and "Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems" (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

### 3.2 Radiated Spurious Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

For radiated spurious emissions measurements and calculations, conversion method is used per the formulas in KDB 971168 Section 5.8.4. Field Strength (EIRP) is calculated using the following formulas:

$$E_{[dB\mu V/m]} = \text{Measured amplitude level}_{[dBm]} + 107 + \text{Cable Loss}_{[dB]} + \text{Antenna Factor}_{[dB/m]}$$

And


$$\text{EIRP}_{[dBm]} = E_{[dB\mu V/m]} + 20\log D - 104.8;$$

Where D is the measurement distance in meters.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014.

Per KDB 414788 D01 v01r01, radiated emission test sites other than open-field test sites (e.g., shielded anechoic chambers), may be employed for emission measurements below 30MHz if characterized so that the measurements correspond to those obtained at an open-field test site. To determine test site equivalency, a reference sample transmitting at 149kHz was measured on an open field test site (asphalt with no ground plane) and then measured in the 3m semi-anechoic chamber. A calibrated 60cm loop antenna was used while the reference device was rotated through the X, Y and Z axis in order to capture the worst case level. A maximum deviation of 2.77dB at 149kHz was measured when comparing the 3 meter semi-anechoic chamber to the open field site.

Radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI C63.26-2015 and TIA-603-E-2016.

|   |   |                               |                                   |
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## 4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.23-2012. All measurement uncertainty values are shown with a coverage factor of  $k = 2$  to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

| Contribution                      | Expanded Uncertainty ( $\pm$ dB) |
|-----------------------------------|----------------------------------|
| Conducted Bench Top Measurements  | 1.77                             |
| Radiated Disturbance (<30MHz)     | 4.38                             |
| Radiated Disturbance (30MHz-1GHz) | 4.75                             |
| Radiated Disturbance (1-18GHz)    | 5.20                             |
| Radiated Disturbance (>18GHz)     | 4.72                             |

|   |   |                                   |
|---|---|-----------------------------------|
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## 5.0 TEST EQUIPMENT CALIBRATION DATA


Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

| Manufacturer         | Model       | Description                                    | Cal Date   | Cal Interval | Cal Due    | Serial Number |
|----------------------|-------------|--|------------|--------------|------------|---------------|
| Agilent Technologies | N9030A      | 3Hz-44GHz PXA Signal Analyzer                  | 6/10/2022  | Annual       | 6/10/2023  | MY49430244    |
| ATM                  | 180-442A-KF | 20dB Nominal Gain Horn Antenna                 | 8/13/2021  | Annual       | 8/13/2022  | T058701-01    |
| ESPEC                | SU-241      | Tabletop Temperature Chamber                   | 10/26/2021 | Annual       | 10/26/2022 | 92009574      |
| ETS-Lindgren         | 3142E       | BiConiLog Antenna (30MHz - 6GHz)               | 10/21/2021 | Annual       | 10/21/2022 | 208204        |
| ETS-Lindgren         | 3117        | Double Ridged Guide Antenna (1-18 GHz)         | 5/11/2022  | Annual       | 5/11/2023  | 205956        |
| Keysight Technology  | N9040B      | UXA Signal Analyzer                            | 2/8/2022   | Annual       | 2/8/2023   | MY57212015    |
| Rohde & Schwarz      | TS-PR18     | Pre-Amplifier (1GHz - 18GHz)                   | 1/6/2022   | Annual       | 1/6/2023   | 101639        |
| Rohde & Schwarz      | FSV40       | Signal Analyzer (10Hz-40GHz)                   | 3/4/2022   | Annual       | 3/4/2023   | 101619        |
| Rohde & Schwarz      | ESW26       | EMI Test Receiver                              | 5/19/2022  | Annual       | 5/19/2023  | 101299        |
| Rohde & Schwarz      | TS-PR8      | Pre-Amplifier (30MHz - 8GHz)                   | 1/6/2022   | Annual       | 1/6/2023   | 102327        |
| Rohde & Schwarz      | ESW44       | EMI Test Receiver                              | 12/2/2021  | Annual       | 12/2/2022  | 101570        |
| Rohde & Schwarz      | CMW500      | Wideband Radio Communication Tester            | 10/11/2021 | Annual       | 10/11/2022 | 161616        |
| Rohde & Schwarz      | CMW500      | Wideband Radio Communication Tester            | 11/4/2021  | Annual       | 11/4/2022  | 151888        |
| Rohde & Schwarz      | TS-PR1840   | Pre-Amplifier (18GHz - 40GHz)                  | 4/18/2022  | Annual       | 4/18/2023  | 100050        |
| Rohde & Schwarz      | TC-TA18     | Cross Polarized Vivaldi Antenna (400MHz-18GHz) | 1/25/2022  | Annual       | 1/25/2023  | 101063        |
| Rohde & Schwarz      | HFH2-Z2     | Loop Antenna                                   | 4/3/2022   | Annual       | 4/3/2023   | 100546        |

**Table 5-1. Test Equipment**

### Notes:

- For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

|   |   |                               |                                   |
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## 6.0 SAMPLE CALCULATIONS

### Spurious Radiated Emission

#### **Example: Spurious emission at 3700.40 MHz**

The receive spectrum analyzer reading at 3 meters with the EUT on the turntable was  $-81.0$  dBm. The gain of the substituted antenna is  $8.1$  dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of  $-81.0$  dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is  $2.0$  dB at  $3700.40$  MHz. So  $6.1$  dB is added to the signal generator reading of  $-30.9$  dBm yielding  $-24.80$  dBm. The fundamental EIRP was  $25.50$  dBm so this harmonic was  $25.50$  dBm  $- (-24.80) = 50.3$  dBc.

|   |   |                               |                                   |
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## 7.0 TEST RESULTS (SPOT-CHECK DATA)


### 7.1 Summary

Company Name: Apple Inc.  
 FCC ID: BCG-A2773  
 FCC Classification: PCS Licensed Transmitter Worn on Body (PCT)  
 Mode(s): WCDMA/LTE

| Technology  | Test Configurations         |            |                |         |                             | Reference Model   | Variant Model     | Delta        |
|-------------|-----------------------------|------------|----------------|---------|-----------------------------|-------------------|-------------------|--------------|
|             | Test Description            | Modulation | BW / RB Config | Channel | Measurement Frequency [MHz] | FCC ID: BCG-A2772 | FCC ID: BCG-A2773 | Average [dB] |
|             |                             |            |                |         |                             | Average [dBm]     | Average [dBm]     |              |
| LTE B2      | Radiated Spurious Emissions | QPSK       | 20 MHz         | L       | 5580                        | -49.57            | -50.45            | 0.88         |
| LTE B2      | Radiated Spurious Emissions | QPSK       | 20 MHz         | M       | 5647.5                      | -51.85            | -52.80            | 0.95         |
| LTE B2      | Radiated Spurious Emissions | QPSK       | 20 MHz         | H       | 5715                        | -49.39            | -50.33            | 0.94         |
| LTE Band 2  | Conducted Powers            | QPSK       | 20MHz / 1/0 RB | M       | 1882.5                      | 13.34             | 13.46             | 0.12         |
| LTE Band 25 | Conducted Powers            | QPSK       | 20MHz / 1/0 RB | M       | 1882.5                      | 13.29             | 13.19             | 0.10         |
| WCDMA B2    | Conducted Powers            | QPSK       | 5MHz           | M       | 1880.0                      | 13.20             | 13.09             | 0.11         |

**Table 7-1. Worst Case Spot-Check Results**

Spot-checks were conducted, all measurements were investigated and found to be within acceptable tolerance in accordance with FCC Approved Data Referencing Test Plan.

|   |   |                               |                                   |
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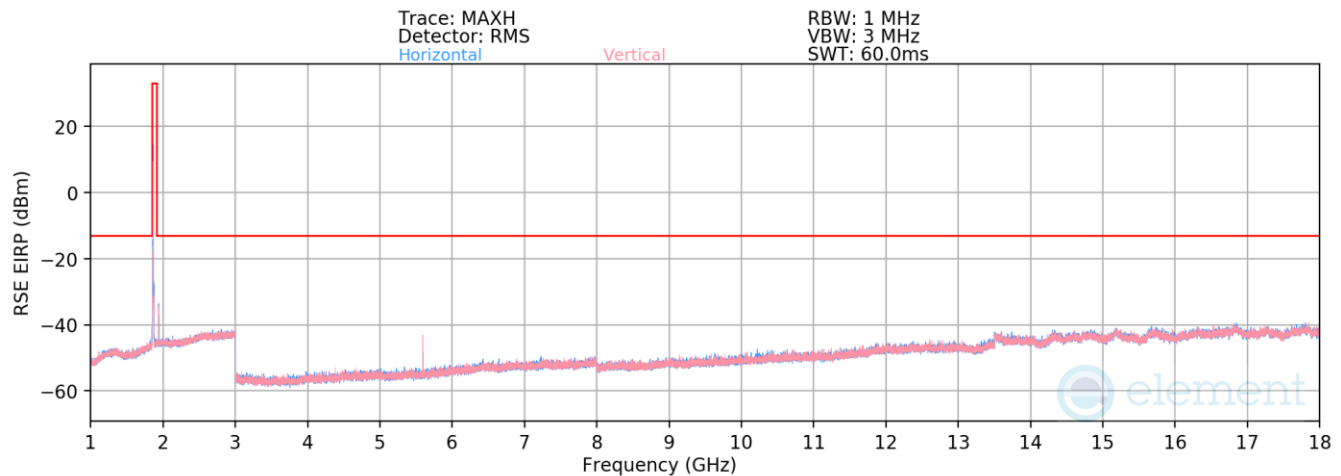
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## 7.2 Radiated Spurious Emissions

§2.1053, 24.238(a)

### LTE



Plot 7-1. Radiated Spurious Emission above 1GHz (LTE Band 2)

|                  |        |
|------------------|--------|
| Bandwidth (MHz): | 20     |
| Frequency (MHz): | 1860.0 |
| RB / Offset:     | 1 / 50 |


| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Analyzer Level [dBm] | AFCL [dB/m] | Field Strength [dBμV/m] | EIRP Spurious Emission Level [dBm] | Limit [dBm] | Margin [dB] |
|-----------------|-----------------|---------------------|----------------------------|----------------------|-------------|-------------------------|------------------------------------|-------------|-------------|
| 3720.0          | V               | -                   | -                          | -79.42               | 5.57        | 33.15                   | -62.11                             | -13.00      | -49.11      |
| 5580.0          | V               | 288                 | 147                        | -70.12               | 7.93        | 44.81                   | -50.45                             | -13.00      | -37.45      |
| 7440.0          | V               | -                   | -                          | -81.24               | 10.74       | 36.50                   | -58.76                             | -13.00      | -45.76      |
| 9300.0          | V               | -                   | -                          | -82.15               | 12.65       | 37.50                   | -57.76                             | -13.00      | -44.76      |
| 11160.0         | V               | -                   | -                          | -82.91               | 15.73       | 39.82                   | -55.44                             | -13.00      | -42.44      |

Table 7-2. Radiated Spurious Data (LTE Band 2 – Low Channel)

|                  |        |
|------------------|--------|
| Bandwidth (MHz): | 20     |
| Frequency (MHz): | 1882.5 |
| RB / Offset:     | 1 / 50 |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Analyzer Level [dBm] | AFCL [dB/m] | Field Strength [dBμV/m] | EIRP Spurious Emission Level [dBm] | Limit [dBm] | Margin [dB] |
|-----------------|-----------------|---------------------|----------------------------|----------------------|-------------|-------------------------|------------------------------------|-------------|-------------|
| 3765.0          | H               | 167                 | 62                         | -77.02               | 5.41        | 35.39                   | -59.87                             | -13.00      | -46.87      |
| 5647.5          | V               | 274                 | 143                        | -72.53               | 7.98        | 42.45                   | -52.80                             | -13.00      | -39.80      |
| 7530.0          | V               | -                   | -                          | -81.66               | 10.91       | 36.25                   | -59.00                             | -13.00      | -46.00      |
| 9412.5          | V               | -                   | -                          | -82.00               | 13.31       | 38.31                   | -56.95                             | -13.00      | -43.95      |
| 11295.0         | V               | -                   | -                          | -82.93               | 16.02       | 40.09                   | -55.17                             | -13.00      | -42.17      |

Table 7-3. Radiated Spurious Data (LTE Band 2 – Mid Channel)

|   |   |                               |                                   |
|---|---|-------------------------------|-----------------------------------|
| FCC ID: BCG-A2773                       |  | PART 22 DATA REFERENCE REPORT | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090039-02.BCG | Test Dates:<br>5/4/2022 - 8/10/2022   | EUT Type:<br>Watch            | Page 11 of 15                     |


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|                  |        |
|------------------|--------|
| Bandwidth (MHz): | 20     |
| Frequency (MHz): | 1900.0 |
| RB / Offset:     | 1 / 50 |

| Frequency [MHz] | Ant. Pol. [H/V] | Antenna Height [cm] | Turntable Azimuth [degree] | Analyzer Level [dBm] | AFCL [dB/m] | Field Strength [dBμV/m] | EIRP Spurious Emission Level [dBm] | Limit [dBm] | Margin [dB] |
|-----------------|-----------------|---------------------|----------------------------|----------------------|-------------|-------------------------|------------------------------------|-------------|-------------|
| 3800.00         | V               | -                   | -                          | -80.12               | 5.81        | 32.69                   | -62.57                             | -13.00      | -49.57      |
| 5700.00         | V               | 284                 | 151                        | -70.31               | 8.24        | 44.93                   | -50.33                             | -13.00      | -37.33      |
| 7600.00         | V               | -                   | -                          | -81.12               | 10.88       | 36.76                   | -58.50                             | -13.00      | -45.50      |
| 9500.00         | V               | -                   | -                          | -82.24               | 13.28       | 38.04                   | -57.21                             | -13.00      | -44.21      |
| 11400.00        | V               | -                   | -                          | -82.91               | 15.74       | 39.83                   | -55.43                             | -13.00      | -42.43      |

**Table 7-4. Radiated Spurious Data (LTE Band 2 – High Channel)**

|   |  |                                   |
|---|--|-----------------------------------|
| FCC ID: BCG-A2773                       |  <b>PART 22 DATA REFERENCE REPORT</b> | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090039-02.BCG | Test Dates:<br>5/4/2022 - 8/10/2022  | EUT Type:<br>Watch                |
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### 7.3 Antenna BCM – ERP/EIRP

#### LTE-B2

| Bandwidth | Mod. | Frequency [MHz] | Ant. Gain [dBi] | RB Size/Offset | Conducted Power [dBm] | ERP [dBm] | EIRP [mW] | EIRP Limit [dBm] | Margin [dB] |
|-----------|------|-----------------|-----------------|----------------|-----------------------|-----------|-----------|------------------|-------------|
| 20 MHz    | QPSK | 1880.0          | -10.80          | 1 / 0          | 24.26                 | 13.46     | 22.182    | 33.01            | -19.55      |

Table 7-5. Antenna BCM ERP/EIRP Data (LTE Band 2)

#### LTE-B25


| Bandwidth | Mod. | Frequency [MHz] | Ant. Gain [dBi] | RB Size/Offset | Conducted Power [dBm] | EIRP [dBm] | EIRP [mW] | EIRP Limit [dBm] | Margin [dB] |
|-----------|------|-----------------|-----------------|----------------|-----------------------|------------|-----------|------------------|-------------|
| 20 MHz    | QPSK | 1882.5          | -10.80          | 1 / 0          | 23.99                 | 13.19      | 20.845    | 33.01            | -19.82      |

Table 7-6. Antenna BCM ERP/EIRP Data (LTE Band 25)

#### WCDMA B2

| Frequency [MHz] | Mode      | Conducted Power [dBm] | Ant. Gain [dBi] | EIRP [dBm] | EIRP [mW] | EIRP Limit [dBm] | Margin [dB] |
|-----------------|-----------|-----------------------|-----------------|------------|-----------|------------------|-------------|
| 1880.00         | WCDMA1900 | 23.89                 | -10.80          | 13.09      | 20.370    | 33.01            | -19.92      |

Table 7-7. Antenna BCM ERP/EIRP Data (WCDMA Band 2)


|   |   |                               |  |                                   |
|---|---|-------------------------------|--|-----------------------------------|
| FCC ID: BCG-A2773                       |  | PART 22 DATA REFERENCE REPORT |  | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090039-02.BCG | Test Dates:<br>5/4/2022 - 8/10/2022   | EUT Type:<br>Watch            |  | Page 13 of 15                     |

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## 8.0 CONCLUSION

The spot-check data measured for variant model **FCC ID: BCG-A2773** is in tolerance with reference model FCC ID: BCG-A2772 per FCC Approved Data Referencing Test Plan.


|  |   |                                      |  |
|--|---|--------------------------------------|--|
| <b>FCC ID:</b> BCG-A2773                       |  | <b>PART 22 DATA REFERENCE REPORT</b> | <b>Approved by:</b><br>Technical Manager |
| <b>Test Report S/N:</b><br>1C2205090039-02.BCG | <b>Test Dates:</b><br>5/4/2022 - 8/10/2022  | <b>EUT Type:</b><br>Watch            | Page 14 of 15                            |

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## 9.0 APPENDIX A: REFERENCE MODEL TEST REPORT

Attached is the test report (1C2205090038-02.BCG) from reference model FCC ID: BCG-A2772, which includes referenced data results.

|   |   |                               |                                   |
|---|---|-------------------------------|-----------------------------------|
| FCC ID: BCG-A2773                       |  element | PART 22 DATA REFERENCE REPORT | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090039-02.BCG | Test Dates:<br>5/4/2022 - 8/10/2022   | EUT Type:<br>Watch            | Page 15 of 15                     |

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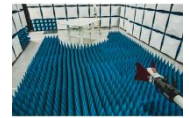


## Element Washington DC LLC

18855 Adams Court, Morgan Hill, CA 95037 USA

Tel. 410.290.6652 / Fax 410.290.6654

<http://www.element.com>



### PART 24 MEASUREMENT REPORT

**Applicant Name:**

Apple Inc.  
One Apple Park Way  
Cupertino, CA 95014  
United States

**Date of Testing:**

6/7/2022 - 8/17/2022

**Test Site/Location:**

Element Washington DC LLC.  
Morgan Hill, CA, USA

**Test Report Serial No.:**

1C2205090038-02.BCG

**FCC ID:**

**BCG-A2772**

**Applicant Name:**

**Apple Inc.**

**Application Type:**

Certification

**Model:**

A2772

**EUT Type:**

Watch

**FCC Classification:**

PCS Licensed Transmitter Worn on Body (PCT)

**FCC Rule Part:**

24

**Test Procedure(s):**

ANSI C63.26-2015, TIA-603-E-2016, KDB 971168 D01 v03r01

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RJ Ortanez

Executive Vice President



|  |  |  |
|--|--|--|
| <b>FCC ID:</b> BCG-A2772                       | <b>PART 24 MEASUREMENT REPORT</b>          | <b>Approved by:</b><br>Technical Manager |
| <b>Test Report S/N:</b><br>1C2205090038-02.BCG | <b>Test Dates:</b><br>6/7/2022 - 8/17/2022 | <b>EUT Type:</b><br>Watch                |
|  |  | Page 1 of 90                             |


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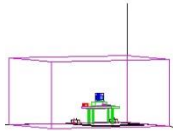
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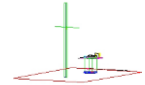
|  |   |                                   |  |
|--|---|-----------------------------------|--|
| <b>FCC ID:</b> BCG-A2772                       |  | <b>PART 24 MEASUREMENT REPORT</b> | <b>Approved by:</b><br>Technical Manager |
| <b>Test Report S/N:</b><br>1C2205090038-02.BCG | <b>Test Dates:</b><br>6/7/2022 - 8/17/2022  | <b>EUT Type:</b><br>Watch         | Page 2 of 90                             |

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## PART 24 MEASUREMENT REPORT



| Mode      | Bandwidth | Modulation      | Tx Frequency Range [MHz] | OBW [MHz] | PAR at 0.1% [dB] | EIRP            |                  | Emission Designator |
|-----------|-----------|-----------------|--------------------------|-----------|------------------|-----------------|------------------|---------------------|
|           |           |                 |                          |           |                  | Max. Power [mW] | Max. Power [dBm] |                     |
| WCDMA1900 | 5 MHz     | Spread Spectrum | 1852.4 - 1907.6          | 4.1049    | 3.29             | 20.893          | 13.20            | 4M10F9W             |
| Band 2    | 1.4 MHz   | QPSK            | 1850.7 - 1914.3          | 1.1021    | 5.31             | 22.336          | 13.49            | 1M10G7W             |
|           |           | 16QAM           | 1850.7 - 1914.3          | 1.1105    | 6.10             | 18.836          | 12.75            | 1M11D7W             |
|           | 3 MHz     | QPSK            | 1851.5 - 1913.5          | 2.7205    | 5.40             | 22.029          | 13.43            | 2M72G7W             |
|           |           | 16QAM           | 1851.5 - 1913.5          | 2.7351    | 6.21             | 18.923          | 12.77            | 2M74D7W             |
|           | 5 MHz     | QPSK            | 1852.5 - 1912.5          | 4.5550    | 5.39             | 22.284          | 13.48            | 4M56G7W             |
|           |           | 16QAM           | 1852.5 - 1912.5          | 4.5637    | 6.12             | 19.543          | 12.91            | 4M56D7W             |
|           | 10MHz     | QPSK            | 1855 - 1910              | 9.1332    | 5.31             | 21.827          | 13.39            | 9M13G7W             |
|           |           | 16QAM           | 1855 - 1910              | 5.4556    | 5.93             | 19.143          | 12.82            | 5M46D7W             |
|           | 15 MHz    | QPSK            | 1857.5 - 1907.5          | 13.6128   | 5.62             | 22.751          | 13.57            | 13M6G7W             |
|           |           | 16QAM           | 1857.5 - 1907.5          | 6.5549    | 6.17             | 19.187          | 12.83            | 6M55D7W             |
|           | 20 MHz    | QPSK            | 1860 - 1905              | 18.2006   | 5.33             | 22.803          | 13.58            | 18M2G7W             |
|           |           | 16QAM           | 1860 - 1905              | 8.4889    | 6.16             | 19.409          | 12.88            | 8M49D7W             |
| Band 25   | 1.4 MHz   | QPSK            | 1850.7 - 1914.3          | 1.1021    | 5.36             | 23.014          | 13.62            | 1M10G7W             |
|           |           | 16QAM           | 1850.7 - 1914.3          | 1.1105    | 6.12             | 19.011          | 12.79            | 1M11D7W             |
|           | 3 MHz     | QPSK            | 1851.5 - 1913.5          | 2.7205    | 5.46             | 21.979          | 13.42            | 2M72G7W             |
|           |           | 16QAM           | 1851.5 - 1913.5          | 2.7351    | 6.25             | 19.588          | 12.92            | 2M74D7W             |
|           | 5 MHz     | QPSK            | 1852.5 - 1912.5          | 4.5550    | 5.42             | 21.878          | 13.40            | 4M56G7W             |
|           |           | 16QAM           | 1852.5 - 1912.5          | 4.5637    | 6.15             | 18.836          | 12.75            | 4M56D7W             |
|           | 10 MHz    | QPSK            | 1855 - 1910              | 9.1332    | 5.38             | 21.777          | 13.38            | 9M13G7W             |
|           |           | 16QAM           | 1855 - 1910              | 5.4556    | 6.01             | 19.999          | 13.01            | 5M46D7W             |
|           | 15 MHz    | QPSK            | 1857.5 - 1907.5          | 13.6128   | 5.72             | 22.699          | 13.56            | 13M6G7W             |
|           |           | 16QAM           | 1857.5 - 1907.5          | 6.5549    | 6.19             | 19.724          | 12.95            | 6M55D7W             |
|           | 20 MHz    | QPSK            | 1860 - 1905              | 18.2006   | 5.38             | 22.803          | 13.58            | 18M2G7W             |
|           |           | 16QAM           | 1860 - 1905              | 8.4889    | 6.22             | 19.543          | 12.91            | 8M49D7W             |

### EUT Overview

|   |   |                    |                                   |
|---|---|--------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  <b>PART 24 MEASUREMENT REPORT</b> |                    | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022   | EUT Type:<br>Watch | Page 3 of 90                      |

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## 1.0 INTRODUCTION

### 1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.


### 1.2 Element Washington DC LLC Test Location

These measurement tests were conducted at the Element Washington DC LLC facility located at 18855 Adams Court, Morgan Hill, CA 95037. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014 and KDB 414788 D01 v01r01.

### 1.3 Test Facility / Accreditations

Measurements were performed at Element Washington DC LLC located in Morgan Hill, CA 95037, U.S.A.

- Element Washington DC LLC is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- Element Washington DC LLC TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- Element Washington DC LLC facility is a registered (22831) test laboratory with the site description on file with ISED.

|   |   |                            |                                   |
|---|---|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
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## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Watch FCC ID:BCG-A2772**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 24.

**Test Device Serial No.:** MQ6GGJGYXC, N6QT4D147W, DLC215300991T0J31

### 2.2 Device Capabilities

This device contains the following capabilities:

850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 802.11a/n UNII, Bluetooth (1x, EDR, HDR4, HDR8, LE1M, LE2M), NFC, UWB, 60.5GHz Transmitter.

This device supports simultaneous transmission operations, which allows for multiple transmitters to transmit simultaneously on the same antenna. The table below shows all configurations possible.


| Simultaneous Tx Config | Antenna FCM  |                          |                    |            |            |
|------------------------|--------------|--------------------------|--------------------|------------|------------|
|                        | WLAN         | Bluetooth                | LTE/WCDMA          | UNII       | UWB        |
|                        | 802.11 b/g/n | BDR, EDR, HDR4/8, LE1/2M | Mid band/High band | 802.11 a/n | Ch.5, Ch.9 |
| Config 1               | ✓            | ✗                        | ✗                  | ✗          | ✓          |
| Config 2               | ✗            | ✓                        | ✗                  | ✗          | ✓          |
| Config 3               | ✗            | ✗                        | ✓                  | ✗          | ✓          |
| Config 4               | ✗            | ✓                        | ✓                  | ✗          | ✗          |
| Config 5               | ✓            | ✗                        | ✓                  | ✗          | ✗          |
| Config 6               | ✗            | ✗                        | ✓                  | ✓          | ✗          |
| Config 7               | ✗            | ✗                        | ✓                  | ✗          | ✓          |
| Config 8               | ✗            | ✓                        | ✓                  | ✗          | ✓          |
| Config 9               | ✓            | ✗                        | ✓                  | ✗          | ✓          |
| Config 10              | ✗            | ✓                        | ✓                  | ✓          | ✗          |

**Table 2-1. Simultaneous Transmission Configurations**

✓ = Support; ✗ = Not Support

#### Note:

All the above simultaneous transmission configurations have been tested and the worst case configuration was found to be config 10 and reported in RF UNII, RF Bluetooth and RF Part 27b test reports.

|  |   |                           |  |
|--|---|---------------------------|--|
| <b>FCC ID:</b> BCG-A2772                       |  <b>PART 24 MEASUREMENT REPORT</b> |                           | <b>Approved by:</b><br>Technical Manager |
| <b>Test Report S/N:</b><br>1C2205090038-02.BCG | <b>Test Dates:</b><br>6/7/2022 - 8/17/2022  | <b>EUT Type:</b><br>Watch | Page 5 of 90                             |

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## 2.3 Antenna Description

Following antenna gains provided by manufacturer were used for testing.

| Band          | Antenna Gain (dBi) |
|---------------|--------------------|
|               | Antenna FCM        |
| LTE Band 25/2 | -10.8              |
| WCDMA 1900    | -10.8              |


**Table 2-2. Highest Antenna Gain**

**Note:** Antenna Specifications has been attached to Appendix A

## 2.4 Test Support Equipment

|   |                        |        |               |      |                   |
|---|------------------------|--------|---------------|------|-------------------|
| 1 | Apple Macbook          | Model: | A1398         | S/N: | C2QKP008F6F3      |
|   | w/AC/DC Adapter        | Model: | A1435         | S/N: | N/A               |
| 2 | Apple USB-C cable      | Model: | N/A           | S/N: | N/A               |
|   | w/ Charging Dock       | Model: | N/A           | S/N: | DQ812910CU008V22F |
|   | w/ Cradle              | Model: | LA2-BD-LG-P1  | S/N: | N-0017525-02      |
| 3 | Apple Magnetic Charger | Model: | A2515         | S/N: | DLC035200UJMFR0AJ |
|   | Apple Magnetic Charger | Model: | A2515         | S/N: | DLC035202KRMFR0A2 |
| 4 | Pathfinder Falcon      | Model: | 920-098626-01 | S/N: | DLC03770065Q6PM1W |
|   | SiP Socket             | Model: | N/A           | S/N: | P1 X2539B PF096   |
| 5 | DC Power Supply        | Model: | KPS3010D      | S/N: | N/A               |
| 6 | Store Sample Wristband | Model: | N/A           | S/N: | DLC219400361YDQ2W |

**Table 2-3. Test Support Equipment**

|   |   |                            |  |                                   |
|---|---|----------------------------|--|-----------------------------------|
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## 2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.26-2015, TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

The worst case configuration was investigated for all combinations of the two materials, aluminum, and stainless steel, and various types of wristbands, metal and non-metal wristbands. The EUT was also investigated with and without wireless charger. The worst case configuration found was used for all testing.

For emissions from 1GHz – 18GHz, low, mid, and high channels were tested with highest power and worst case configuration. The emissions below 1GHz and above 18GHz were tested with the highest transmitting power and the worst case channel.


The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

## 2.6 Software and Firmware

The test was conducted with firmware version watchOS 9.0 installed on the EUT.

## 2.7 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

|  |   |  |
|--|---|--|
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## 3.0 DESCRIPTION OF TESTS

### 3.1 Evaluation Procedure

The measurement procedures described in the document titled "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI C63.26-2015/TIA-603-E-2016) and "Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems" (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

Deviation from Measurement Procedure.....None

### 3.2 Radiated Spurious Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

For radiated spurious emissions measurements and calculations, conversion method is used per the formulas in KDB 971168 Section 5.8.4. Field Strength (EIRP) is calculated using the following formulas:

$$E_{[dB\mu V/m]} = \text{Measured amplitude level}_{[dBm]} + 107 + \text{Cable Loss}_{[dB]} + \text{Antenna Factor}_{[dB/m]}$$


And

$$\text{EIRP}_{[dBm]} = E_{[dB\mu V/m]} + 20\log D - 104.8; \text{ where } D \text{ is the measurement distance in meters.}$$

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014.

Per KDB 414788 D01 v01r01, radiated emission test sites other than open-field test sites (e.g., shielded anechoic chambers), may be employed for emission measurements below 30MHz if characterized so that the measurements correspond to those obtained at an open-field test site. To determine test site equivalency, a reference sample transmitting at 149kHz was measured on an open field test site (asphalt with no ground plane) and then measured in the 3m semi-anechoic chamber. A calibrated 60cm loop antenna was used while the reference device was rotated through the X, Y and Z axis in order to capture the worst case level. A maximum deviation of 2.77dB at 149kHz was measured when comparing the 3 meter semi-anechoic chamber to the open field site.

Radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI C63.26-2015 and TIA-603-E-2016.


|   |   |                            |                                   |
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## 4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.23-2012. All measurement uncertainty values are shown with a coverage factor of  $k = 2$  to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

| Contribution                      | Expanded Uncertainty ( $\pm$ dB) |
|-----------------------------------|----------------------------------|
| Conducted Bench Top Measurements  | 1.77                             |
| Radiated Disturbance (<30MHz)     | 4.38                             |
| Radiated Disturbance (30MHz-1GHz) | 4.75                             |
| Radiated Disturbance (1-18GHz)    | 5.20                             |
| Radiated Disturbance (>18GHz)     | 4.72                             |

|   |  |                                   |
|---|--|-----------------------------------|
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## 5.0 TEST EQUIPMENT CALIBRATION DATA


Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

| Manufacturer         | Model       | Description                                    | Cal Date   | Cal Interval | Cal Due    | Serial Number |
|----------------------|-------------|--|------------|--------------|------------|---------------|
| Agilent Technologies | N9030A      | 3Hz-44GHz PXA Signal Analyzer                  | 6/10/2022  | Annual       | 6/10/2023  | MY49430244    |
| ATM                  | 180-442A-KF | 20dB Nominal Gain Horn Antenna                 | 8/13/2021  | Annual       | 8/13/2022  | T058701-01    |
| ESPEC                | SU-241      | Tabletop Temperature Chamber                   | 10/26/2021 | Annual       | 10/26/2022 | 92009574      |
| ETS-Lindgren         | 3142E       | BiConiLog Antenna (30MHz - 6GHz)               | 10/21/2021 | Annual       | 10/21/2022 | 208204        |
| ETS-Lindgren         | 3117        | Double Ridged Guide Antenna (1-18 GHz)         | 5/11/2022  | Annual       | 5/11/2023  | 205956        |
| Keysight Technology  | N9040B      | UXA Signal Analyzer                            | 2/8/2022   | Annual       | 2/8/2023   | MY57212015    |
| Rohde & Schwarz      | TS-PR18     | Pre-Amplifier (1GHz - 18GHz)                   | 1/6/2022   | Annual       | 1/6/2023   | 101639        |
| Rohde & Schwarz      | FSV40       | Signal Analyzer (10Hz-40GHz)                   | 3/4/2022   | Annual       | 3/4/2023   | 101619        |
| Rohde & Schwarz      | ESW26       | EMI Test Receiver                              | 5/19/2022  | Annual       | 5/19/2023  | 101299        |
| Rohde & Schwarz      | TS-PR8      | Pre-Amplifier (30MHz - 8GHz)                   | 1/6/2022   | Annual       | 1/6/2023   | 102327        |
| Rohde & Schwarz      | ESW44       | EMI Test Receiver                              | 12/2/2021  | Annual       | 12/2/2022  | 101570        |
| Rohde & Schwarz      | CMW500      | Wideband Radio Communication Tester            | 10/11/2021 | Annual       | 10/11/2022 | 161616        |
| Rohde & Schwarz      | CMW500      | Wideband Radio Communication Tester            | 11/4/2021  | Annual       | 11/4/2022  | 151888        |
| Rohde & Schwarz      | TS-PR1840   | Pre-Amplifier (18GHz - 40GHz)                  | 4/18/2022  | Annual       | 4/18/2023  | 100050        |
| Rohde & Schwarz      | TC-TA18     | Cross Polarized Vivaldi Antenna (400MHz-18GHz) | 1/25/2022  | Annual       | 1/25/2023  | 101063        |
| Rohde & Schwarz      | HFH2-Z2     | Loop Antenna                                   | 4/3/2022   | Annual       | 4/3/2023   | 100546        |

**Table 5-1. Test Equipment**

### Notes:

- For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

|   |   |                    |                                   |
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## 6.0 SAMPLE CALCULATIONS

### Emission Designator

#### WCDMA Emission Designator

**Emission Designator = 4M16F9W**

WCDMA BW = 4.16 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

#### QPSK Modulation

**Emission Designator = 8M62G7W**

BW = 8.62 MHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination of Any

#### QAM Modulation

**Emission Designator = 8M45D7W**

BW = 8.45 MHz

D = Amplitude/Angle Modulated


7 = Quantized/Digital Info

W = Combination of Any

### Spurious Radiated Emission

#### **Example: Spurious emission at 3700.40 MHz**

The receive spectrum analyzer reading at 3 meters with the EUT on the turntable was -81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of -81.0 dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 3700.40 MHz. So 6.1 dB is added to the signal generator reading of -30.9 dBm yielding -24.80 dBm. The fundamental EIRP was 25.50 dBm so this harmonic was 25.50 dBm - (-24.80) = 50.3 dBc.

|   |   |                            |                                   |
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## 7.0 TEST RESULTS

### 7.1 Summary


Company Name: Apple Inc.  
 FCC ID: BCG-A2772  
 FCC Classification: PCS Licensed Transmitter Worn on Body (PCT)  
 Mode(s): WCDMA/LTE

| Test Condition | Test Description   | FCC Part Section(s) | Test Limit  | Test Result | Reference              |
|----------------|--|---------------------|---|-------------|------------------------|
| CONDUCTED      | Occupied Bandwidth   | 2.1049              | N/A   | N/A         | Section 7.2            |
|                | Conducted Band Edge / Spurious Emissions                       | 2.1051, 24.238(a)   | -13 dBm at Band Edge and for all out-of-band emissions  | PASS        | Sections 7.3, 7.4      |
|                | Peak-Average Ratio   | 24.232(d)           | < 13 dB   | PASS        | Section 7.5            |
|                | Transmitter Conducted Output Power                             | 2.1046              | N/A   | N/A         | See RF Exposure Report |
|                | Frequency Stability  | 2.1055, 24.235      | Fundamental emissions stay within authorized frequency block over the temperature and voltage range as tested | PASS        | Section 7.8            |
|                | Effective Radiated Power / Equivalent Isotropic Radiated Power | 24.232(c)           | < 2 Watts max. EIRP   | PASS        | Section 7.6            |

**Table 7-1. Summary of Test Results**

#### Notes:

1. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2. The analyzer plots were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3. All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4. All conducted emissions measurements are performed with automated test software to capture the corresponding plots necessary to show compliance. The measurement software utilized is Element EMC Software Tool v1.1.

|   |   |                    |                                   |
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## 7.2 Occupied Bandwidth

**\$2.1049**

### Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

### Test Procedure Used

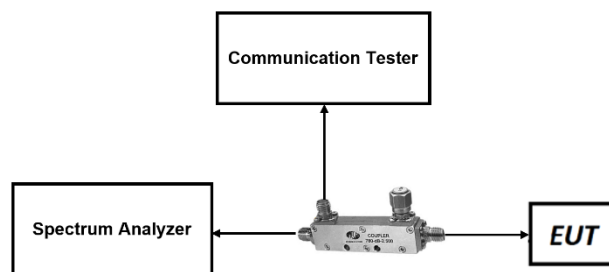
KDB 971168 D01 v03r01 – Section 4.2

### Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW  $\geq 3 \times$  RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

### Test Setup


The EUT and measurement equipment were set up as shown in the diagram below.



**Figure 7-1. Test Instrument & Measurement Setup**

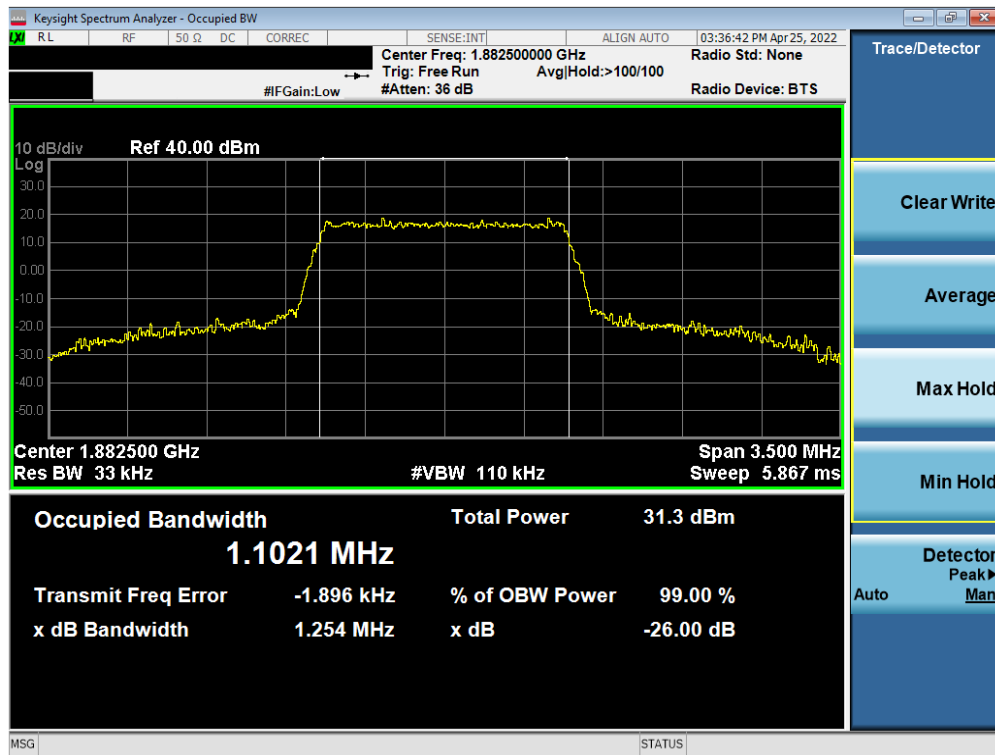
### Test Notes

None.

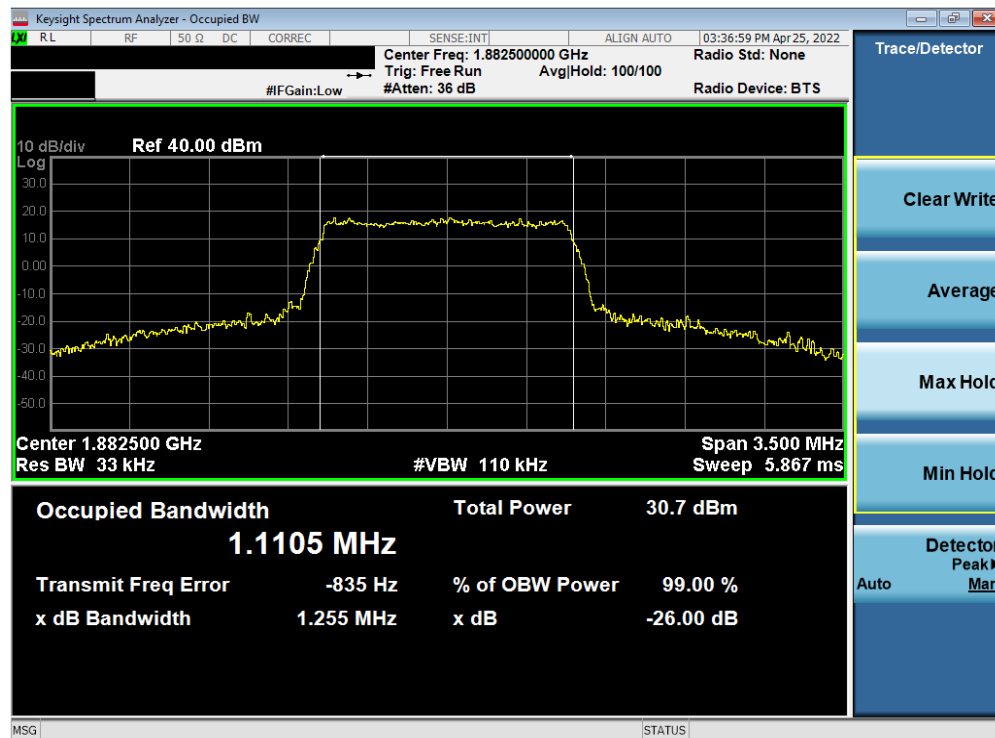
|   |   |                            |                                   |
|---|---|----------------------------|-----------------------------------|
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## LTE Band 25/2



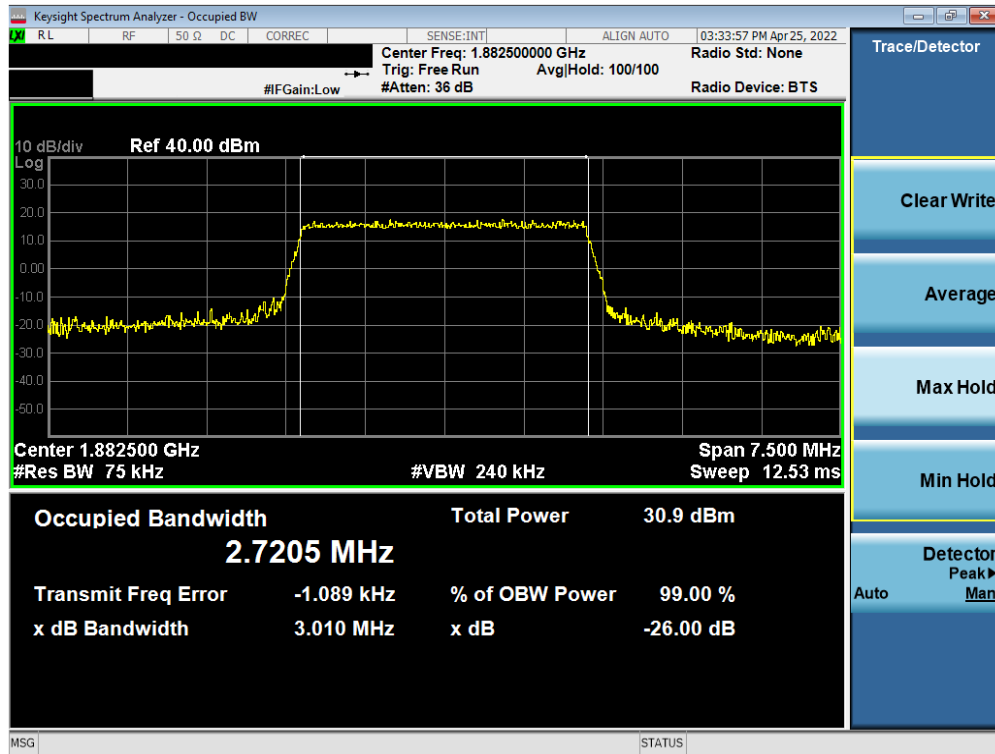
Plot 7-1. Occupied Bandwidth Plot (LTE Band 25/2 - 1.4MHz QPSK - Full RB Configuration)



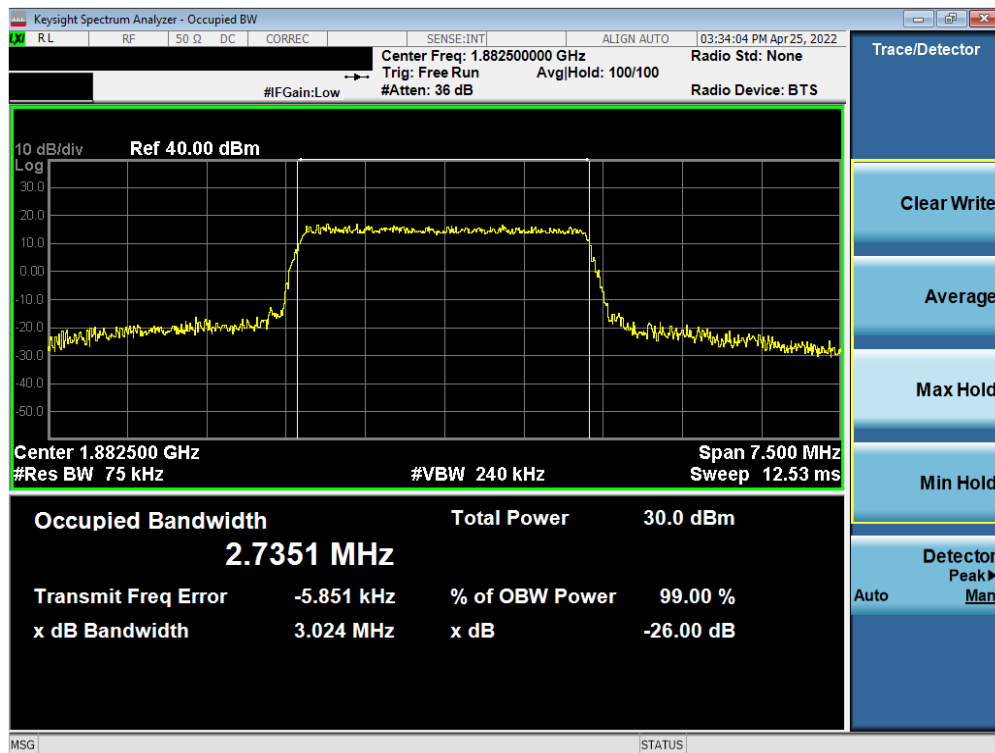
Plot 7-2. Occupied Bandwidth Plot (LTE Band 25/2 - 1.4MHz 16-QAM - Full RB Configuration)

|   |   |                            |                                   |
|---|---|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
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Plot 7-3. Occupied Bandwidth Plot (LTE Band 25/2 - 3MHz QPSK - Full RB Configuration)

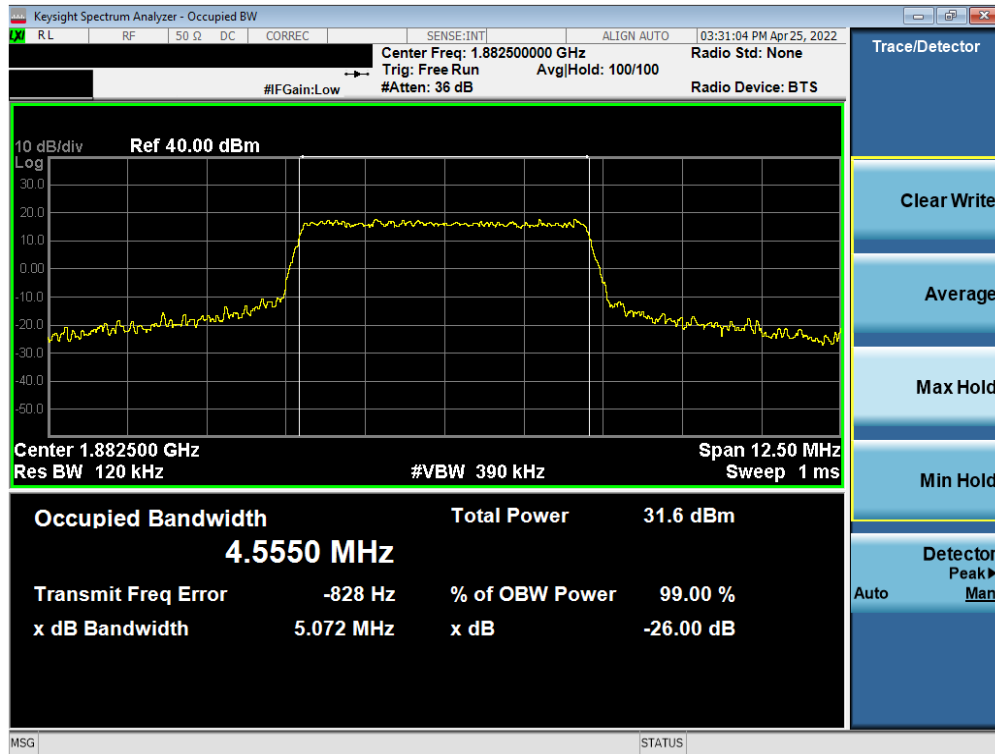


Plot 7-4. Occupied Bandwidth Plot (LTE Band 25/2 - 3MHz 16-QAM - Full RB Configuration)

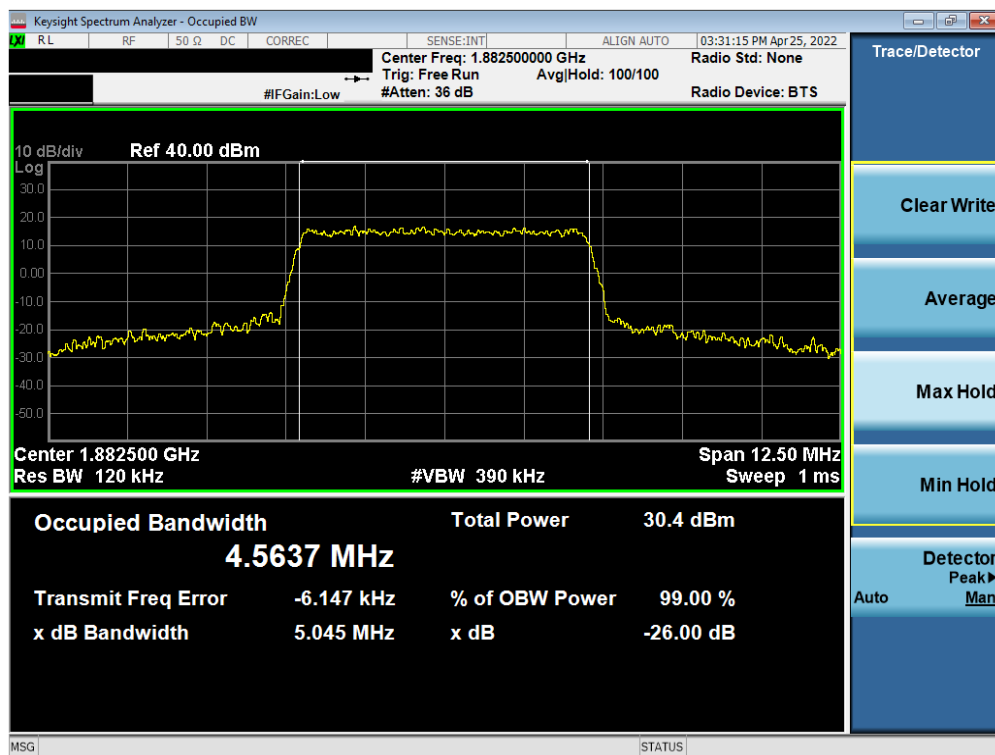
|   |   |                    |                                   |
|---|---|--------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  <b>PART 24 MEASUREMENT REPORT</b> |                    | Approved by:<br>Technical Manager |
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Plot 7-5. Occupied Bandwidth Plot (LTE Band 25/2 - 5MHz QPSK - Full RB Configuration)

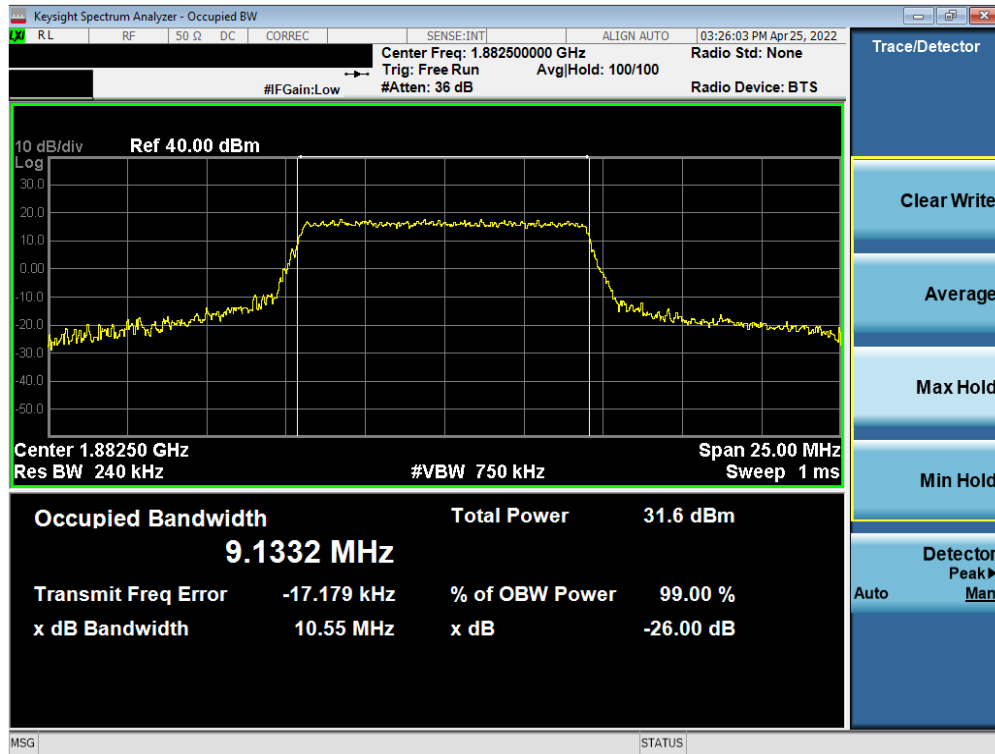


Plot 7-6. Occupied Bandwidth Plot (LTE Band 25/2 - 5MHz 16-QAM - Full RB Configuration)

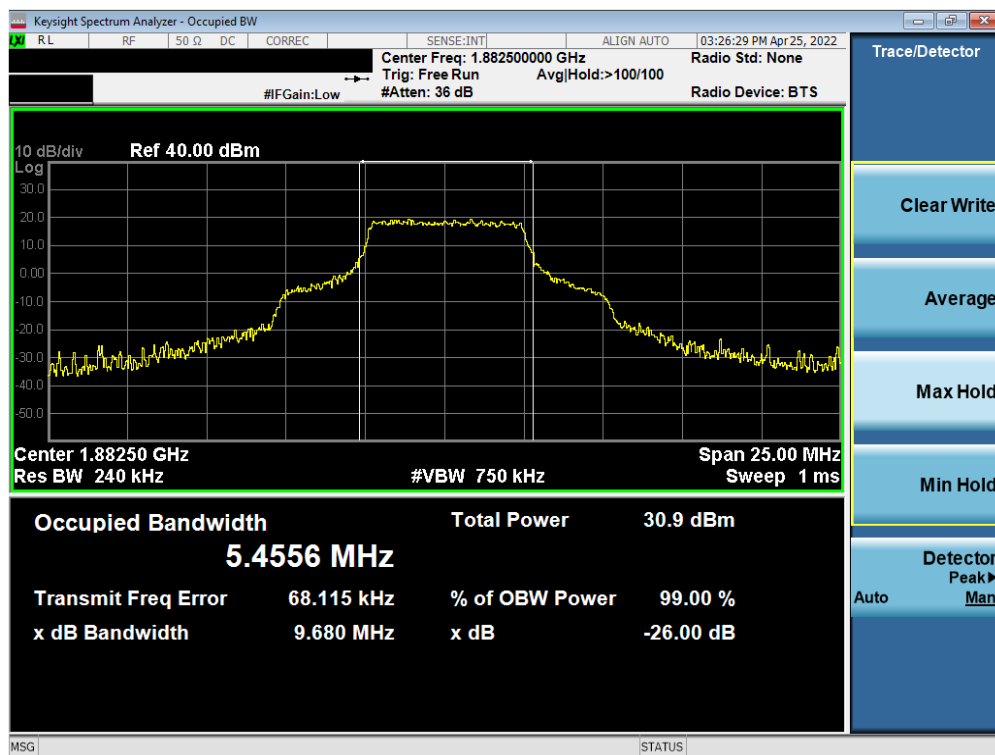
|   |   |                            |                                   |
|---|---|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
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Plot 7-7. Occupied Bandwidth Plot (LTE Band 25/2 - 10MHz QPSK - Full RB Configuration)

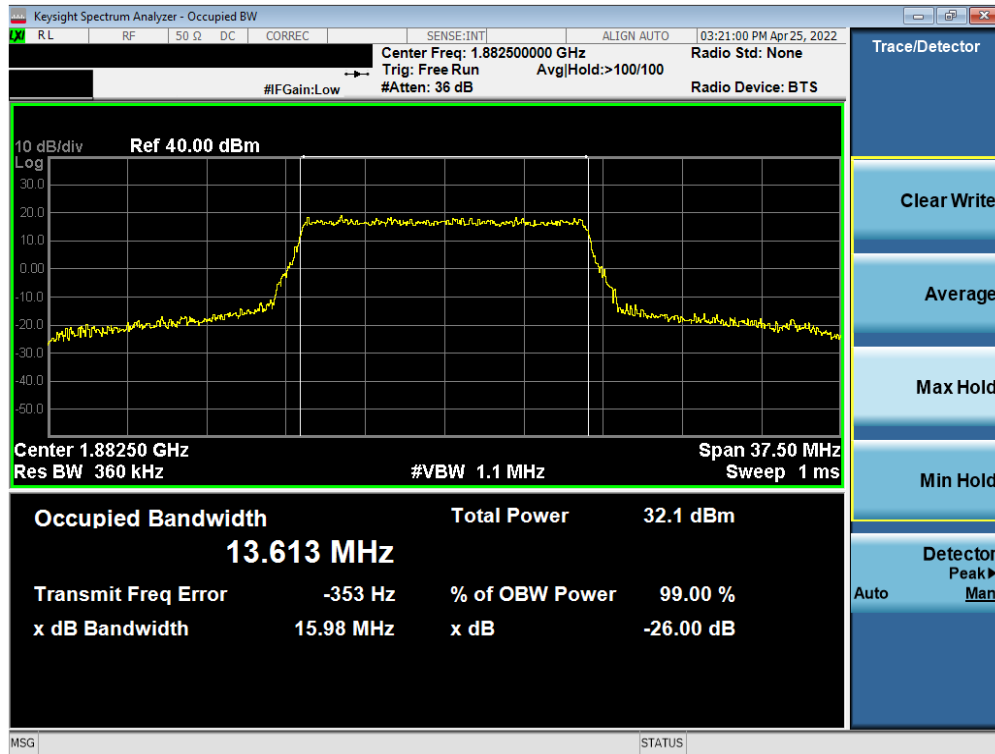


Plot 7-8. Occupied Bandwidth Plot (LTE Band 25/2 - 10MHz 16-QAM - Full RB Configuration)

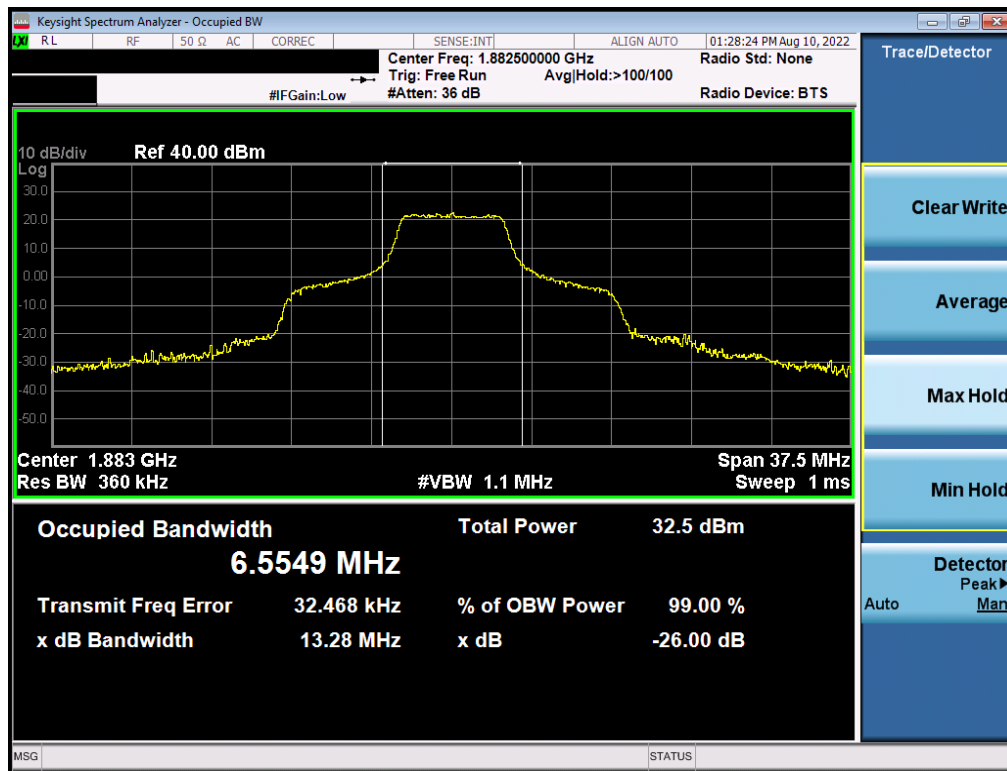
|   |   |                    |                                   |
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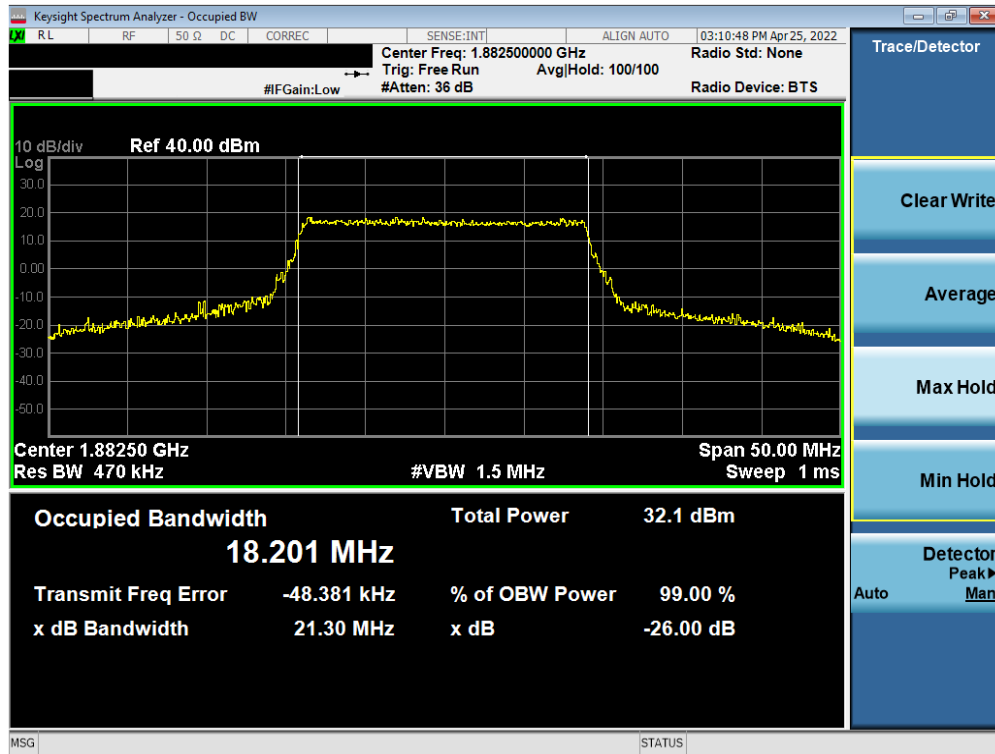


Plot 7-9. Occupied Bandwidth Plot (LTE Band 25/2 - 15MHz QPSK - Full RB Configuration)

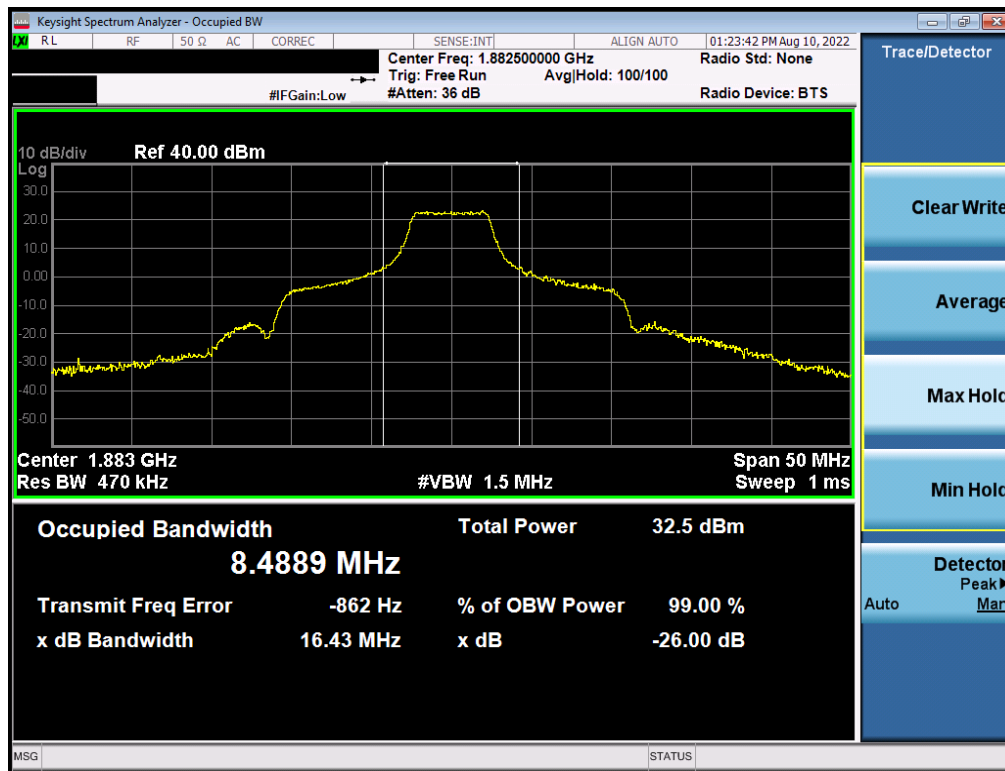


Plot 7-10. Occupied Bandwidth Plot (LTE Band 25/2 - 15MHz 16-QAM - Full RB Configuration)

|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
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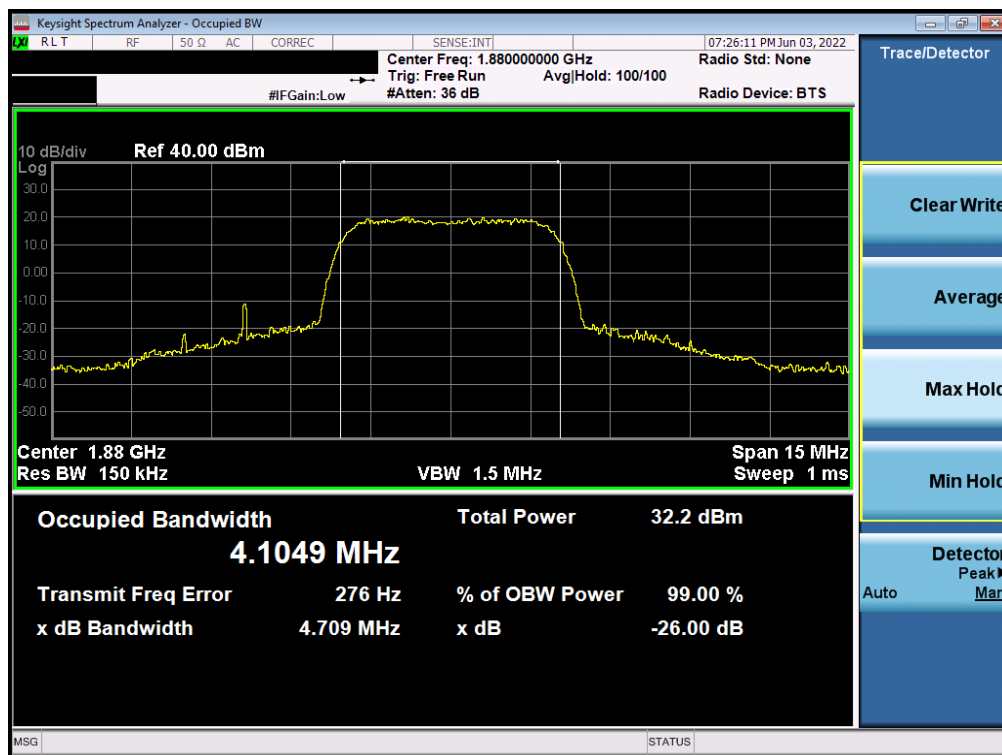


Plot 7-11. Occupied Bandwidth Plot (LTE Band 25/2 - 20MHz QPSK - Full RB Configuration)




Plot 7-12. Occupied Bandwidth Plot (LTE Band 25/2 - 20MHz 16-QAM - Full RB Configuration)

|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
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Plot 7-13. Occupied Bandwidth Plot (WCDMA, Ch. 9400)

|   |   |                    |                                   |
|---|---|--------------------|-----------------------------------|
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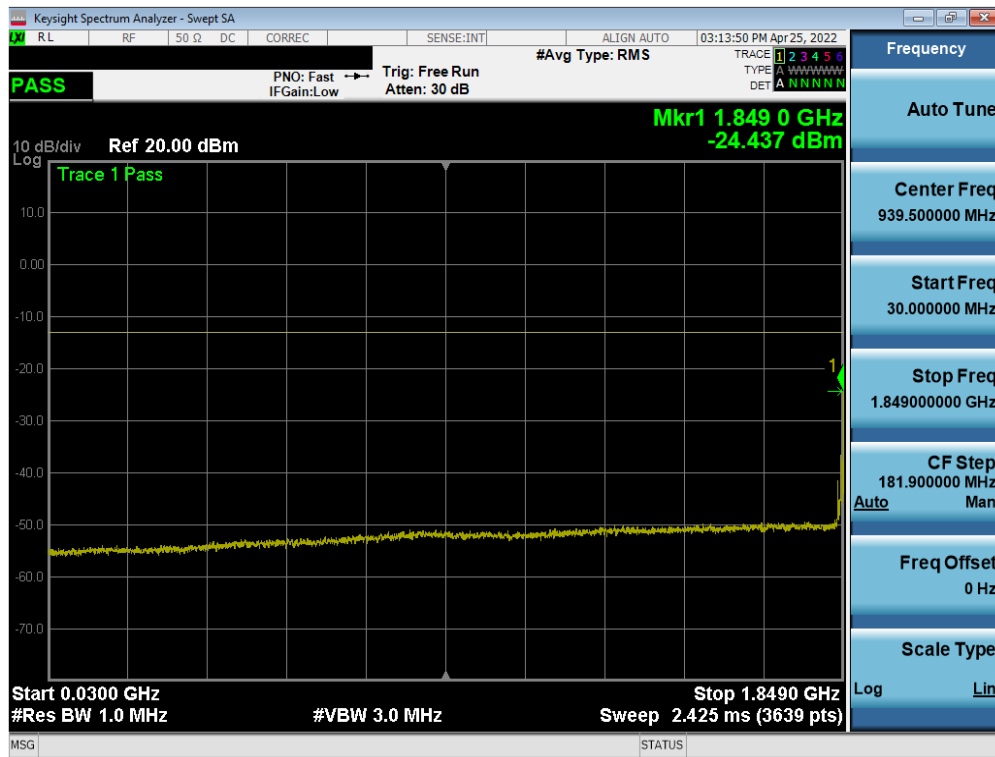
## Test Notes

1. Per Part 24, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

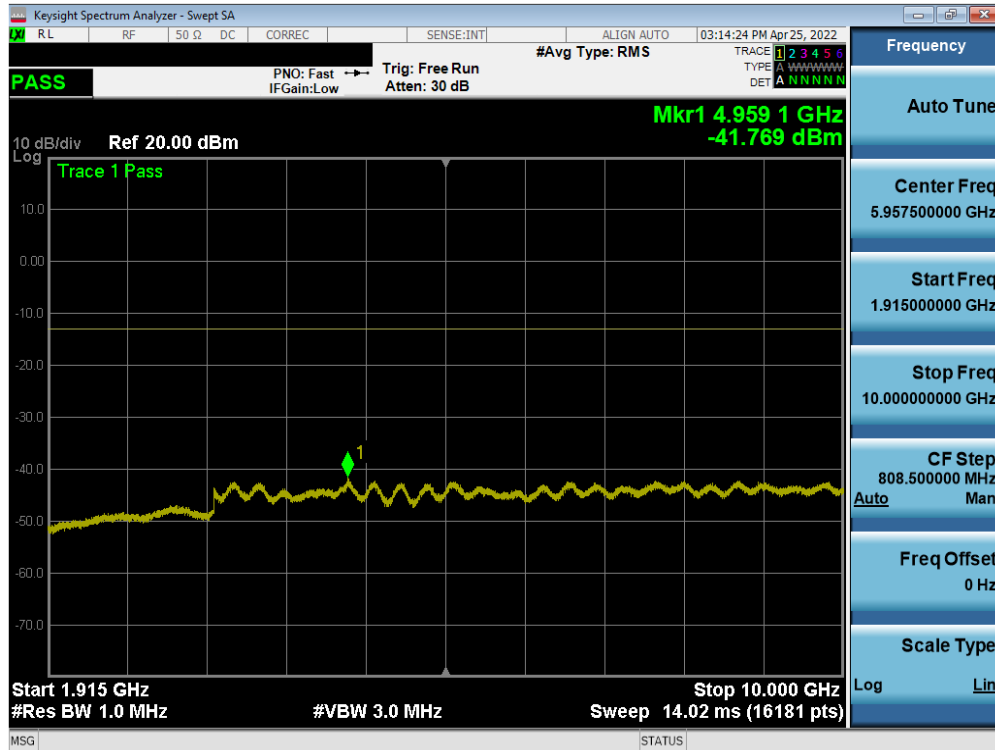
|  |   |                                   |  |
|--|---|-----------------------------------|--|
| <b>FCC ID:</b> BCG-A2772                       |  | <b>PART 24 MEASUREMENT REPORT</b> | <b>Approved by:</b><br>Technical Manager |
| <b>Test Report S/N:</b><br>1C2205090038-02.BCG | <b>Test Dates:</b><br>6/7/2022 - 8/17/2022  | <b>EUT Type:</b><br>Watch         | Page 22 of 90                            |

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## LTE Band 25/2



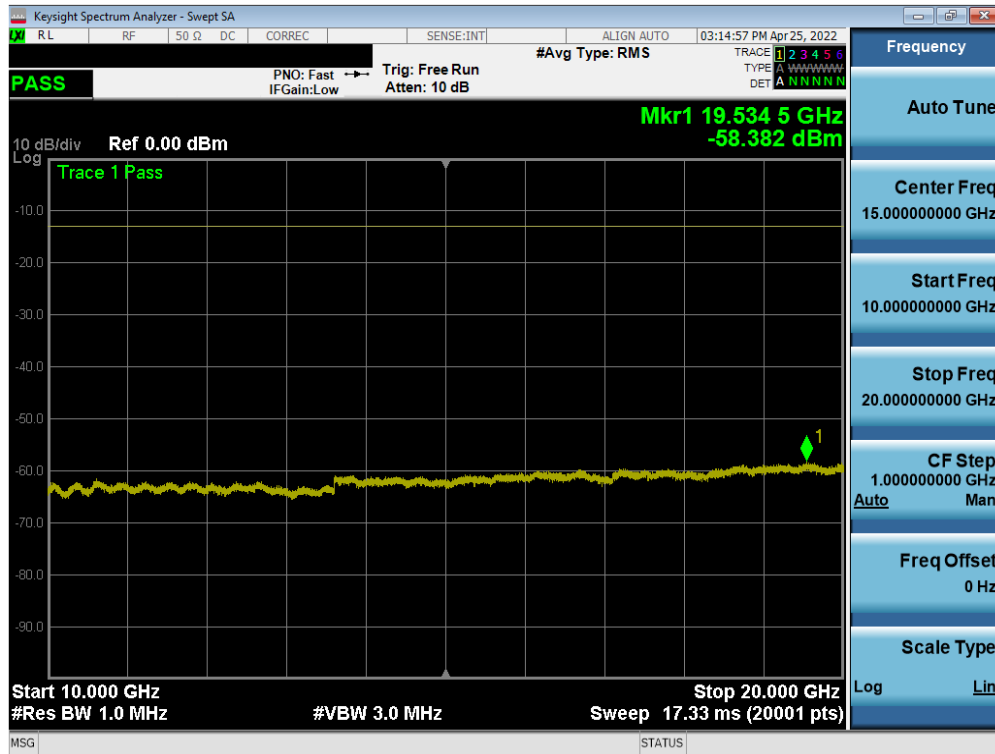
Plot 7-14. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



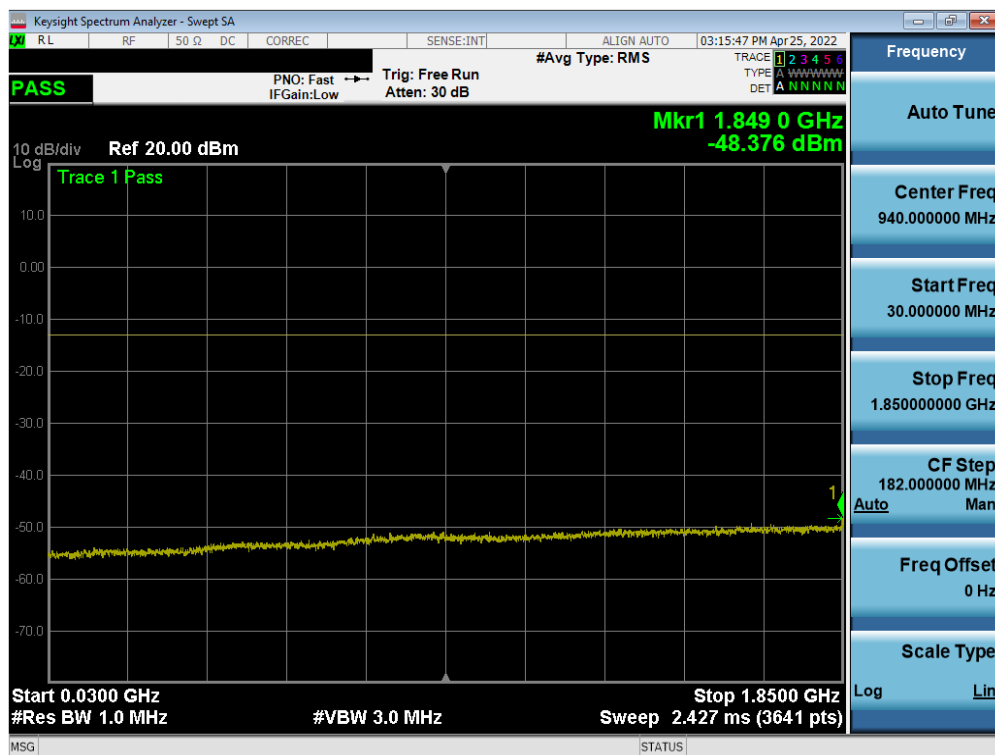
Plot 7-15. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

|   |  |                    |                                   |
|---|--|--------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  PART 24 MEASUREMENT REPORT |                    | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022  | EUT Type:<br>Watch | Page 23 of 90                     |

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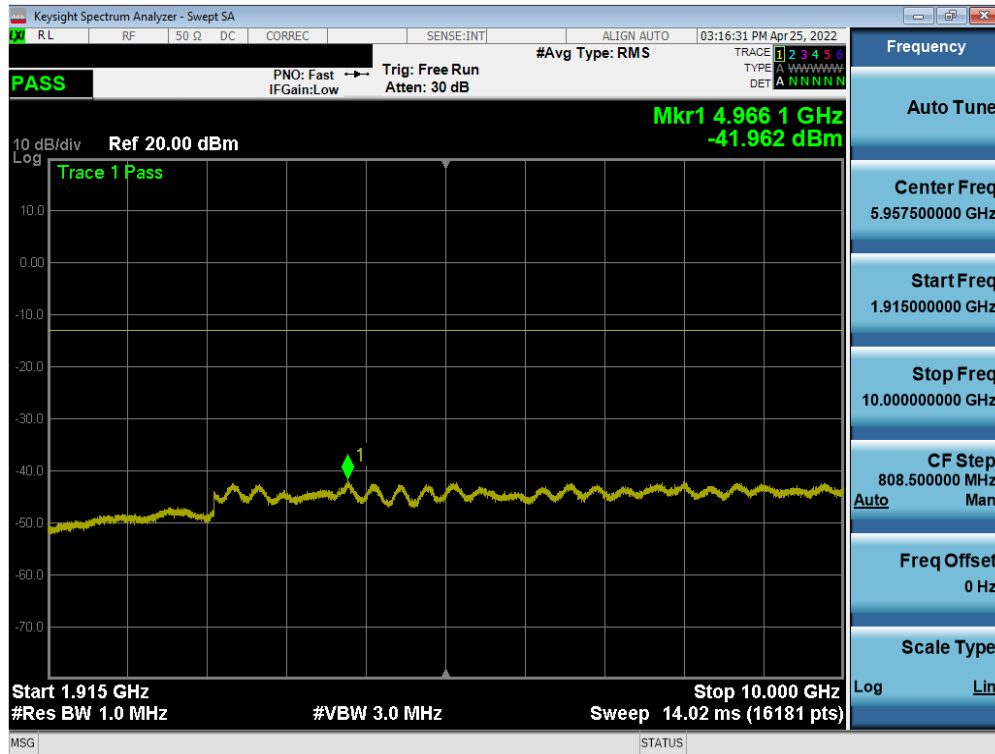
Plot 7-16. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



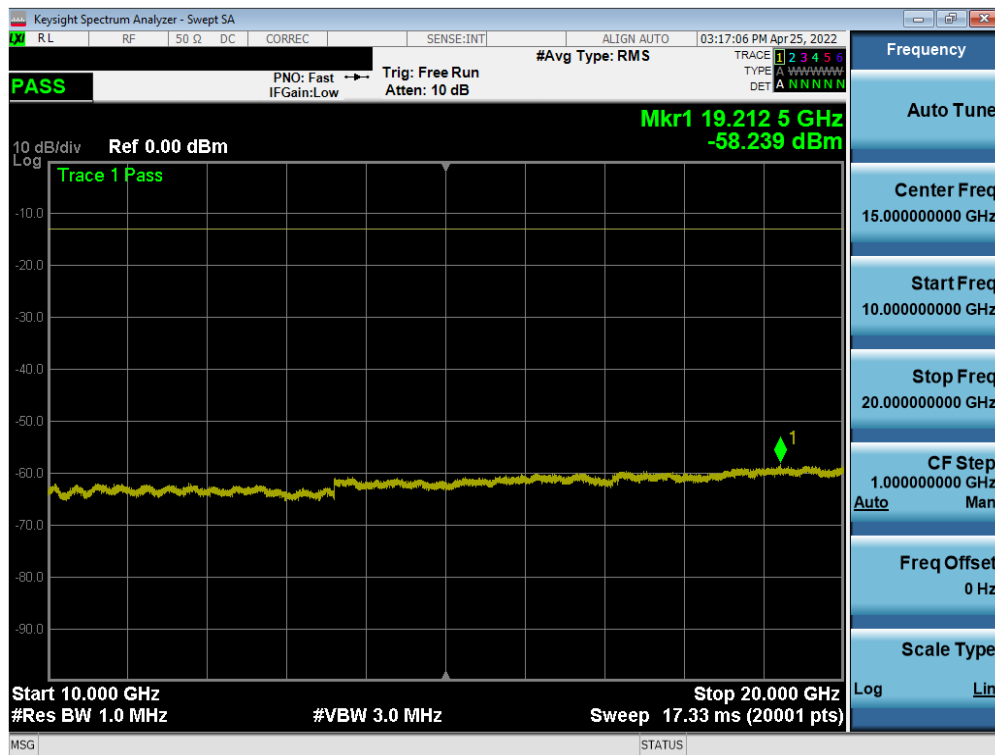
Plot 7-17. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022 | EUT Type:<br>Watch         | Page 24 of 90                     |

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Plot 7-18. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

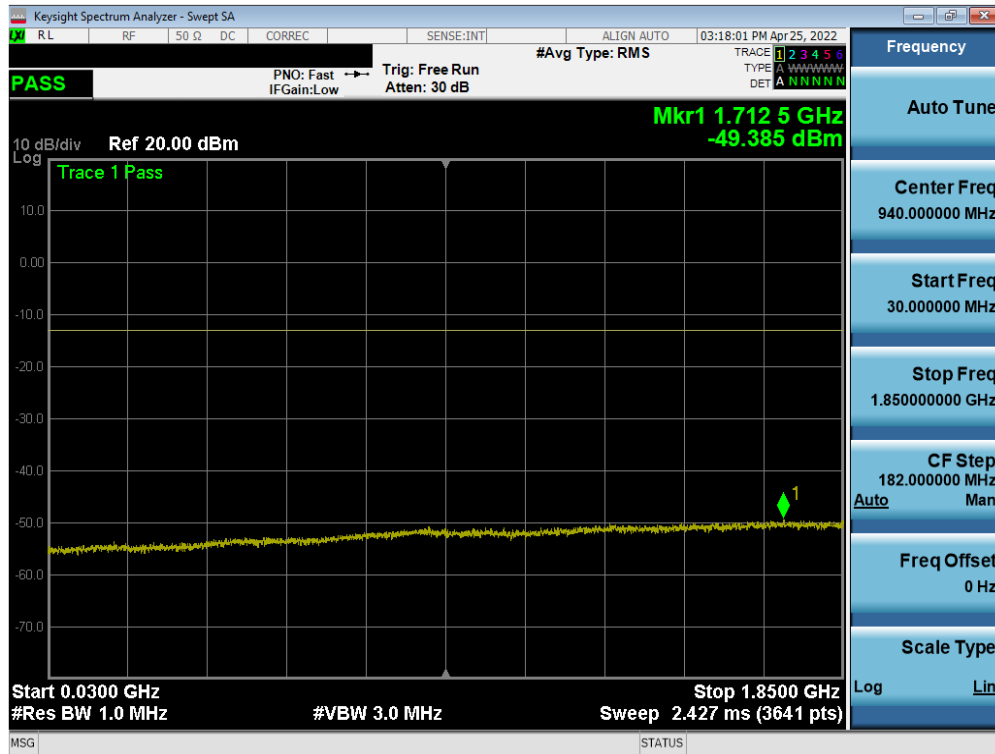


Plot 7-19. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

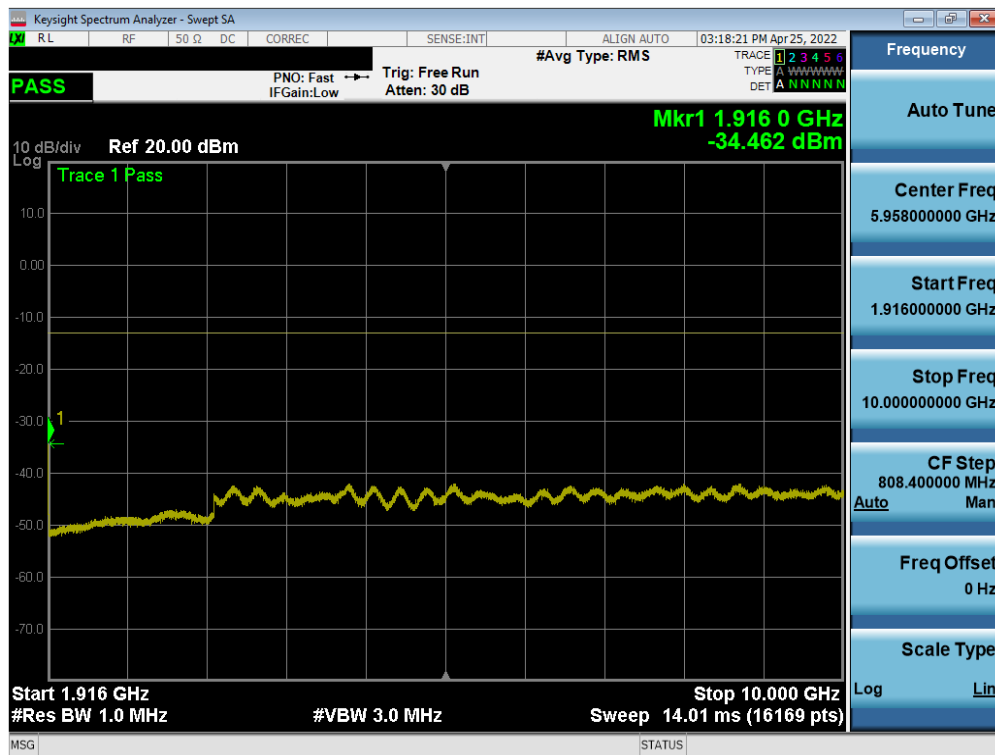
|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022 | EUT Type:<br>Watch         | Page 25 of 90                     |

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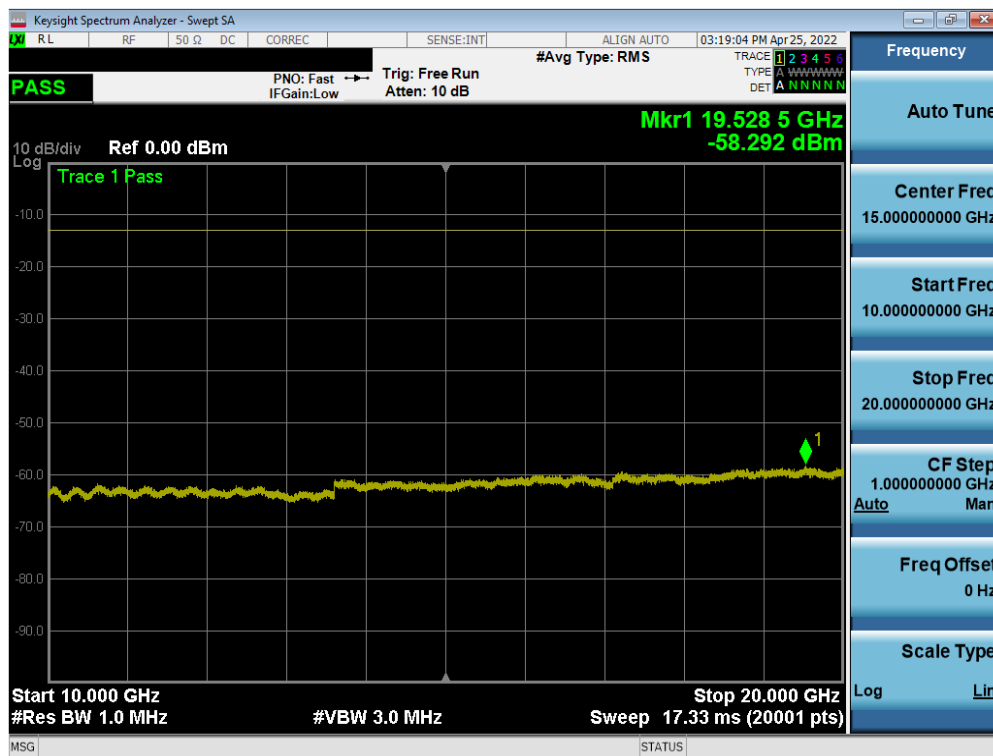


Plot 7-20. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)




Plot 7-21. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

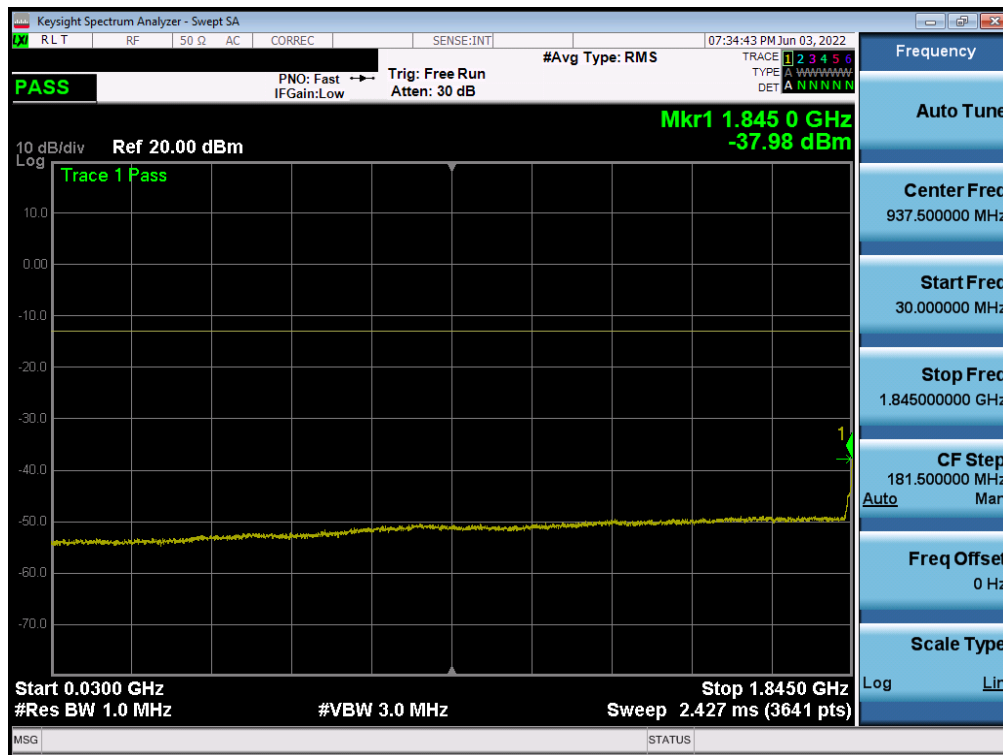
|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022 | EUT Type:<br>Watch         | Page 26 of 90                     |



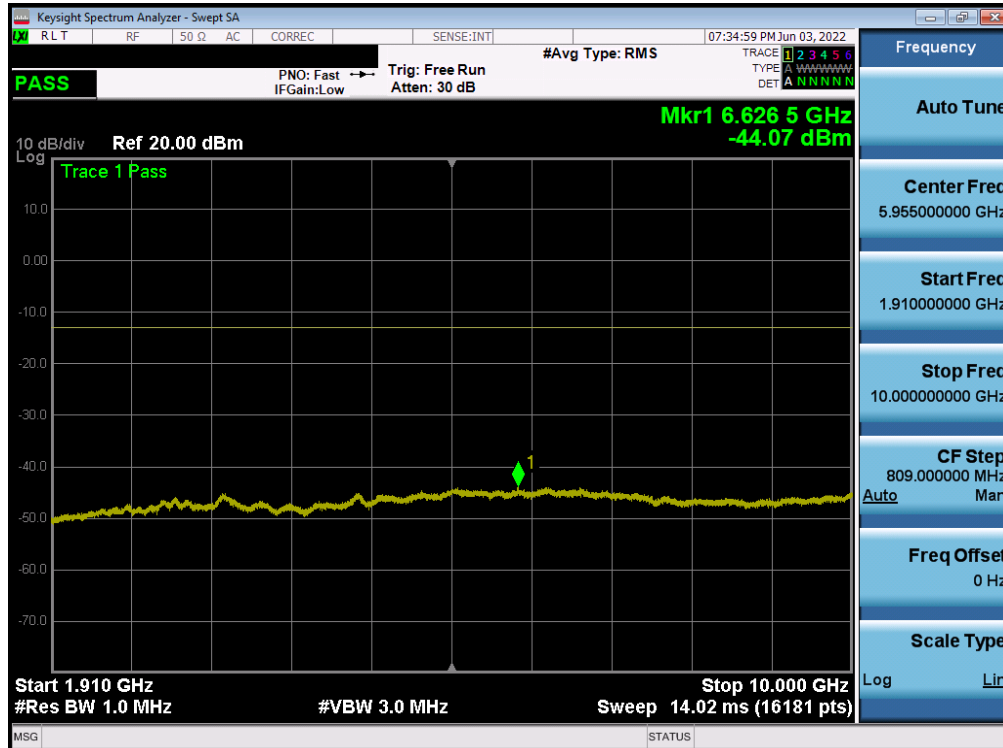
Plot 7-22. Conducted Spurious Plot (LTE Band 25/2 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

|   |   |                    |                                   |
|---|---|--------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  <b>PART 24 MEASUREMENT REPORT</b> |                    | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022   | EUT Type:<br>Watch | Page 27 of 90                     |


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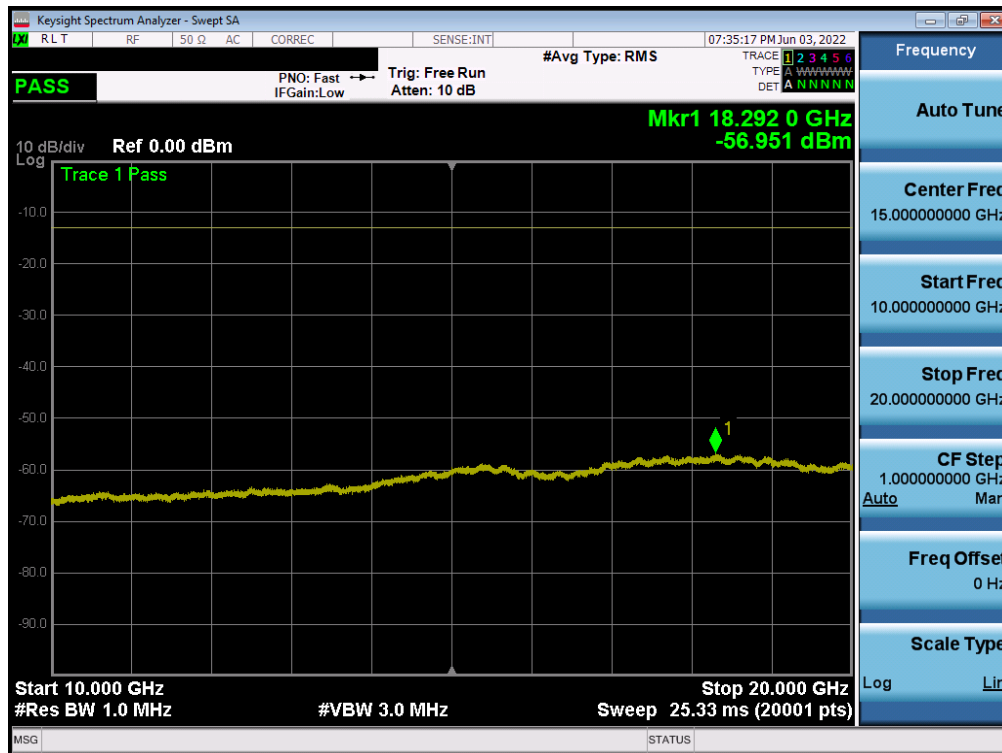


Plot 7-23. Conducted Spurious Plot (WCDMA Ch. 9262)



Plot 7-24. Conducted Spurious Plot (WCDMA Ch. 9262)

|   |  |                    |                                   |
|---|--|--------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  PART 24 MEASUREMENT REPORT |                    | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022  | EUT Type:<br>Watch | Page 28 of 90                     |

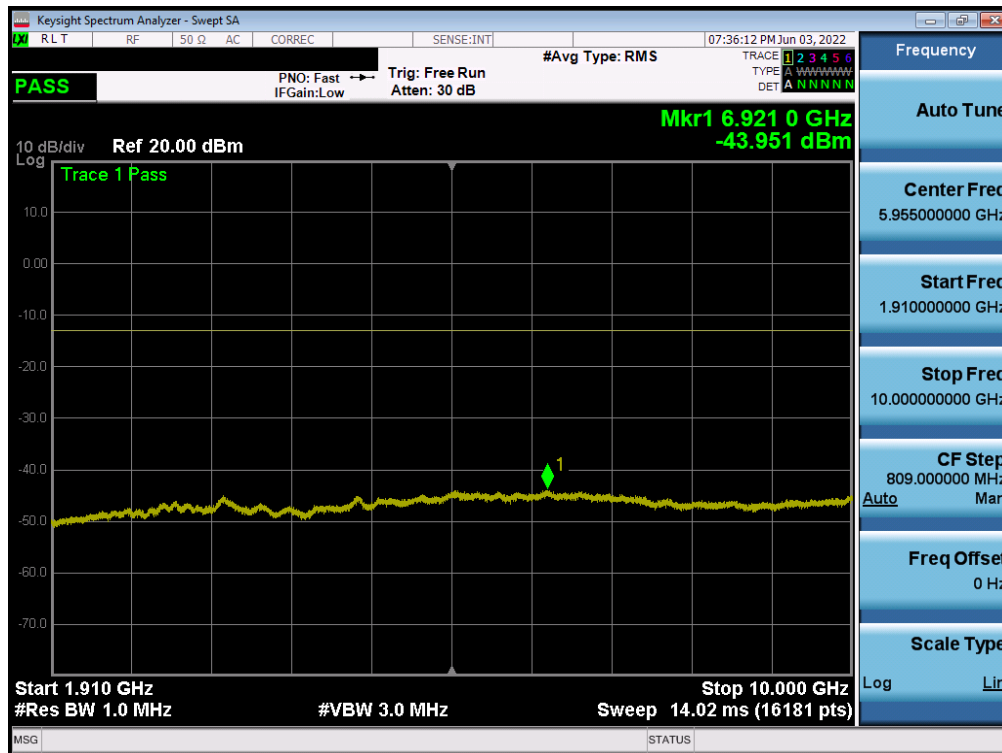


Plot 7-25. Conducted Spurious Plot (WCDMA Ch. 9262)

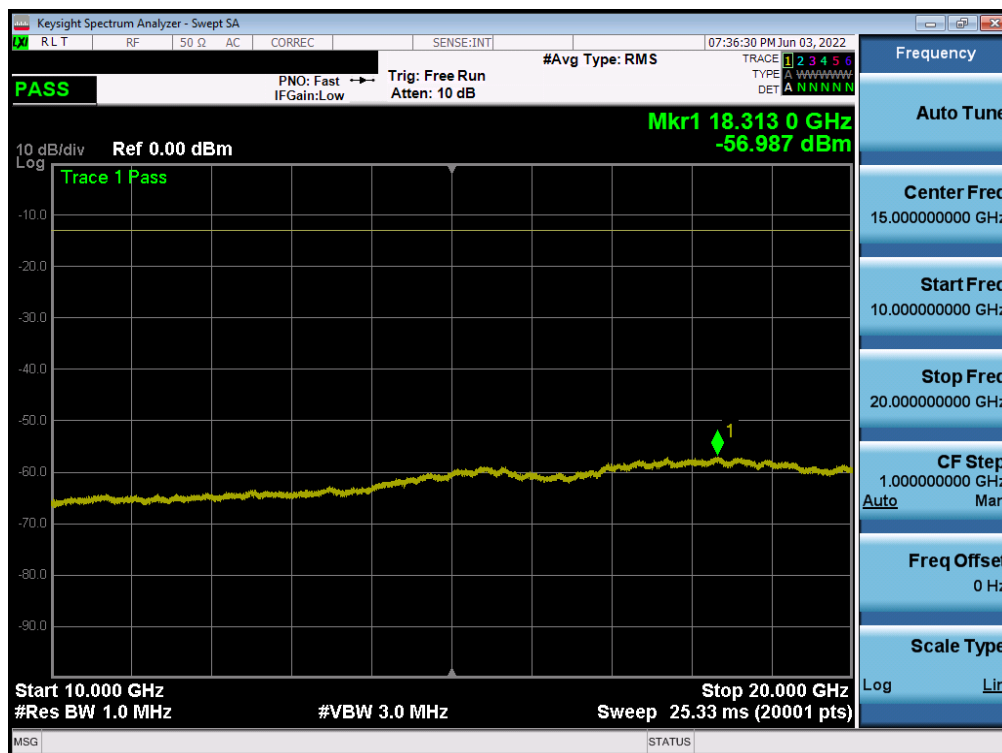


Plot 7-26. Conducted Spurious Plot (WCDMA Ch. 9400)

|   |                                     |                    |                                   |
|---|-------------------------------------|--------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | PART 24 MEASUREMENT REPORT          |                    | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022 | EUT Type:<br>Watch | Page 29 of 90                     |

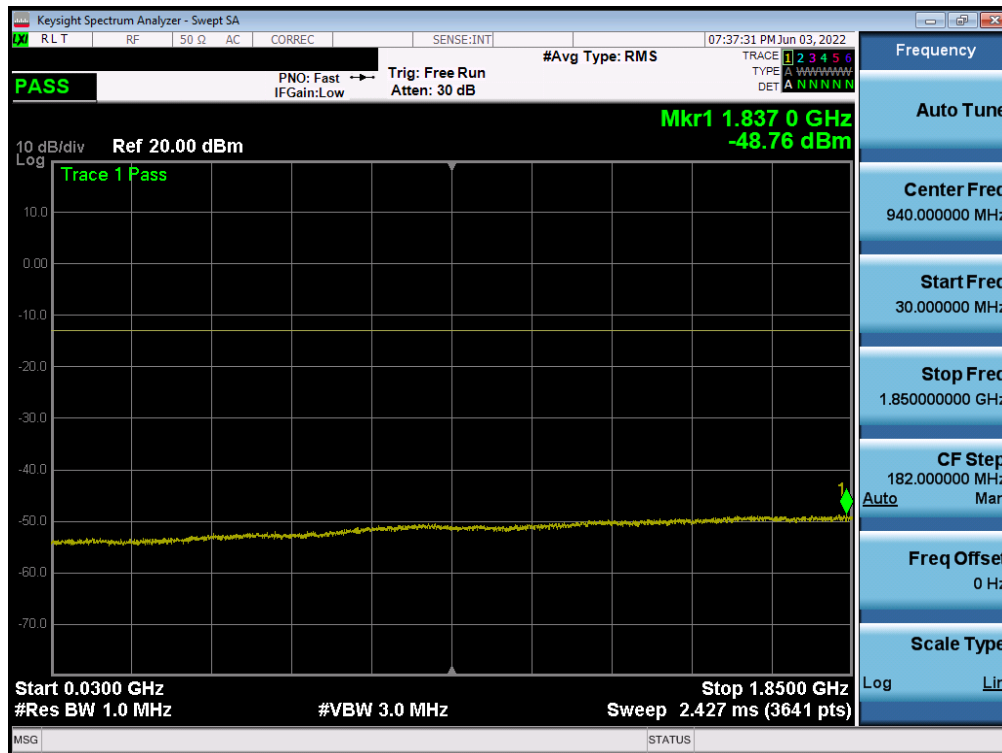


Plot 7-27. Conducted Spurious Plot (WCDMA Ch. 9400)

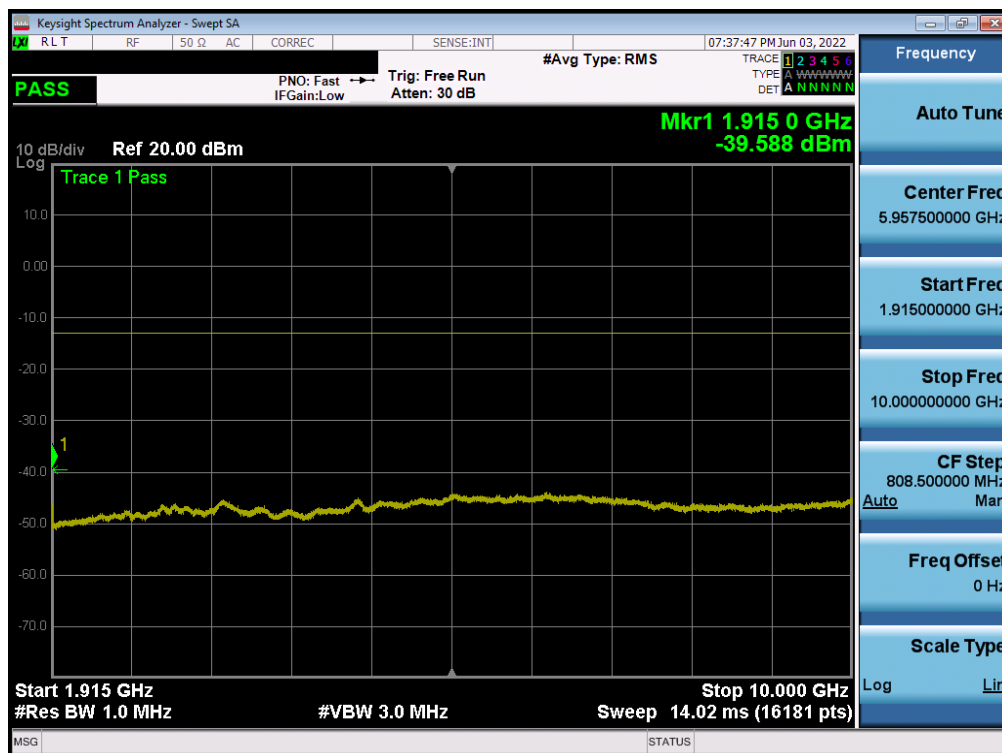


Plot 7-28. Conducted Spurious Plot (WCDMA Ch. 9400)

|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022 | EUT Type:<br>Watch         | Page 30 of 90                     |

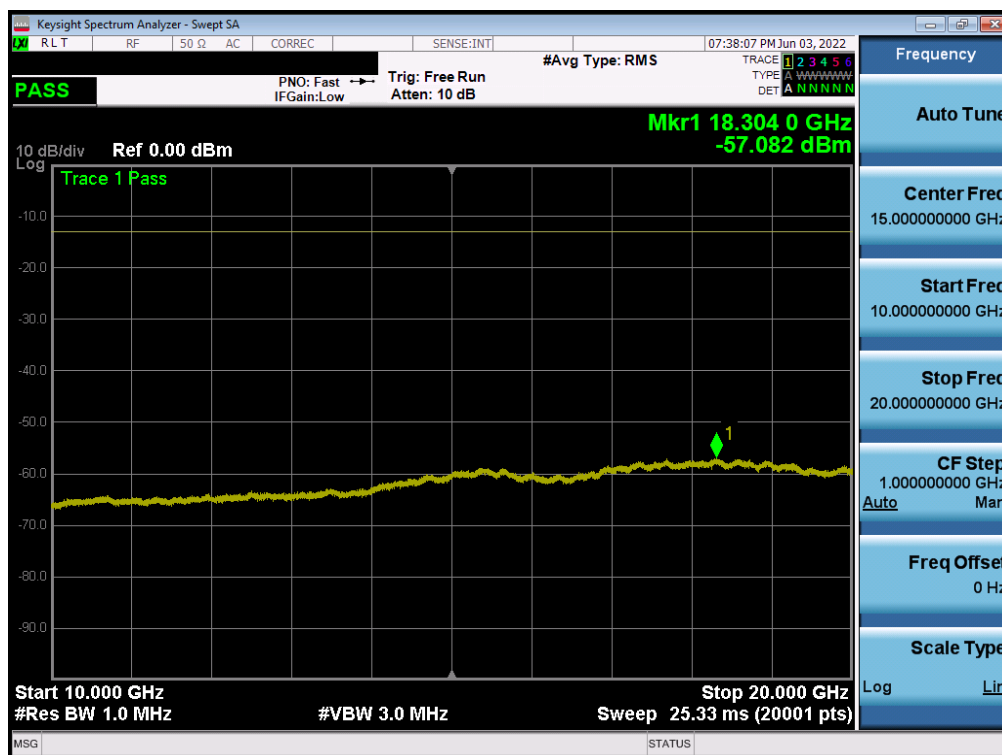


Plot 7-29. Conducted Spurious Plot (WCDMA Ch. 9538)




Plot 7-30. Conducted Spurious Plot (WCDMA Ch. 9538)

|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022 | EUT Type:<br>Watch         | Page 31 of 90                     |



Plot 7-31. Conducted Spurious Plot (WCDMA Ch. 9538)

|   |  |                    |                                   |
|---|--|--------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  PART 24 MEASUREMENT REPORT |                    | Approved by:<br>Technical Manager |
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## 7.4 Band Edge Emissions at Antenna Terminal

§2.1051, §24.238(a)

### Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

***The minimum permissible attenuation level of any spurious emission is  $43 + 10 \log_{10}(P_{[Watts]})$ , where  $P$  is the transmitter power in Watts.***

### Test Procedure Used

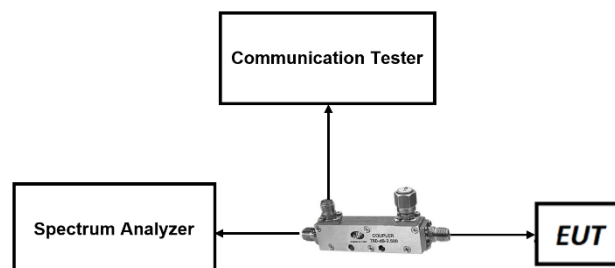
KDB 971168 D01 v03r01 – Section 6.0

### Test Settings


1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW  $\geq$  1% of the emission bandwidth
4. VBW  $\geq$  3 x RBW
5. Detector = RMS
6. Number of sweep points  $\geq$  2 x Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

### Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.



**Figure 7-3. Test Instrument & Measurement Setup**


|   |   |                            |                                   |
|---|---|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
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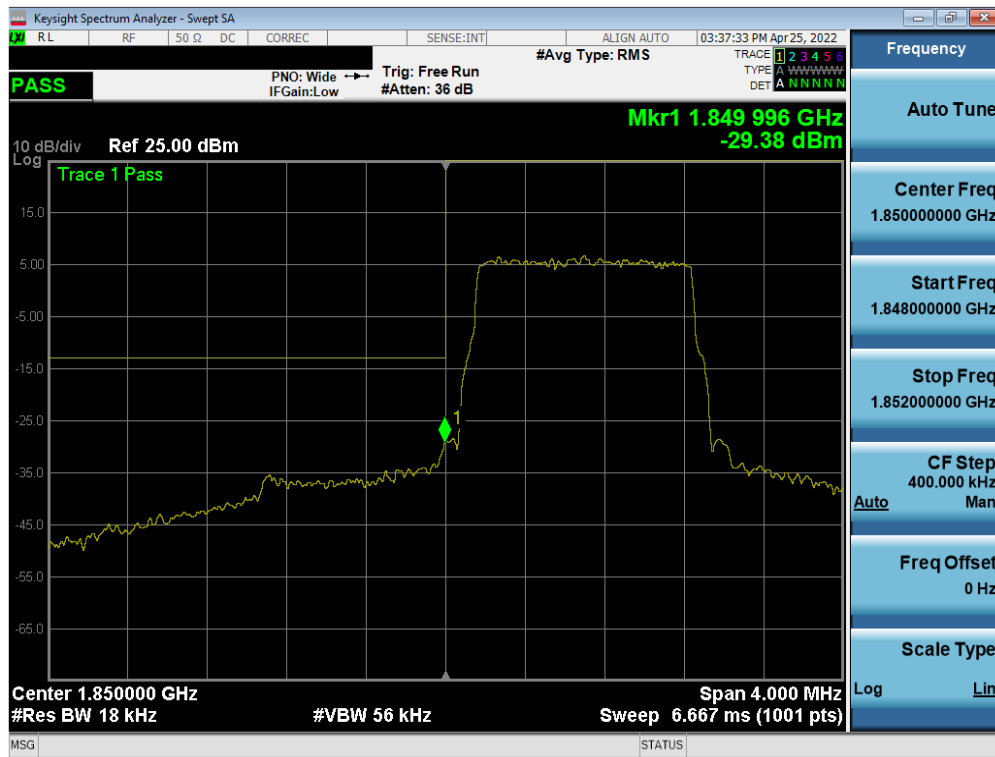
## Test Notes

1. Per 24.238(a), in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

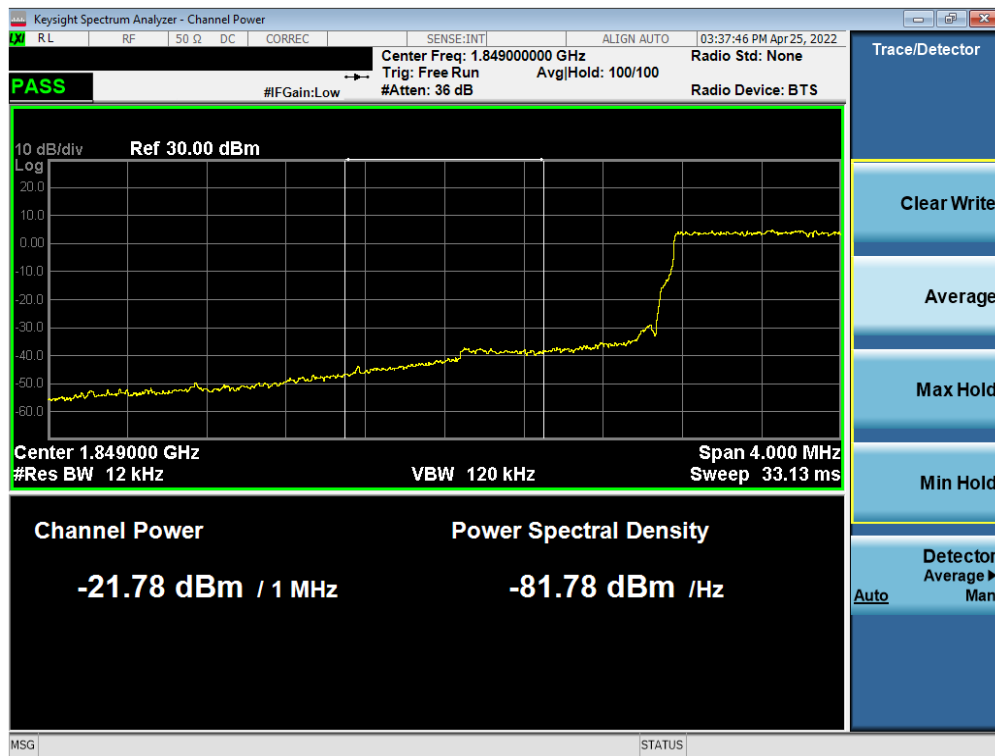
|  |   |                                   |  |
|--|---|-----------------------------------|--|
| <b>FCC ID:</b> BCG-A2772                       |  | <b>PART 24 MEASUREMENT REPORT</b> | <b>Approved by:</b><br>Technical Manager |
| <b>Test Report S/N:</b><br>1C2205090038-02.BCG | <b>Test Dates:</b><br>6/7/2022 - 8/17/2022  | <b>EUT Type:</b><br>Watch         | Page 34 of 90                            |

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## LTE Band 25



Plot 7-32. Lower Band Edge Plot (LTE Band 25 – 1.4MHz QPSK – Full RB Configuration)

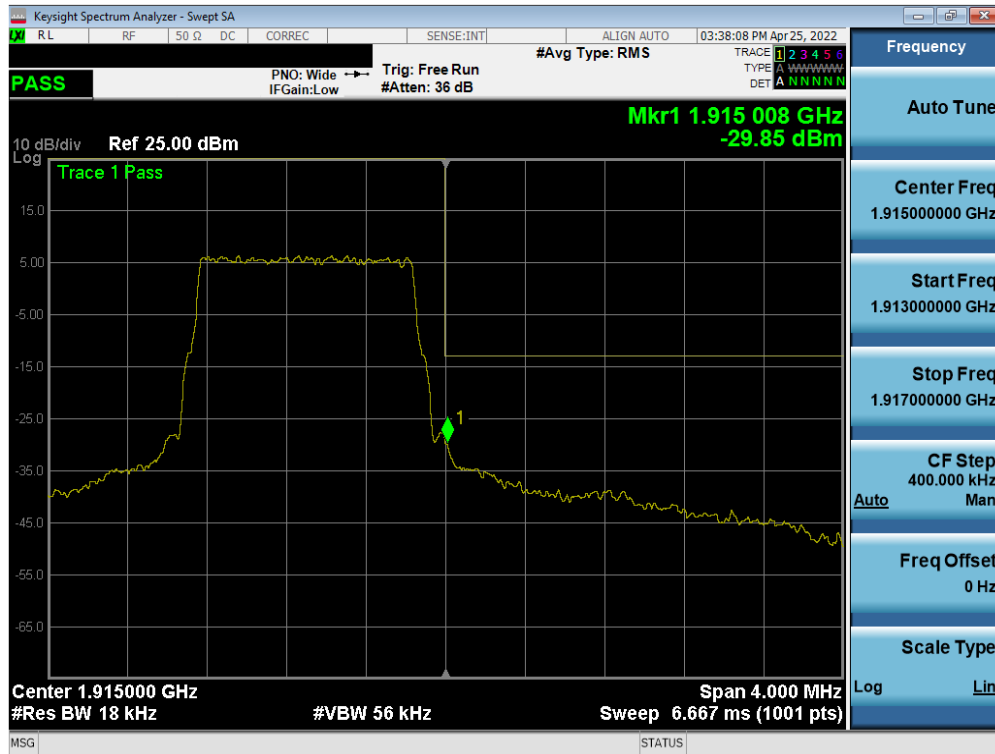


Plot 7-33. Extended Lower Band Edge Plot (LTE Band 25 – 1.4MHz QPSK – Full RB Configuration)

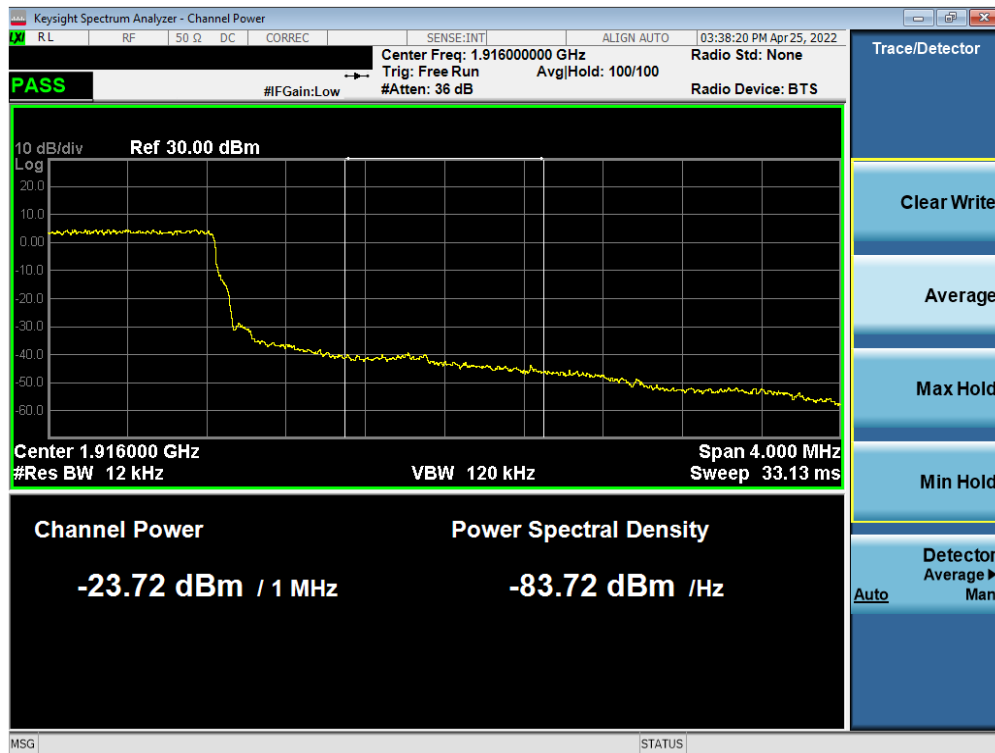
|   |  |                    |                                   |
|---|--|--------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  PART 24 MEASUREMENT REPORT |                    | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022  | EUT Type:<br>Watch | Page 35 of 90                     |

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Plot 7-34. Upper Band Edge Plot (LTE Band 25 – 1.4MHz QPSK – Full RB Configuration)

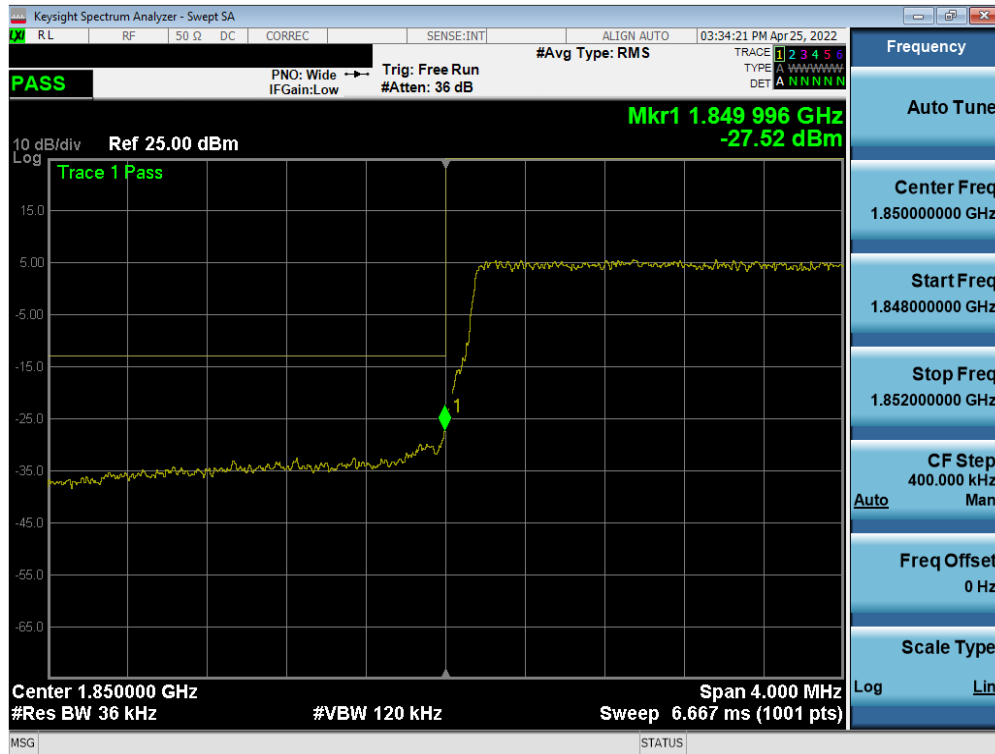


Plot 7-35. Extended Upper Band Edge Plot (LTE Band 25 – 1.4MHz QPSK – Full RB Configuration)

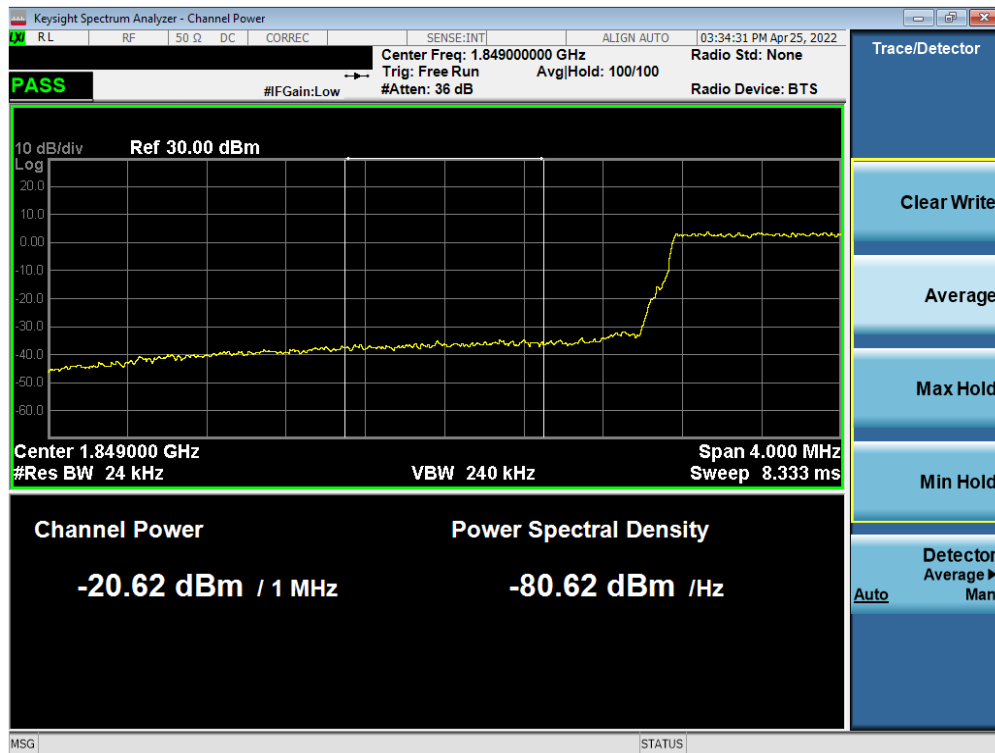
|   |   |                    |                                   |
|---|---|--------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  <b>PART 24 MEASUREMENT REPORT</b> |                    | Approved by:<br>Technical Manager |
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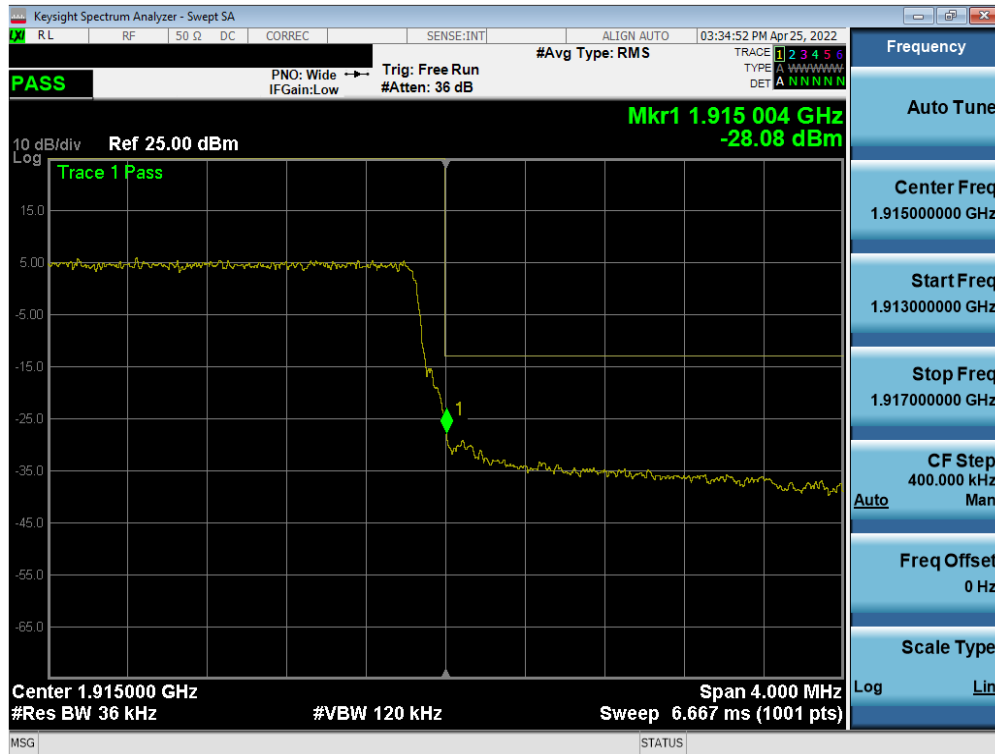


Plot 7-36. Lower Band Edge Plot (LTE Band 25 – 3MHz QPSK – Full RB Configuration)

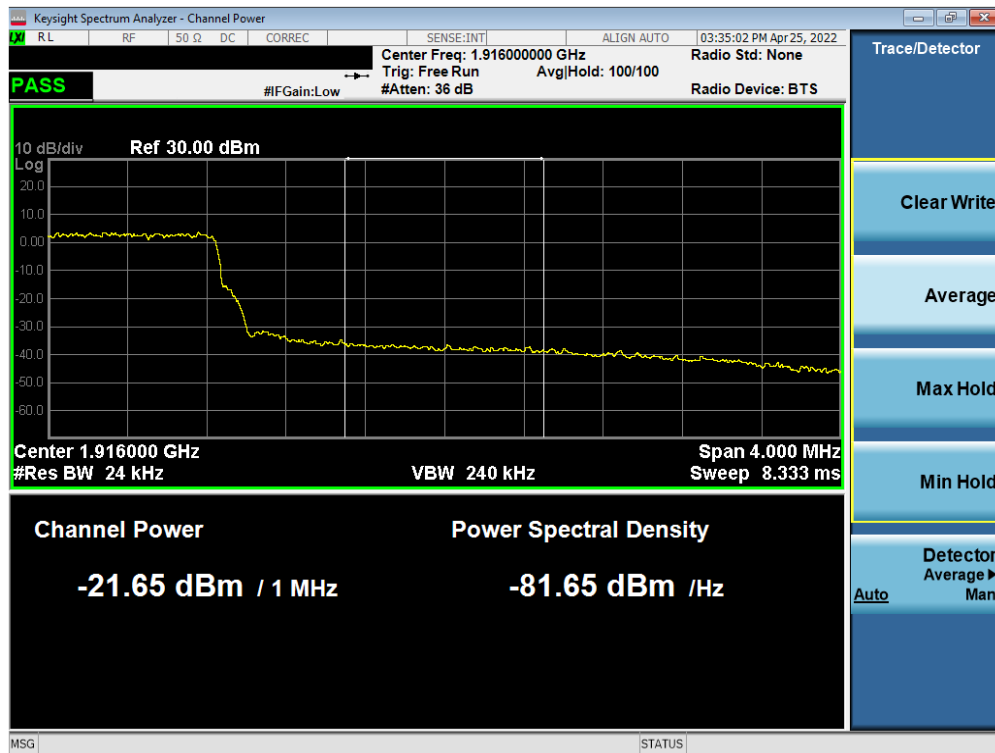


Plot 7-37. Extended Lower Band Edge Plot (LTE Band 25 – 3MHz QPSK – Full RB Configuration)

|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
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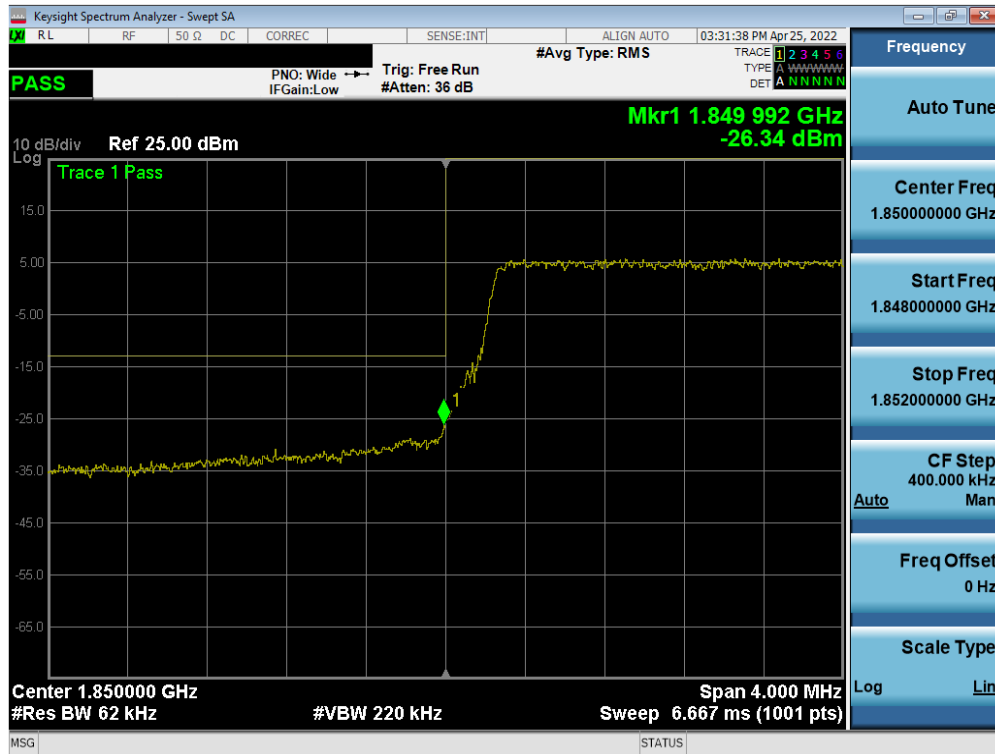


Plot 7-38. Upper Band Edge Plot (LTE Band 25 – 3MHz QPSK – Full RB Configuration)

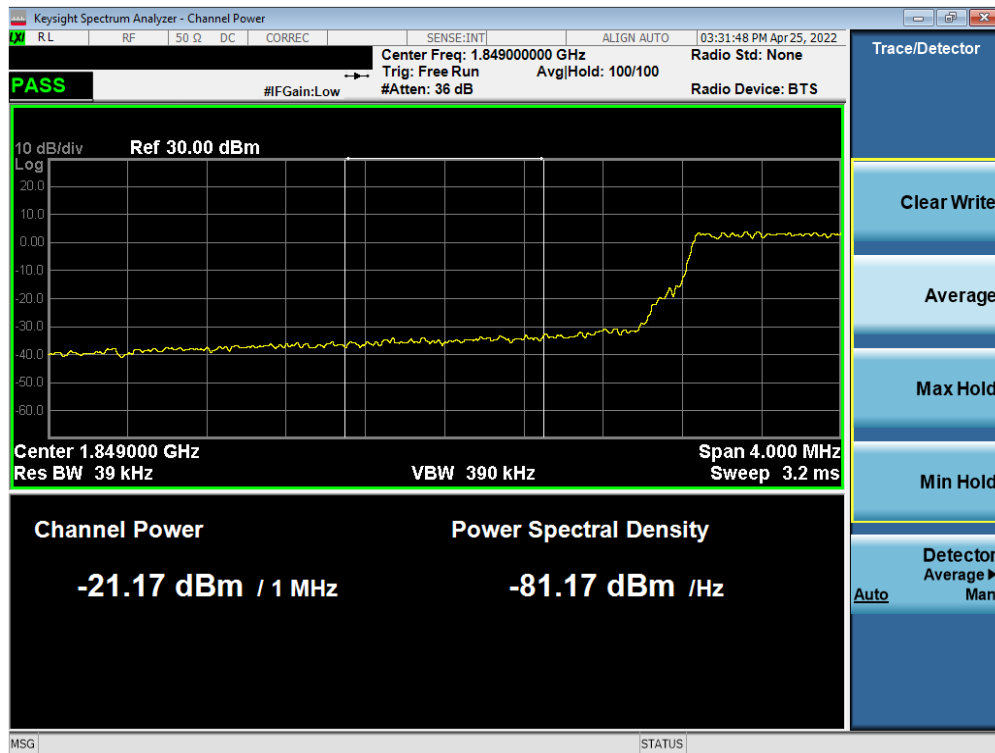


Plot 7-39. Extended Upper Band Edge Plot (LTE Band 25 – 3MHz QPSK – Full RB Configuration)

|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
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Plot 7-40. Lower Band Edge Plot (LTE Band 25 – 5MHz QPSK – Full RB Configuration)

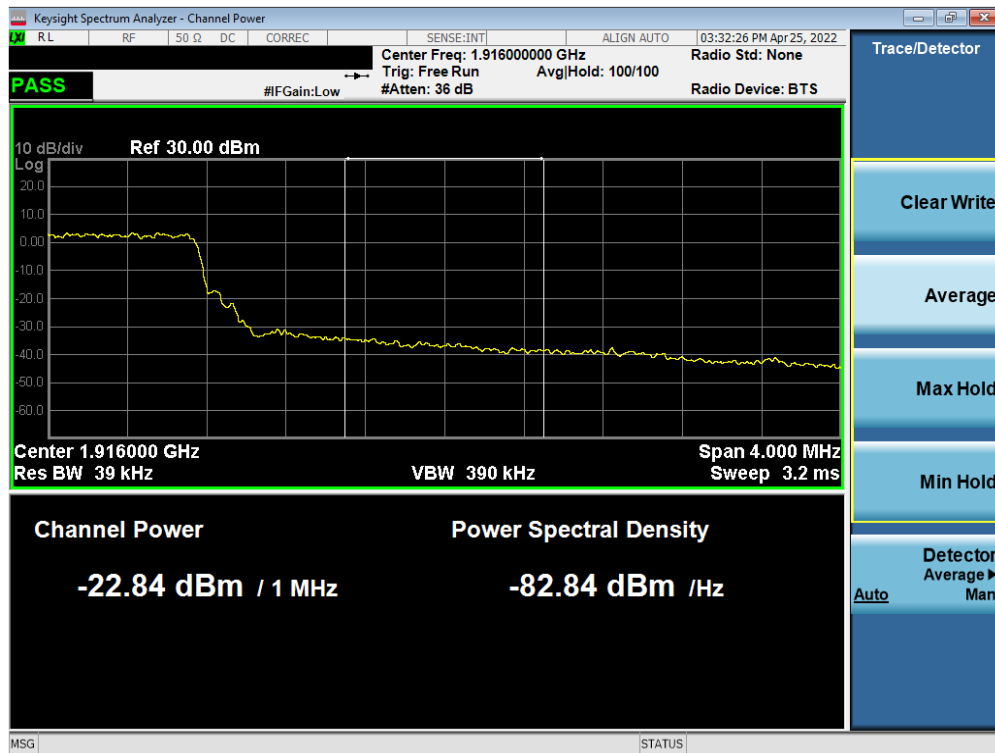


Plot 7-41. Extended Lower Band Edge Plot (LTE Band 25 – 5MHz QPSK – Full RB Configuration)

|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
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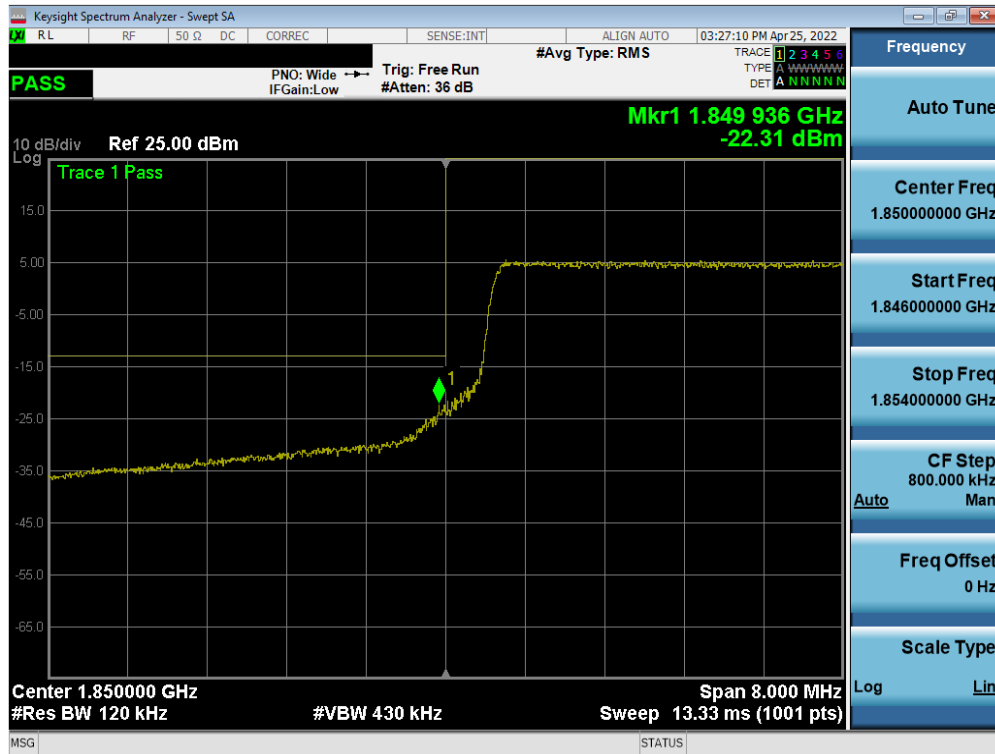


Plot 7-42. Upper Band Edge Plot (LTE Band 25 – 5MHz QPSK – Full RB Configuration)

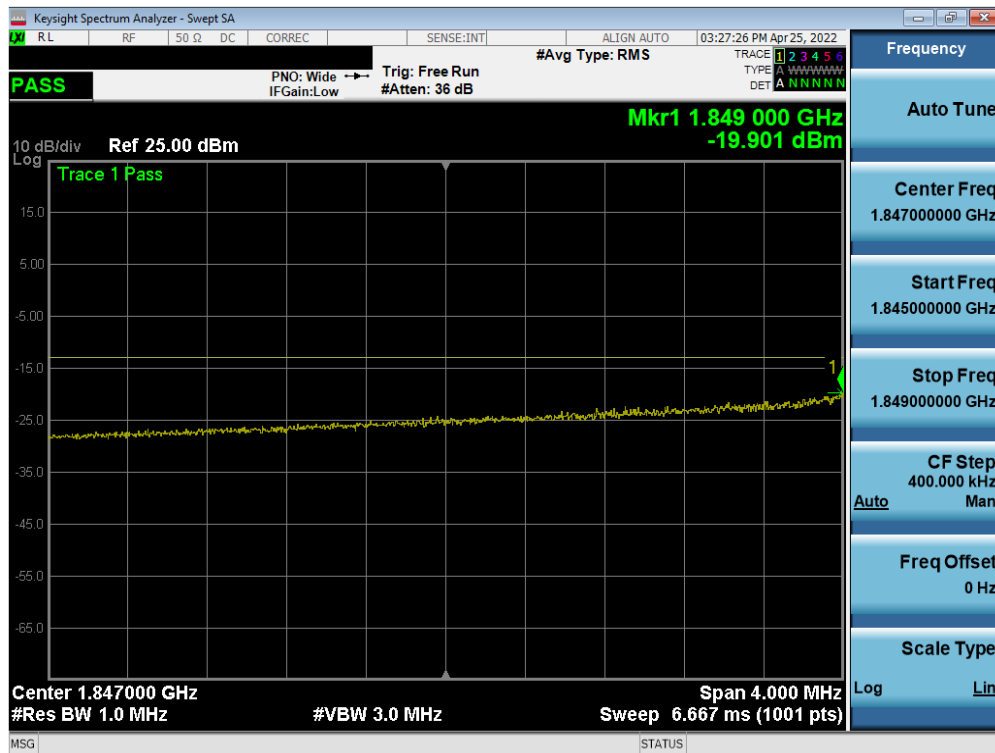


Plot 7-43. Extended Upper Band Edge Plot (LTE Band 25 – 5MHz QPSK – Full RB Configuration)

|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022 | EUT Type:<br>Watch         | Page 40 of 90                     |



Plot 7-44. Lower Band Edge Plot (LTE Band 25 – 10MHz QPSK – Full RB Configuration)

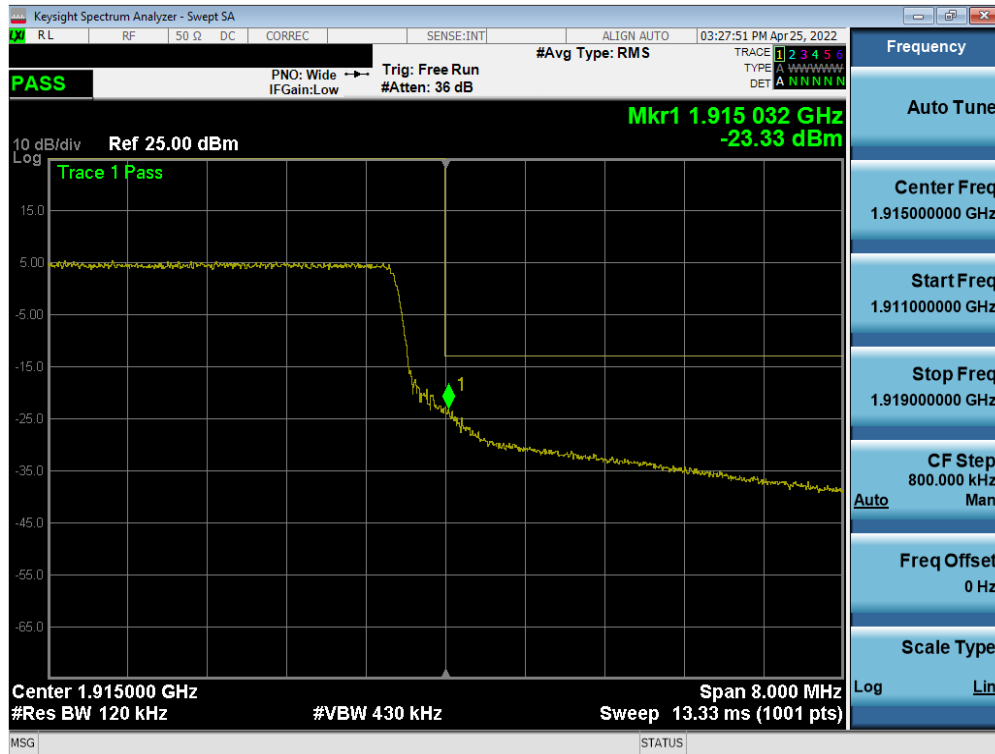


Plot 7-45. Extended Lower Band Edge Plot (LTE Band 25 – 10MHz QPSK – Full RB Configuration)

|   |                                     |                    |                                   |
|---|-------------------------------------|--------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | <b>PART 24 MEASUREMENT REPORT</b>   |                    | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022 | EUT Type:<br>Watch | Page 41 of 90                     |

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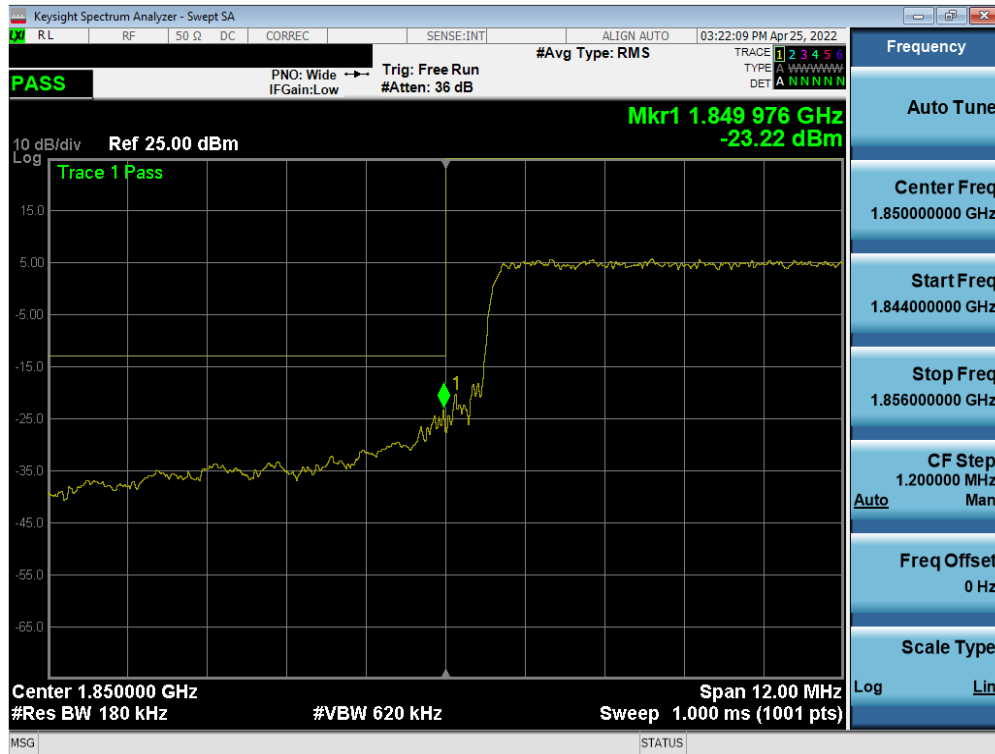
Plot 7-46. Upper Band Edge Plot (LTE Band 25 – 10MHz QPSK – Full RB Configuration)



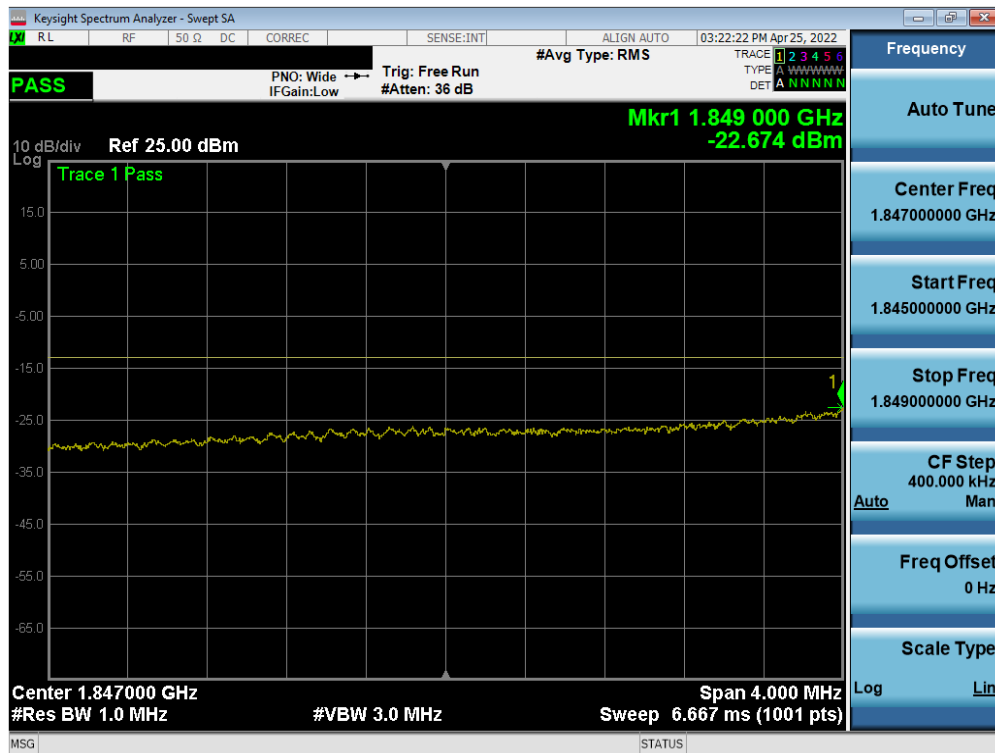
Plot 7-47. Extended Upper Band Edge Plot (LTE Band 25 – 10MHz QPSK – Full RB Configuration)

|   |   |                    |                                   |
|---|---|--------------------|-----------------------------------|
| FCC ID: BCG-A2772                       |  <b>PART 24 MEASUREMENT REPORT</b> |                    | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022   | EUT Type:<br>Watch | Page 42 of 90                     |

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Plot 7-48. Lower Band Edge Plot (LTE Band 25 – 15MHz QPSK – Full RB Configuration)



Plot 7-49. Extended Lower Band Edge Plot (LTE Band 25 – 15MHz QPSK – Full RB Configuration)

|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
| Test Report S/N:<br>1C2205090038-02.BCG | Test Dates:<br>6/7/2022 - 8/17/2022 | EUT Type:<br>Watch         | Page 43 of 90                     |

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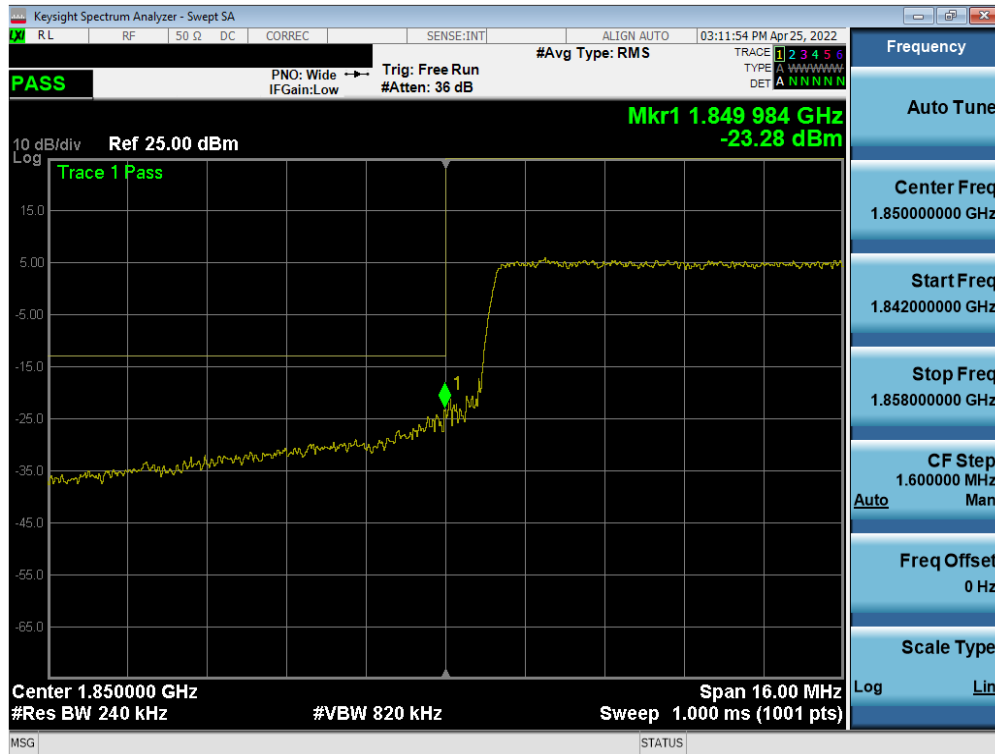


Plot 7-50. Upper Band Edge Plot (LTE Band 25 – 15MHz QPSK – Full RB Configuration)

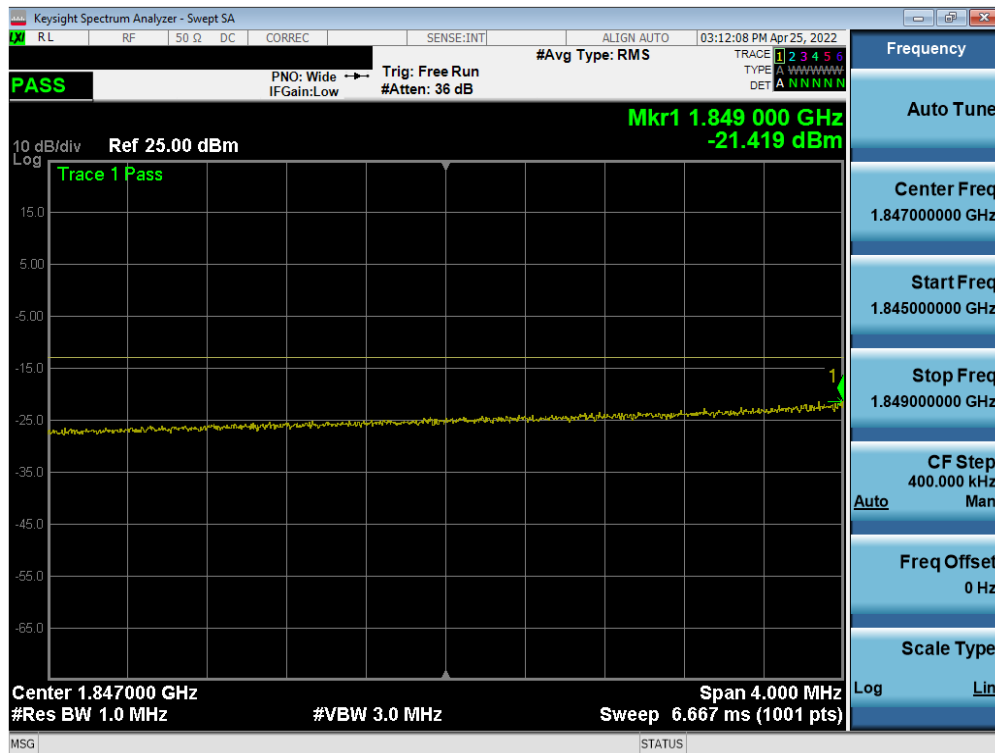


Plot 7-51. Extended Upper Band Edge Plot (LTE Band 25 – 15MHz QPSK – Full RB Configuration)

|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
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Plot 7-52. Lower Band Edge Plot (LTE Band 25 – 20MHz QPSK – Full RB Configuration)



Plot 7-53. Extended Lower Band Edge Plot (LTE Band 25 – 20MHz QPSK – Full RB Configuration)

|   |                                     |                            |                                   |
|---|-------------------------------------|----------------------------|-----------------------------------|
| FCC ID: BCG-A2772                       | element                             | PART 24 MEASUREMENT REPORT | Approved by:<br>Technical Manager |
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