

# TEST REPORT



**Dt&C Co., Ltd.**

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042  
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC2407-0084(1)

2. Customer

• Name (FCC) : BLUEBIRD INC.

• Address (FCC) : 3F, 115, Irwon-ro, Gangnam-gu, Seoul South Korea

3. Use of Report : FCC Certification

4. Product Name / Model Name : Enterprise Full Touch Handheld Computer / S50

FCC ID : SS4S50F1

5. FCC Regulation(s): Part 15.407

Test Method used: See appended test report.

6. Date of Test : 2024.07.18 ~ 2024.07.23, 2024.08.14

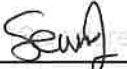
7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

8. Testing Environment : See appended test report.

9. Test Result : Refer to the attached test result.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

This test report is not related to KOLAS accreditation.

|             |                                                                                                         |                                                                                                         |
|-------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Affirmation | Tested by                                                                                               | Technical Manager                                                                                       |
|             | Name : SeungMin Gil  | Name : JaeJin Lee  |

2024 . 08 . 14 .

**Dt&C Co., Ltd.**

If this report is required to confirmation of authenticity, please contact to [report@dtnc.net](mailto:report@dtnc.net)

## Test Report Version

| Test Report No.    | Date          | Description                          | Revised by   | Reviewed by |
|--------------------|---------------|--------------------------------------|--------------|-------------|
| DRTFCC2407-0084    | Jul. 25, 2024 | Initial issue                        | SeungMin Gil | JaeJin Lee  |
| DRTFCC2407-0084(1) | Aug. 14, 2024 | Add a AWGN signal plot as an example | SeungMin Gil | JaeJin Lee  |
|                    |               |                                      |              |             |
|                    |               |                                      |              |             |
|                    |               |                                      |              |             |
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## 1. General Information

### 1.1. Description of EUT

|                                                     |                                                                                                                                                                                                |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>FCC ID</b>                                       | SS4S50F1                                                                                                                                                                                       |
| <b>Product Name</b>                                 | Enterprise Full Touch Handheld Computer                                                                                                                                                        |
| <b>Model Name(s)</b>                                | S50, S70                                                                                                                                                                                       |
| <b>FVIN(Firmware Version Identification Number)</b> | R1.00                                                                                                                                                                                          |
| <b>EUT Serial Number</b>                            | S50XXXXXXXXXE315F9A9,<br>S50XXXXXXXXX15B0C478                                                                                                                                                  |
| <b>Supplying power</b>                              | DC 3.85 V                                                                                                                                                                                      |
| <b>Modulation Technique</b>                         | OFDM, OFDMA                                                                                                                                                                                    |
| <b>Antenna Information</b>                          | Internal Antenna<br>ANT 8<br>NII-5: 1.50 dBi<br>NII-6: 0.94 dBi<br>NII-7: 1.51 dBi<br>NII-8: 0.25 dBi<br>ANT 9<br>NII-5: -0.82 dBi<br>NII-6: -7.91 dBi<br>NII-7: -5.07 dBi<br>NII-8: -2.55 dBi |

### 1.2. Declaration by the applicant / manufacturer

N/A

### 1.3. Testing Laboratory

|                                                                                                                                                                                      |   |                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------|
| <b>Dt&amp;C Co., Ltd.</b>                                                                                                                                                            |   |                  |
| The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. |   |                  |
| The test site complies with the requirements of Part 2.948 according to ANSI C63.4-2014.                                                                                             |   |                  |
| - FCC & IC MRA Designation No. : KR0034                                                                                                                                              |   |                  |
| - ISED#: 5740A                                                                                                                                                                       |   |                  |
| <a href="http://www.dtnet.net">www.dtnet.net</a>                                                                                                                                     |   |                  |
| Telephone                                                                                                                                                                            | : | + 82-31-321-2664 |
| FAX                                                                                                                                                                                  | : | + 82-31-321-1664 |

### 1.4. Testing Environment

| Ambient Condition   |                 |
|---------------------|-----------------|
| ▪ Temperature       | +24 °C ~ +25 °C |
| ▪ Relative Humidity | +50 % ~ +53 %   |

### 1.5. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014 and ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of  $k = 2$  to indicate a 95 % level of confidence.

| Parameter                       | Measurement uncertainty                               |
|---------------------------------|-------------------------------------------------------|
| Antenna-port conducted emission | 0.9 dB (The confidence level is about 95 %, $k = 2$ ) |

## 1.6. Test Equipment List

| Type              | Manufacturer         | Model             | Cal.Date<br>(yy/mm/dd) | Next.Cal.Date<br>(yy/mm/dd) | S/N        |
|-------------------|----------------------|-------------------|------------------------|-----------------------------|------------|
| Spectrum Analyzer | KEYSIGHT             | N9020A            | 23/12/15               | 24/12/15                    | MY50410272 |
| DC Power Supply   | Agilent Technologies | 66332A            | 23/12/15               | 24/12/15                    | US37470950 |
| Multimeter        | FLUKE                | 17B+              | 23/12/15               | 24/12/15                    | 36390701WS |
| Signal Generator  | KEYSIGHT             | M9383A            | 23/12/15               | 24/12/15                    | E76F804A28 |
| Thermohygrometer  | BODYCOM              | BJ5478            | 23/12/15               | 24/12/15                    | 120612-1   |
| Power Divider     | Weinschel            | 1515-1            | 23/12/15               | 24/12/15                    | TW493      |
| Power Splitter    | Anritsu              | K241B             | 23/12/15               | 24/12/15                    | 016681     |
| Attenuator        | SMAJK                | SMAJK-50-30       | 24/06/03               | 25/06/03                    | 3-50-30    |
| Attenuator        | SMAJK                | SMAJK-50-30       | 24/06/03               | 25/06/03                    | 15081905   |
| Attenuator        | Saluki               | 2.92TS50-30dB-40G | 24/06/03               | 25/06/03                    | 21090702   |
| Attenuator        | SRTechnology         | F01-D1230-01      | 24/06/03               | 25/06/03                    | 13092401   |
| Cable             | Radiall              | TESTPRO3          | 24/01/03               | 25/01/03                    | RFC-01     |
| Cable             | Radiall              | TESTPRO3          | 24/01/03               | 25/01/03                    | RFC-03     |
| Cable             | Radiall              | TESTPRO3          | 24/01/03               | 25/01/03                    | RFC-44     |

Note2: The cable is not a regular calibration item, so it has been calibrated by Dt&C itself.

## 2. Test Methodology

The EUT was tested using the following test method.

- 1) ANSI C63.10-2013
- 2) KDB 987594 D02v01r01
- 3) KDB 789033 D02v02r01
- 4) KDB 662911 D01v02r01

### 2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

### 2.2. EUT Exercise

The EUT was operated in the test mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart E.

### 2.3. General Test Procedures

#### Conducted Emissions

According to the requirements in Section 6.2 of ANSI C63.10-2013, the EUT is placed on the table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector.

#### Radiated Emissions

The EUT is placed on a non-conductive table, which is 0.8 m above ground plane. For emission measurements above 1 GHz, the table height is 1.5 m. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the highest emission, the relative positions of the EUT were rotated through three orthogonal axis. EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10-2013.

### 2.4. Instrument Calibration

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

## 2.5. Description of Test Modes

The EUT has been tested with the operating condition for maximizing the emission characteristics. A test program is used to control the EUT for staying in continuous transmitting.

**Note:** Only 802.11ax(HE160) mode were tested for in-band emissions and Contention-based protocol test items.

### Transmitting Configuration of EUT

| Mode            | SISO  |       | MIMO      |
|-----------------|-------|-------|-----------|
|                 | Ant 1 | Ant 2 | Ant 1 & 2 |
| 802.11ax(HE160) | O     | O     | O         |

O = Support, X = Not Support

### Tested Band and Frequency

#### LPI

| 802.11ax(HE160) |     |             |
|-----------------|-----|-------------|
| Band            | CH  | Freq. (MHz) |
| U-NII 5         | 15  | 6025        |
|                 | 47  | 6185        |
|                 | 79  | 6345        |
| U-NII 6         | 111 | 6505        |
|                 | -   | -           |
|                 | -   | -           |
| U-NII 7         | 143 | 6665        |
|                 | 175 | 6825        |
|                 | -   | -           |
| U-NII 8         | 207 | 6985        |
|                 | -   | -           |
|                 | -   | -           |

### EUT Operation test setup

- **Test Software:** Qualcomm Radio Control Toolkit v4.0

- **Power setting**

#### LPI

| Band    | CH  | Freq. (MHz) | SISO_ANT1 | SISO_ANT2 | MIMO |
|---------|-----|-------------|-----------|-----------|------|
| U-NII 5 | 15  | 6025        | 8.5       | 10        | 8.5  |
|         | 47  | 6185        | 8.5       | 9         | 8.5  |
|         | 79  | 6345        | 8         | 10.5      | 9    |
| U-NII 6 | 111 | 6505        | 10        | 14        | 11   |
|         | NA  | NA          | NA        | NA        | NA   |
|         | NA  | NA          | NA        | NA        | NA   |
| U-NII 7 | 143 | 6665        | 9.5       | 13.5      | 11   |
|         | 175 | 6825        | 8.5       | 12        | 9.5  |
|         | NA  | NA          | NA        | NA        | NA   |
| U-NII 8 | 207 | 6985        | 9.5       | 11        | 10   |
|         | NA  | NA          | NA        | NA        | NA   |
|         | NA  | NA          | NA        | NA        | NA   |

### 3. Summary of Test Result

| FCC Part Section(s)                                                             | Test Description                        | Limit                                                                                                               | Test Condition | Status<br>Note 1 |
|---------------------------------------------------------------------------------|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------|------------------|
| 15.407(a)(10)                                                                   | Emission Bandwidth<br>(26 dB Bandwidth) | < 320 MHz                                                                                                           | Conducted      | C                |
| 2.1049                                                                          | Occupied Bandwidth<br>(99 %)            | 99% of the occupied bandwidth must be contained within all the U-NII sub bands authorized for that equipment class. |                | C                |
| 15.407(b)(7)                                                                    | In-Band Emissions                       | Part 15.407(b)(7)<br>(Refer to section 4.2)                                                                         |                | C                |
| 15.407(d)(6)                                                                    | Contention-based protocol               | Low-power indoor devices must detect co-channel energy with 90% or greater certainty.                               |                | C                |
| Note 1: C = Comply    NC = Not Comply    NT = Not Tested    NA = Not Applicable |                                         |                                                                                                                     |                |                  |

## 4. Test Result

### 4.1. Emission Bandwidth (26 dB Bandwidth) & Occupied BW (99 %)

#### ■ Test Requirements and limit

##### Emission Bandwidth (26 dB Bandwidth)

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

##### Occupied BW (99 %)

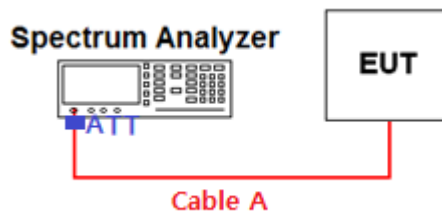
The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

##### Limit

**Part 15.407(a)(10):** The maximum transmitter channel bandwidth for U-NII devices in the 5.925-7.125 GHz band is 320 megahertz.

**KDB 987594 D04v02 Section 5:** 99% of the occupied bandwidth must be contained within all the U-NII sub bands authorized for that equipment class.

#### ■ Test Configuration



#### ■ Test Procedure

- KDB 987594 D02v01r01

- KDB 789033 D02v02r01

##### Emission Bandwidth (26 dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.

- 1) Set RBW = approximately 1% of the emission bandwidth.
- 2) Set the VBW > RBW.
- 3) Detector = Peak.
- 4) Trace mode = max hold.
- 5) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described in this section

##### 99% Occupied Bandwidth

The transmitter output is connected to the Spectrum Analyzer.

- 1) Set center frequency to the nominal EUT channel center frequency.
- 2) Set span = 1.5 times to 5.0 times the OBW.
- 3) Set RBW = 1% to 5% of the OBW
- 4) Set VBW  $\geq 3 \times$  RBW
- 5) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- 6) Use the 99% power bandwidth function of the instrument (if available).

## Test Results

### Test Mode: LPI & 802.11ax(HE160)\_SISO

| Band    | Mode            | CH  | Frequency (MHz) | Tones | RU Index | ANT 1<br>26dB BW<br>(MHz) | ANT 2<br>26dB BW<br>(MHz) | ANT 1<br>99% dB BW<br>(MHz) | ANT 2<br>99% dB BW<br>(MHz) |
|---------|-----------------|-----|-----------------|-------|----------|---------------------------|---------------------------|-----------------------------|-----------------------------|
| U-NII 5 | 802.11ax(HE160) | 15  | 6025            | SU    | -        | 164.32                    | 164.65                    | 154.74                      | 155.06                      |
| U-NII 5 | 802.11ax(HE160) | 47  | 6185            | SU    | -        | 164.04                    | 163.46                    | 154.43                      | 154.06                      |
| U-NII 5 | 802.11ax(HE160) | 79  | 6345            | SU    | -        | 164.79                    | 163.55                    | 154.92                      | 154.05                      |
| U-NII 6 | 802.11ax(HE160) | 111 | 6505            | SU    | -        | 164.10                    | 164.15                    | 154.97                      | 155.35                      |
| U-NII 7 | 802.11ax(HE160) | 143 | 6665            | SU    | -        | 164.27                    | 164.12                    | 154.72                      | 155.24                      |
| U-NII 7 | 802.11ax(HE160) | 175 | 6825            | SU    | -        | 165.42                    | 163.14                    | 155.75                      | 155.17                      |
| U-NII 8 | 802.11ax(HE160) | 207 | 6985            | SU    | -        | 163.30                    | 164.47                    | 154.66                      | 154.87                      |

### Test Mode: LPI & 802.11ax(HE160)\_MIMO

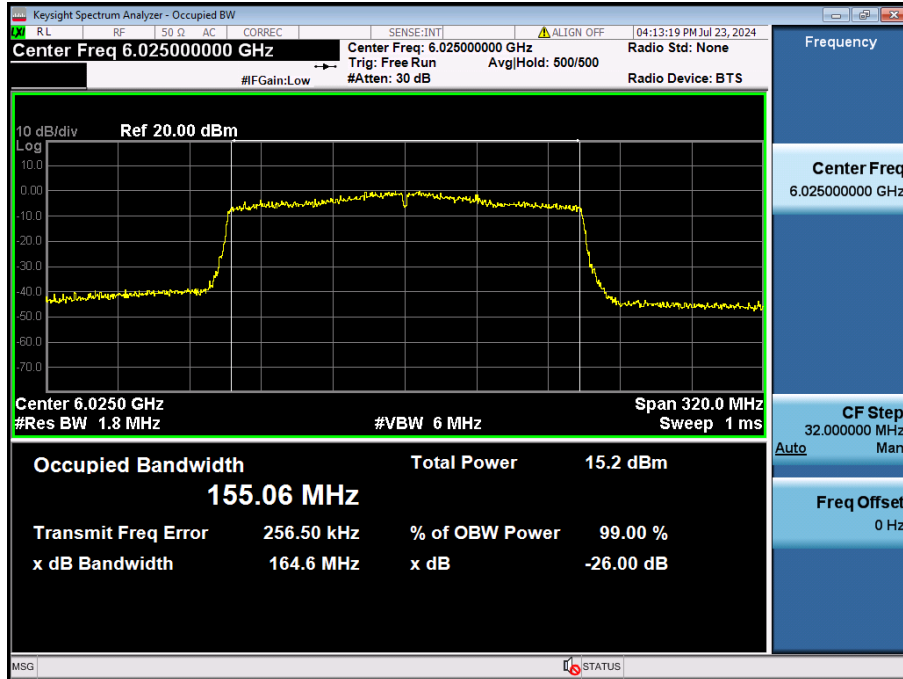
| Band    | Mode            | CH  | Frequency (MHz) | Tones | RU Index | ANT 1<br>26dB BW<br>(MHz) | ANT 2<br>26dB BW<br>(MHz) | ANT 1<br>99% dB BW<br>(MHz) | ANT 2<br>99% dB BW<br>(MHz) |
|---------|-----------------|-----|-----------------|-------|----------|---------------------------|---------------------------|-----------------------------|-----------------------------|
| U-NII 5 | 802.11ax(HE160) | 15  | 6025            | SU    | -        | 164.62                    | 162.98                    | 154.74                      | 155.04                      |
| U-NII 5 | 802.11ax(HE160) | 47  | 6185            | SU    | -        | 163.71                    | 163.46                    | 154.67                      | 154.35                      |
| U-NII 5 | 802.11ax(HE160) | 79  | 6345            | SU    | -        | 163.45                    | 163.40                    | 154.98                      | 154.47                      |
| U-NII 6 | 802.11ax(HE160) | 111 | 6505            | SU    | -        | 164.00                    | 164.00                    | 155.24                      | 155.52                      |
| U-NII 7 | 802.11ax(HE160) | 143 | 6665            | SU    | -        | 164.23                    | 164.07                    | 155.21                      | 155.02                      |
| U-NII 7 | 802.11ax(HE160) | 175 | 6825            | SU    | -        | 164.96                    | 163.92                    | 155.57                      | 155.37                      |
| U-NII 8 | 802.11ax(HE160) | 207 | 6985            | SU    | -        | 163.82                    | 163.14                    | 155.01                      | 154.50                      |

Note: Maximum Occupied bandwidth are attached.

SISO

26 dB Bandwidth & Occupied BW

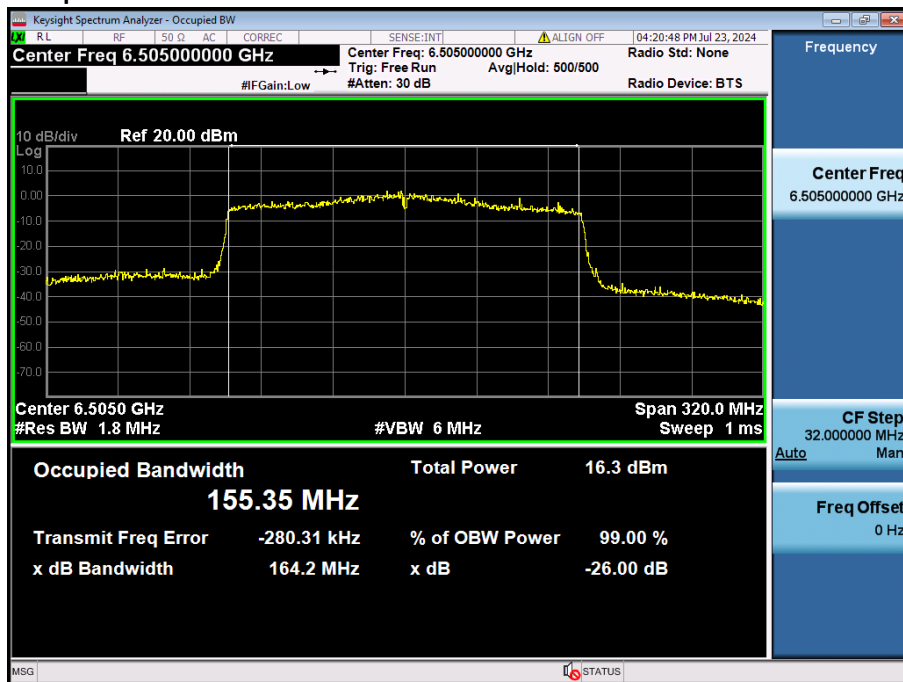
Test Mode: LPI & U-NII 5 & 802.11ax(HE160) & 6025 MHz & SU & ANT2



SISO

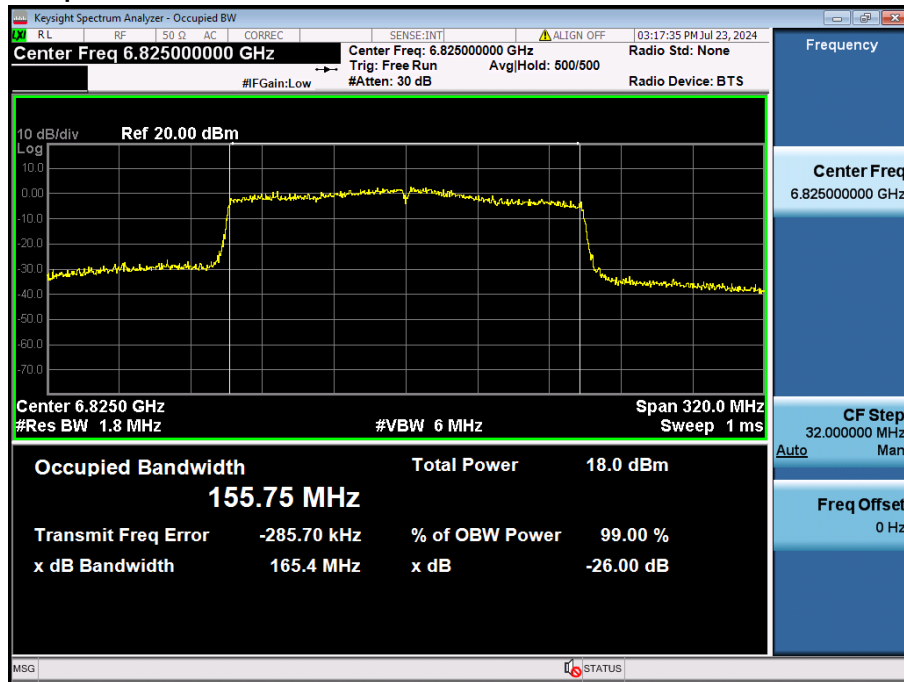
26 dB Bandwidth & Occupied BW

Test Mode: LPI & U-NII 6 & 802.11ax(HE160) & 6505 MHz & SU & ANT2



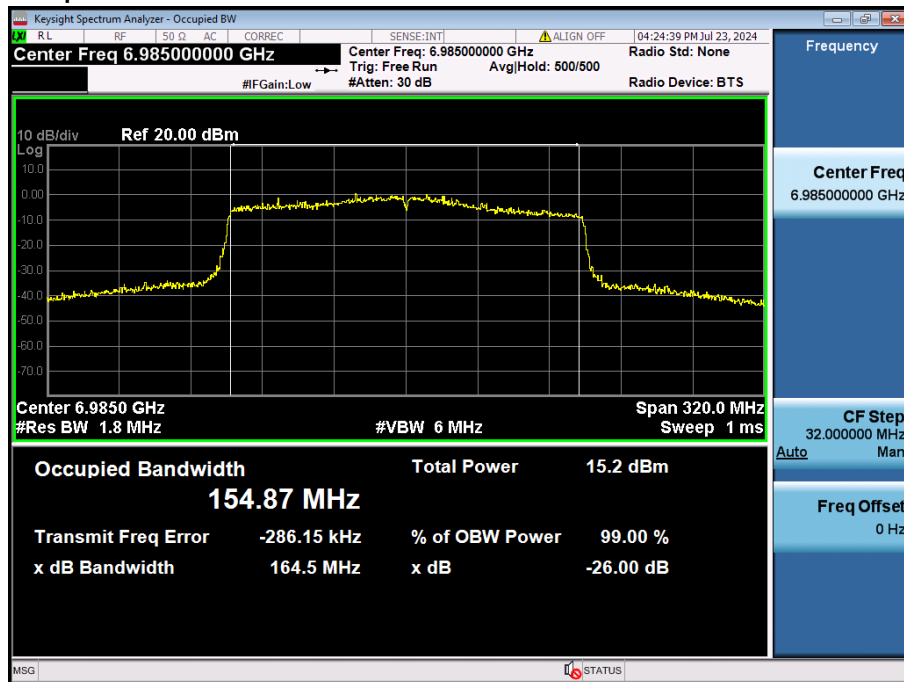
SISO  
26 dB Bandwidth & Occupied BW

Test Mode: LPI & U-NII 7 & 802.11ax(HE160) & 6825 MHz & SU & ANT1



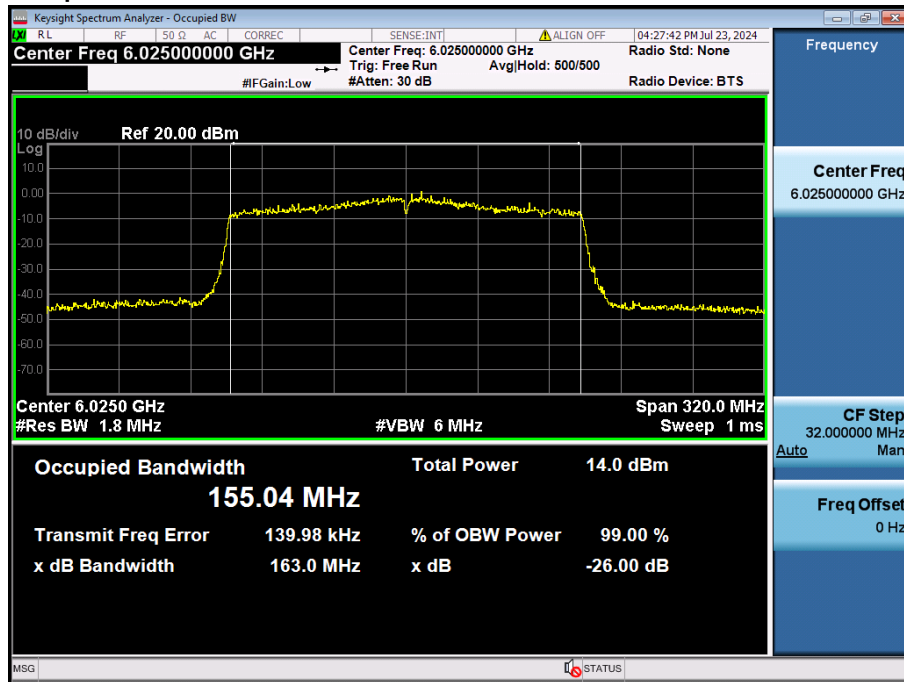
SISO  
26 dB Bandwidth & Occupied BW

Test Mode: LPI & U-NII 8 & 802.11ax(HE160) & 6985 MHz & SU & ANT2

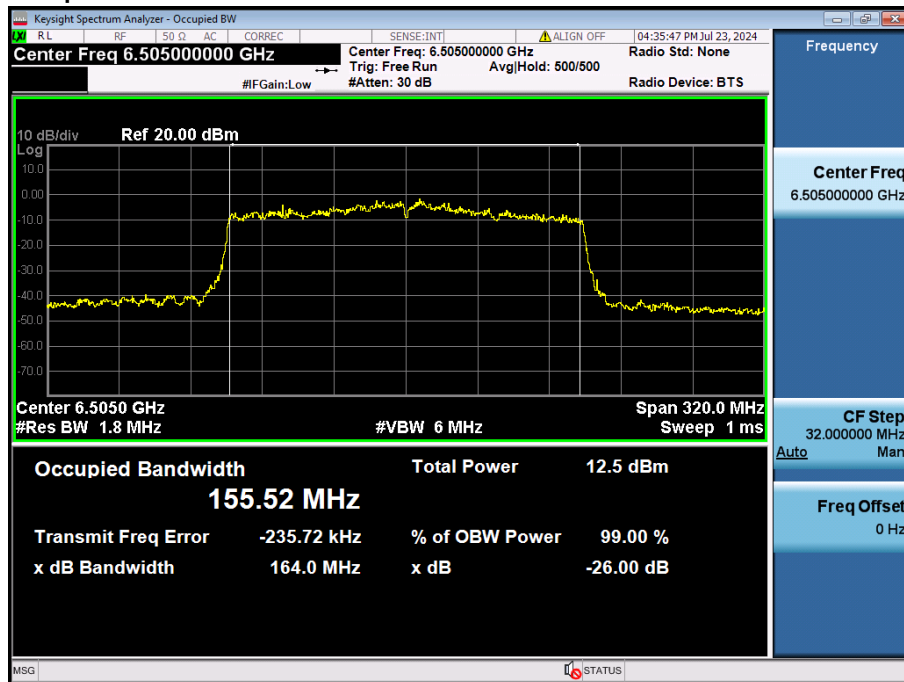


**MIMO**  
**26 dB Bandwidth & Occupied BW**

Test Mode: LPI &amp; U-NII 5 &amp; 802.11ax(HE160) &amp; 6025 MHz &amp; SU &amp; ANT2

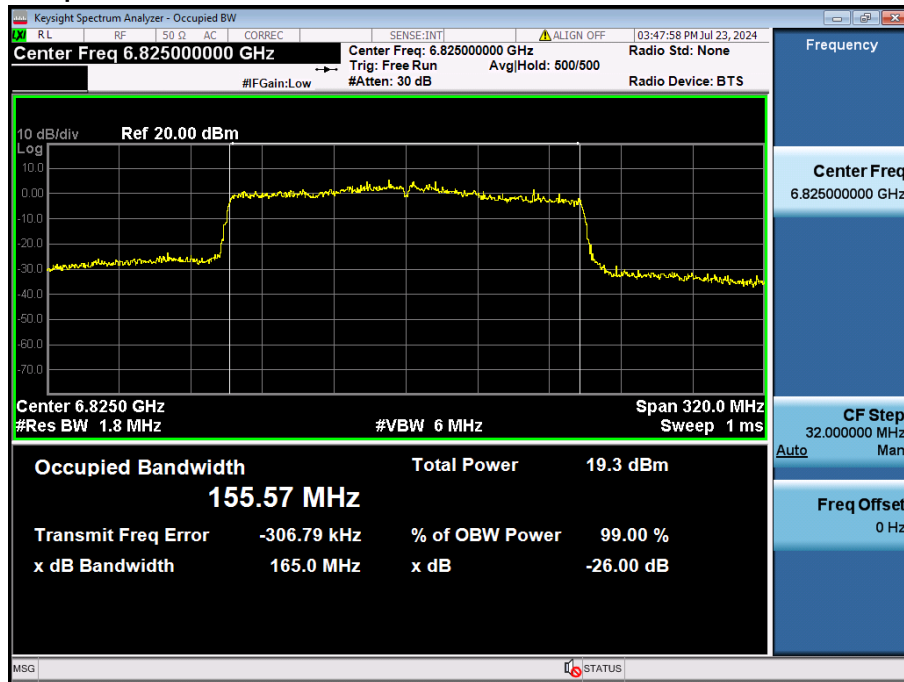
**MIMO**  
**26 dB Bandwidth & Occupied BW**

Test Mode: LPI &amp; U-NII 6 &amp; 802.11ax(HE160) &amp; 6505 MHz &amp; SU &amp; ANT2

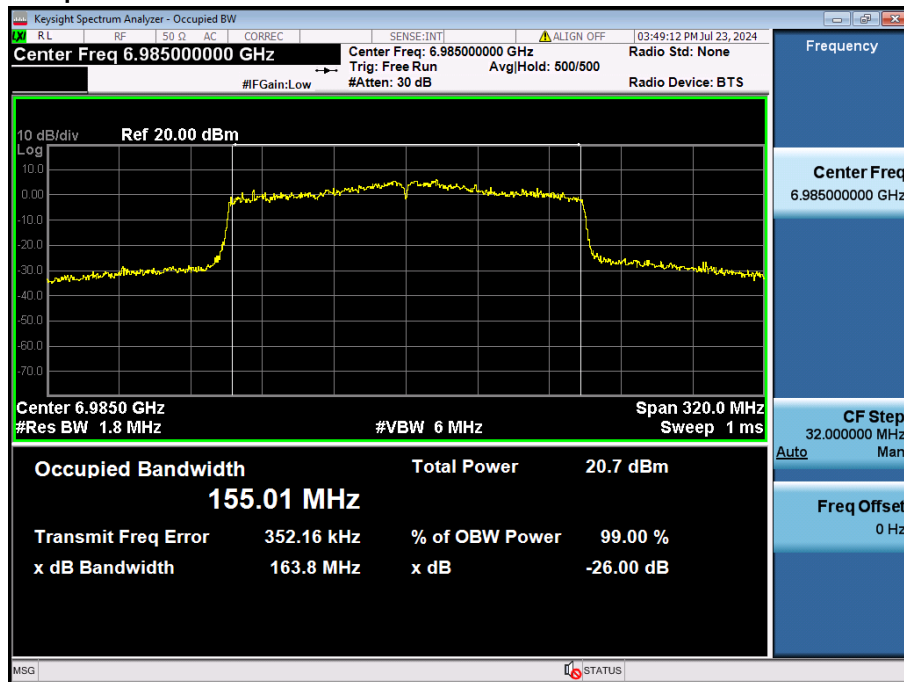


**MIMO**  
**26 dB Bandwidth & Occupied BW**

Test Mode: LPI &amp; U-NII 7 &amp; 802.11ax(HE160) &amp; 6825 MHz &amp; SU &amp; ANT1

**MIMO**  
**26 dB Bandwidth & Occupied BW**

Test Mode: LPI &amp; U-NII 8 &amp; 802.11ax(HE160) &amp; 6985 MHz &amp; SU &amp; ANT1



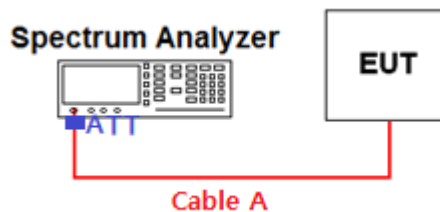
## 4.2. In-Band Emissions

### ■ Test Requirements and limit

#### Part 15.407(b)(7)

For transmitters operating within the 5.925-7.125 GHz bands: Power spectral density must be suppressed by 20 dB at 1 MHz outside of channel edge, by 28 dB at one channel bandwidth from the channel center, and by 40 dB at one- and one-half times the channel bandwidth away from channel center. At frequencies between one megahertz outside an unlicensed device's channel edge and one channel bandwidth from the center of the channel, the limits must be linearly interpolated between 20 dB and 28 dB suppression, and at frequencies between one and one- and one-half times an unlicensed device's channel bandwidth, the limits must be linearly interpolated between 28 dB and 40 dB suppression. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must be suppressed by at least 40 dB.

### ■ Test Configuration



### ■ Test Procedure

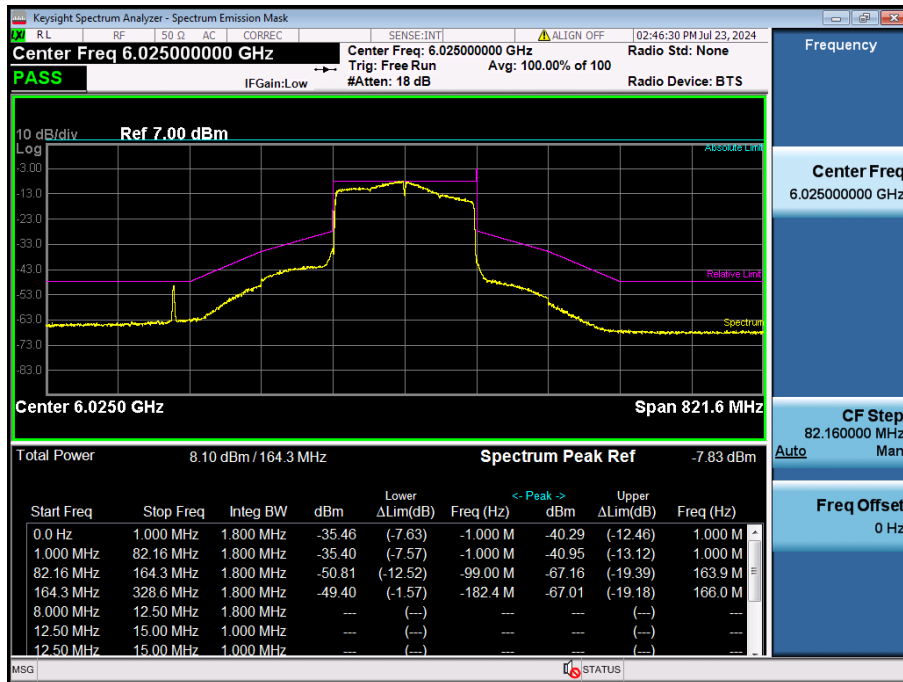
#### - KDB 987594 D02v01r01

- 1) Connect output of the antenna port to a spectrum analyzer or EMI receiver, with appropriate attenuation, as to not damage the instrumentation.
- 2) Set the reference level of the measuring equipment in accordance with procedure 4.1.5.2 of ANSI C63.10-2013.
- 3) Measure the 26 dB EBW using the test procedure 12.4.1 of ANSI C63.10-2013. (This will be used to determine the channel edge.)
- 4) Measure the power spectral density (which will be used for emissions mask reference) using the following procedure:
  - a) Set the span to encompass the entire 26 dB EBW of the signal.
  - b) Set RBW = same RBW used for 26 dB EBW measurement.
  - c) Set VBW  $\geq 3 \times$  RBW
  - d) Number of points in sweep  $\geq [2 \times \text{span} / \text{RBW}]$ .
  - e) Sweep time = auto.
  - f) Detector = RMS (i.e., power averaging)
  - g) Trace average at least 100 traces in power averaging (rms) mode.
  - h) Use the peak search function on the instrument to find the peak of the spectrum.
- 5) For the purposes of developing the emission mask, the channel bandwidth is defined as the 26 dB EBW.
- 6) Using the measuring equipment limit line function, develop the emissions mask based on the following requirements. The emissions power spectral density must be reduced below the peak power spectral density (in dB) as follows:
  - a. Suppressed by 20 dB at 1 MHz outside of the channel edge. (The channel edge is defined as the 26-dB point on either side of the carrier center frequency.)
  - b. Suppressed by 28 dB at one channel bandwidth from the channel center.
  - c. Suppressed by 40 dB at one- and one-half times the channel bandwidth from the channel center.
- 7) Adjust the span to encompass the entire mask as necessary.
- 8) Clear trace.
- 9) Trace average at least 100 traces in power averaging (rms) mode.
- 10) Adjust the reference level as necessary so that the crest of the channel touches the top of the emission mask.

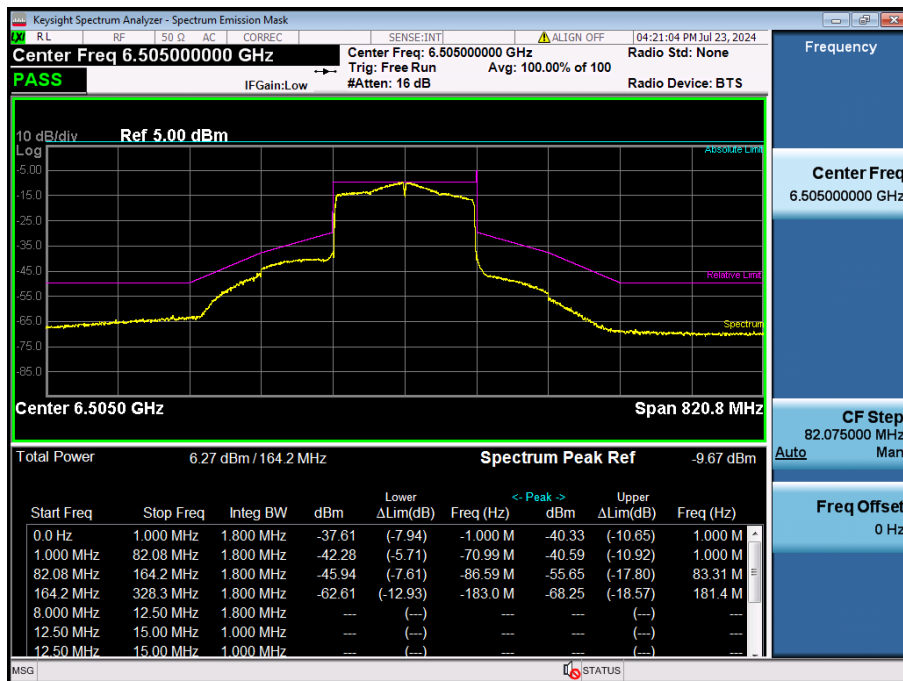
Note: All antenna configurations and Lowest/Middle/Highest channels were tested and worst-case results were reported.  
Refer to next page for worst-case plots.

SISO  
In-Band Emissions

Test Mode: LPI &amp; U-NII 5 &amp; 802.11ax(HE160) &amp; 6025 MHz &amp; SU &amp; ANT1

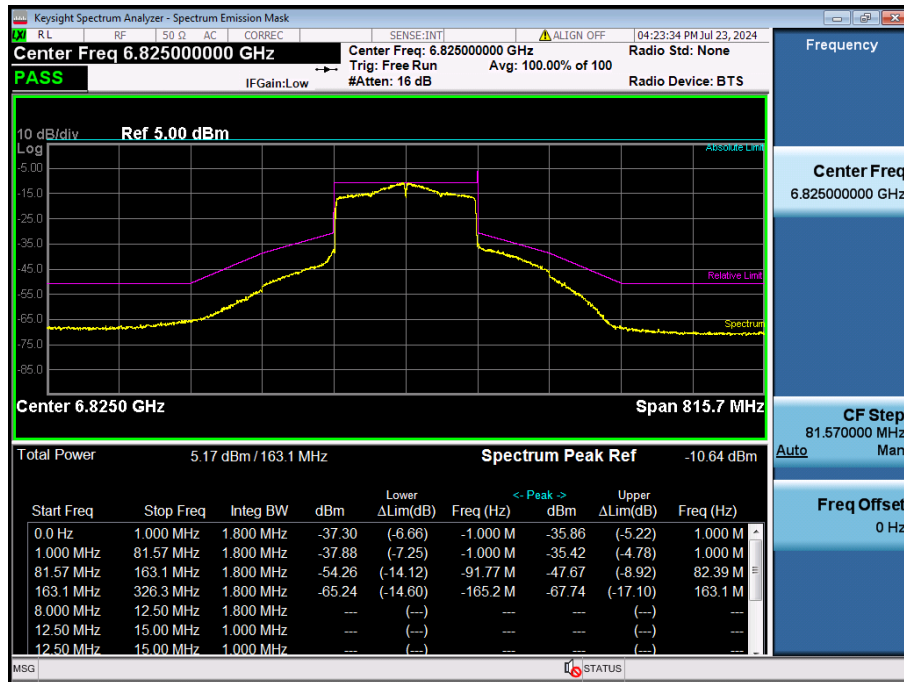
SISO  
In-Band Emissions

Test Mode: LPI &amp; U-NII 6 &amp; 802.11ax(HE160) &amp; 6505 MHz &amp; SU &amp; ANT2

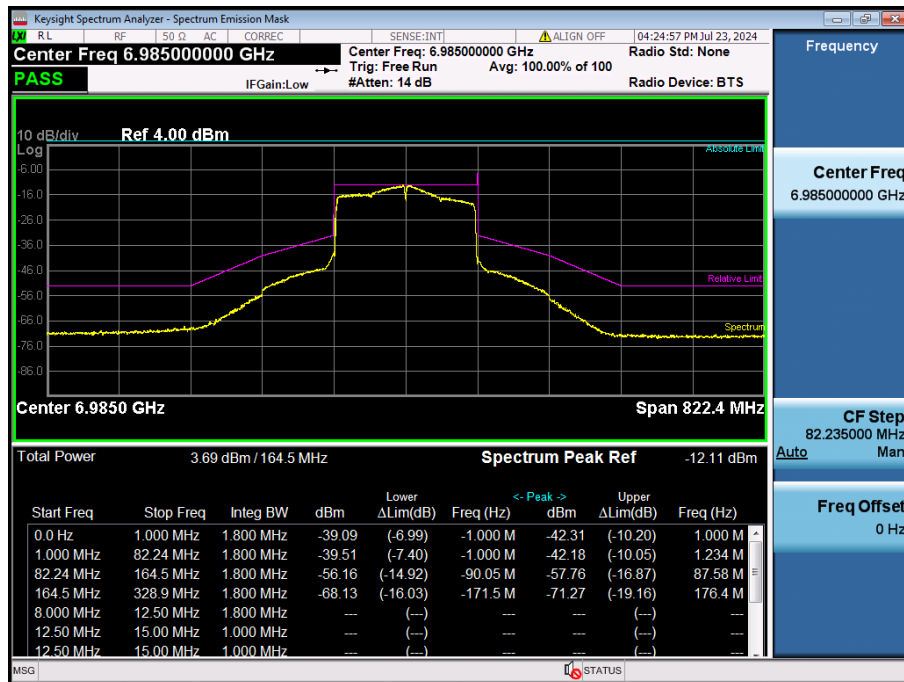


SISO  
In-Band Emissions

Test Mode: LPI &amp; U-NII 7 &amp; 802.11ax(HE160) &amp; 6825 MHz &amp; SU &amp; ANT2

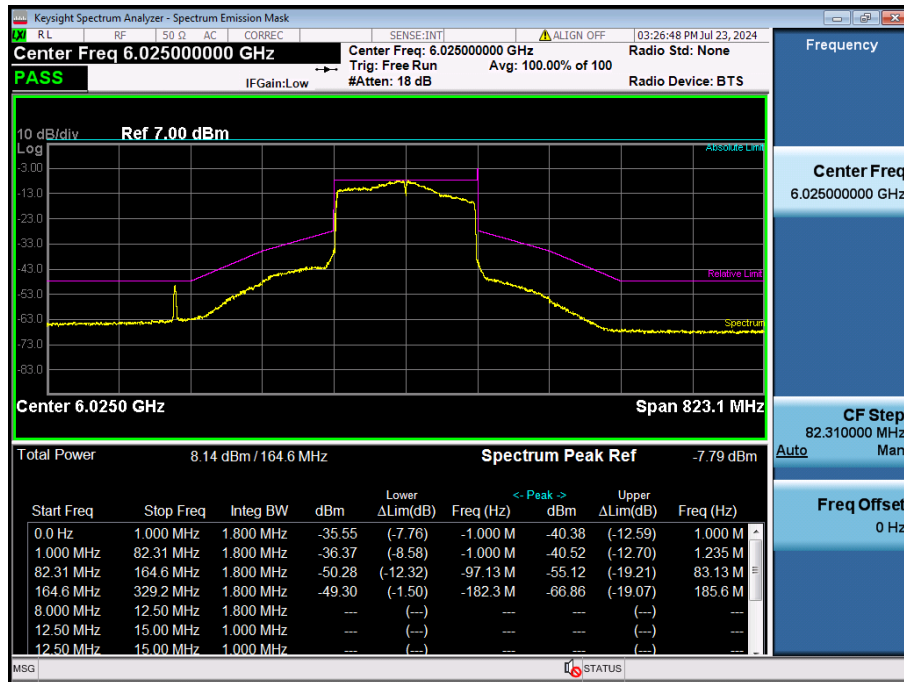
SISO  
In-Band Emissions

Test Mode: LPI &amp; U-NII 8 &amp; 802.11ax(HE160) &amp; 6985 MHz &amp; SU &amp; ANT2

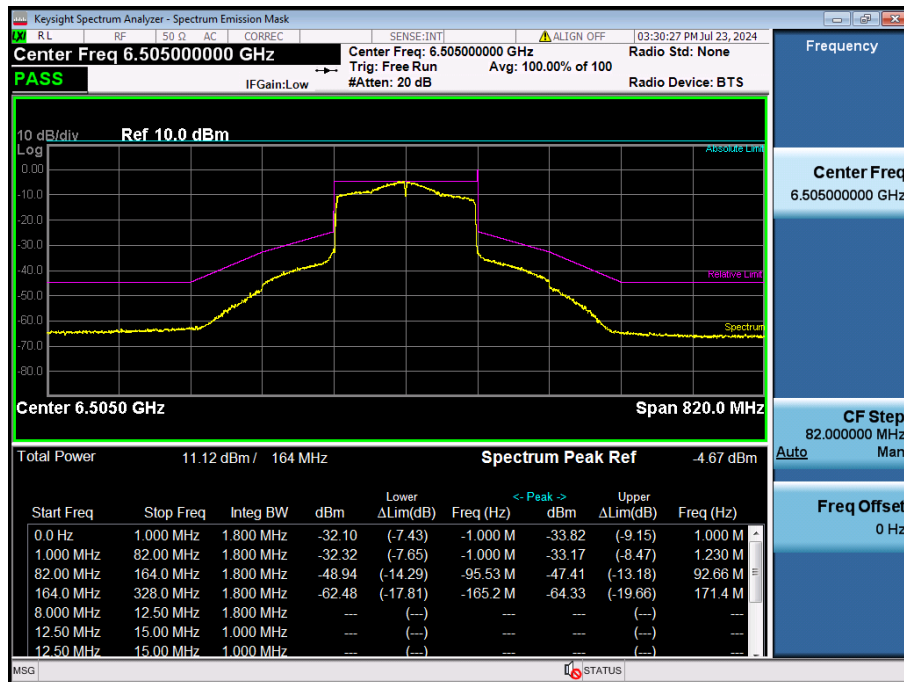


MIMO  
In-Band Emissions

Test Mode: LPI &amp; U-NII 5 &amp; 802.11ax(HE160) &amp; 6025 MHz &amp; SU &amp; ANT1

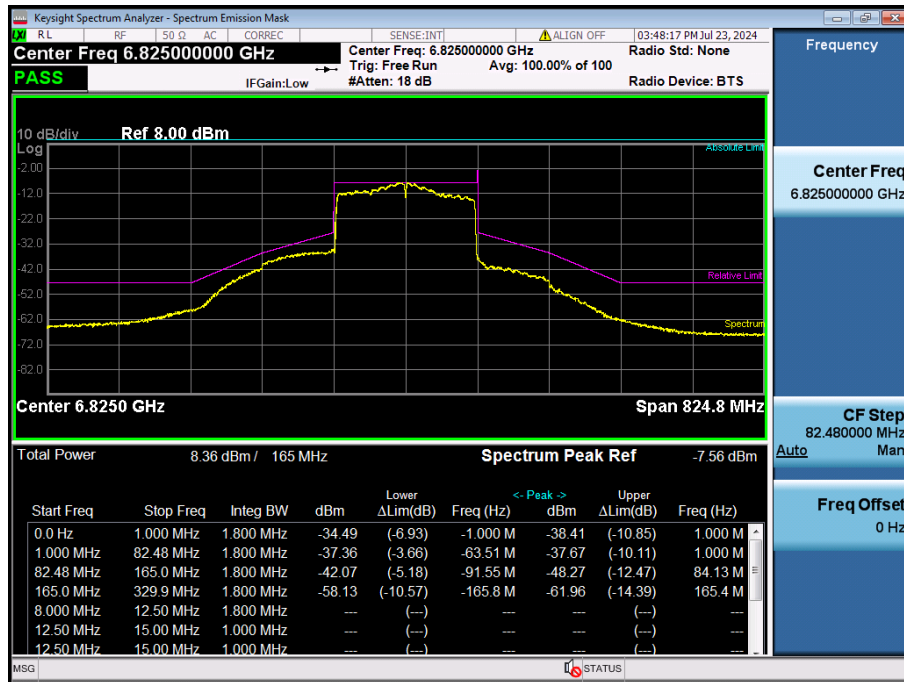
MIMO  
In-Band Emissions

Test Mode: LPI &amp; U-NII 6 &amp; 802.11ax(HE160) &amp; 6505 MHz &amp; SU &amp; ANT1

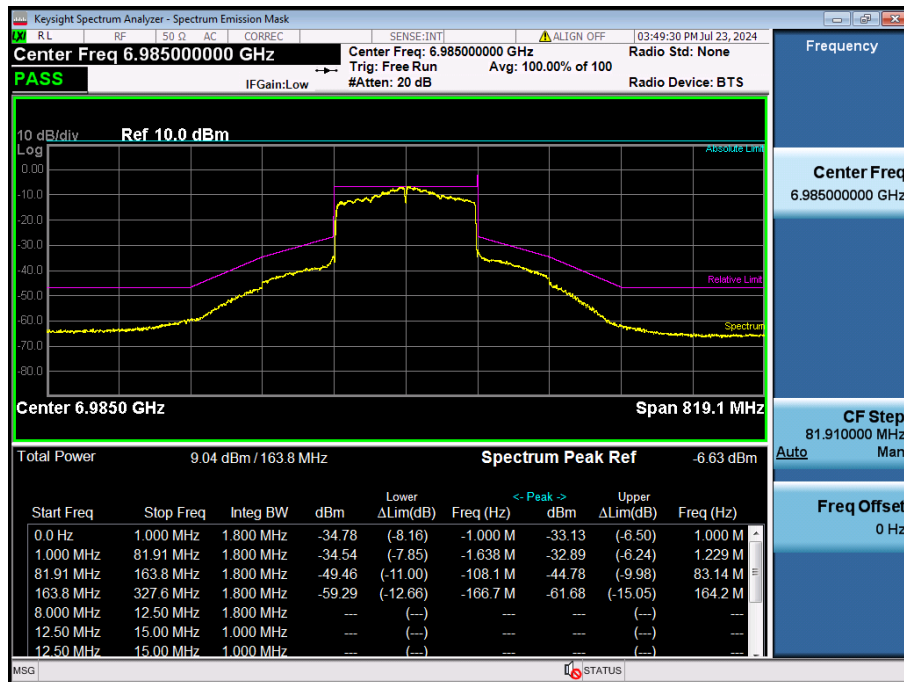


MIMO  
In-Band Emissions

Test Mode: LPI &amp; U-NII 7 &amp; 802.11ax(HE160) &amp; 6825 MHz &amp; SU &amp; ANT1

MIMO  
In-Band Emissions

Test Mode: LPI &amp; U-NII 8 &amp; 802.11ax(HE160) &amp; 6985 MHz &amp; SU &amp; ANT1



### 4.3. Contention-based protocol

#### ■ Test Requirements and limit

##### 15.407(d)(6)

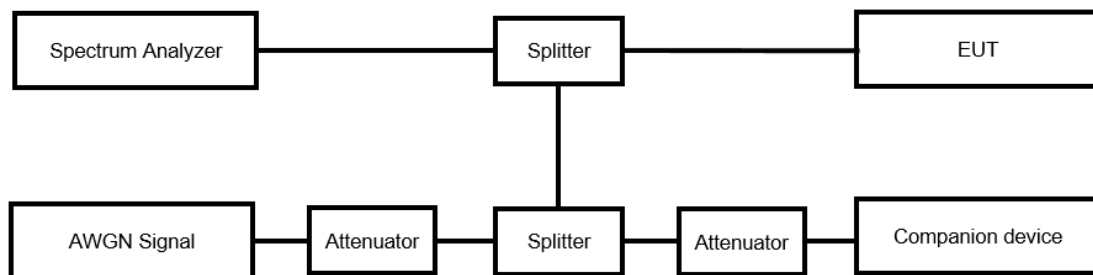
Indoor access points, subordinate devices and client devices operating in the 5.925-7.125 GHz band must employ a contention-based protocol.

##### KDB 987594 D02v01r01 Section II.I.

Indoor access points, subordinate devices and client devices operating in the 5.925-7.125 GHz band (herein referred to as unlicensed devices) are required to use technologies that include a contention-based protocol to avoid co-channel interference with incumbent devices sharing the band. To ensure incumbent co-channel operations are detected in a technology-agnostic manner, unlicensed devices are required to detect co-channel radio frequency energy (energy detect) and avoid simultaneous transmission. Unlicensed low-power indoor devices must detect co-channel radio frequency power that is at least -62 dBm or lower. Upon detection of energy in the band, unlicensed low power indoor devices must vacate the channel (in which incumbent signal is transmitted) and stay off the incumbent channel as long as detected radio frequency power is equal to or greater than the threshold (-62 dBm)<sup>1</sup>. The -62 dBm (or lower) threshold is referenced to a 0 dBi antenna gain.

To ensure incumbent operations are reliably detected in the band, low power indoor devices must detect RF energy throughout their intended operating channel. For example, an 802.11 device that plans to transmit a 40 MHz- wide signal (on a primary 20 MHz channel and a secondary 20 MHz channel) must detect energy throughout the entire 40 MHz channel. Additionally, **low-power indoor devices must detect co-channel energy with 90% or greater certainty.**

#### ■ Test Configuration



## Test Procedure

### - KDB 987594 D02v01r01

- 1) Configure the EUT to transmit with a constant duty cycle.
- 2) Set the operating parameters of the EUT including power level, operating frequency, modulation and bandwidth.
- 3) Set the signal analyzer center frequency to the nominal EEUT channel center frequency. The span range of the signal analyzer shall be between two times and five times the OBW of the EUT. Connect the output port of the EUT to the signal analyzer 2, as shown in test configuration. Ensure that the attenuator 2 provides enough attenuation to not overload the signal analyzer 2 receiver.
- 4) Monitoring the signal analyzer 2, verify the EUT is operating and transmitting with the parameters set at step two.
- 5) Using an AWGN signal source, generate (but do not transmit, i.e., RF OFF) a 10 MHz-wide AWGN signal. Use Table 1 to determine the center frequency of the 10 MHz AWGN signal relative to the EUT's channel bandwidth and center frequency.
- 6) Set the AWGN signal power to an extremely low level (more than 20 dB below the -62 dBm threshold). Connect the AWGN signal source, via a 3-dB splitter, to the signal analyzer 1 and the EUT as shown in test configuration.
- 7) Transmit the AWGN signal (RF ON) and verify its characteristics on the signal analyzer 1.
- 8) Monitor the signal analyzer 2 to verify if the AWGN signal has been detected and the EUT has ceased transmission. If the EUT continues to transmit, then incrementally increase the AWGN signal power level until the EUT stops transmitting.
- 9) (Including all losses in the RF paths) Determine and record the AWGN signal power level (at the EUT's antenna port) at which the EUT ceased transmission. Repeat the procedure at least 10 times to verify the EUT can detect an AWGN signal with 90% (or better) level of certainty.
- 10) Refer to Table 1 to determine number of times the detection threshold testing needs to be repeated. If testing is required more than once, then go back to step 5, choose a different center frequency for the AWGN signal and repeat the process.

**Table 1.** Criteria to determine number of times detection threshold test may be performed

| If                                    | Number of Tests                                              | Placement of Incumbent Transmission                                                                                                                                                          |
|---------------------------------------|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $BW_{EUT} \leq BW_{Inc}$              | Once                                                         | Tune incumbent and EUT transmissions ( $f_{c1}=f_{c2}$ )                                                                                                                                     |
| $BW_{Inc} < BW_{EUT} \leq 2BW_{Inc}$  | Once                                                         | Incumbent transmission is contained within $BW_{EUT}$                                                                                                                                        |
| $2BW_{Inc} < BW_{EUT} \leq 4BW_{Inc}$ | Twice. Incumbent transmission is contained within $BW_{Inc}$ | Incumbent transmission is located as closely as possible to the lower edge and upper edge, respectively, of the EUT channel                                                                  |
| $BW_{EUT} > 4BW_{Inc}$                | Three times                                                  | Incumbent transmission is located as closely as possible to the lower edge of the EUT channel, in the middle of EUT channel, and as closely as possible to the upper edge of the EUT channel |

where:

$BW_{EUT}$ : Transmission bandwidth of EUT signal

$BW_{Inc}$ : Transmission bandwidth of the simulated incumbent signal (10 MHz wide AWGN signal)

$f_{c1}$ : Center frequency of EUT transmission

$f_{c2}$ : Center frequency of simulated incumbent signal

## Test Results

### Detection Results

| Band  | Channel BW (MHz) | Channel | EUT Frequency (MHz) | AWGN Frequency (MHz) | AWGN Power (dBm) | Antenna Gain(dBi) | Adjusted Power (dBm) | Detection Limit (dBm) | EUT TX Status |
|-------|------------------|---------|---------------------|----------------------|------------------|-------------------|----------------------|-----------------------|---------------|
| NII-5 | 160              | 47      | 6185                | 6110                 | -77.4            | -0.82             | -76.6                | -62.0                 | OFF           |
| NII-5 | 160              | 47      | 6185                | 6110                 | -79.8            | -0.82             | -79.0                | -62.0                 | Minimal       |
| NII-5 | 160              | 47      | 6185                | 6110                 | -85.8            | -0.82             | -85.0                | -62.0                 | ON            |
| NII-5 | 160              | 47      | 6185                | 6185                 | -74.8            | -0.82             | -73.9                | -62.0                 | OFF           |
| NII-5 | 160              | 47      | 6185                | 6185                 | -75.7            | -0.82             | -74.8                | -62.0                 | Minimal       |
| NII-5 | 160              | 47      | 6185                | 6185                 | -85.9            | -0.82             | -85.0                | -62.0                 | ON            |
| NII-5 | 160              | 47      | 6185                | 6260                 | -80.8            | -0.82             | -80.0                | -62.0                 | OFF           |
| NII-5 | 160              | 47      | 6185                | 6260                 | -82.9            | -0.82             | -82.1                | -62.0                 | Minimal       |
| NII-5 | 160              | 47      | 6185                | 6260                 | -85.8            | -0.82             | -85.0                | -62.0                 | ON            |
| NII-6 | 160              | 111     | 6505                | 6430                 | -77.3            | -7.91             | -69.3                | -62.0                 | OFF           |
| NII-6 | 160              | 111     | 6505                | 6430                 | -80.0            | -7.91             | -72.0                | -62.0                 | Minimal       |
| NII-6 | 160              | 111     | 6505                | 6430                 | -93.0            | -7.91             | -85.0                | -62.0                 | ON            |
| NII-6 | 160              | 111     | 6505                | 6505                 | -73.1            | -7.91             | -65.2                | -62.0                 | OFF           |
| NII-6 | 160              | 111     | 6505                | 6505                 | -74.5            | -7.91             | -66.6                | -62.0                 | Minimal       |
| NII-6 | 160              | 111     | 6505                | 6505                 | -92.9            | -7.91             | -85.0                | -62.0                 | ON            |
| NII-6 | 160              | 111     | 6505                | 6580                 | -76.9            | -7.91             | -69.0                | -62.0                 | OFF           |
| NII-6 | 160              | 111     | 6505                | 6580                 | -79.3            | -7.91             | -71.4                | -62.0                 | Minimal       |
| NII-6 | 160              | 111     | 6505                | 6580                 | -92.9            | -7.91             | -85.0                | -62.0                 | ON            |
| NII-7 | 160              | 143     | 6665                | 6590                 | -75.6            | -5.07             | -70.5                | -62.0                 | OFF           |
| NII-7 | 160              | 143     | 6665                | 6590                 | -77.4            | -5.07             | -72.3                | -62.0                 | Minimal       |
| NII-7 | 160              | 143     | 6665                | 6590                 | -90.1            | -5.07             | -85.0                | -62.0                 | ON            |
| NII-7 | 160              | 143     | 6665                | 6665                 | -72.3            | -5.07             | -67.2                | -62.0                 | OFF           |
| NII-7 | 160              | 143     | 6665                | 6665                 | -73.6            | -5.07             | -68.5                | -62.0                 | Minimal       |
| NII-7 | 160              | 143     | 6665                | 6665                 | -90.1            | -5.07             | -85.0                | -62.0                 | ON            |
| NII-7 | 160              | 143     | 6665                | 6740                 | -77.7            | -5.07             | -72.6                | -62.0                 | OFF           |
| NII-7 | 160              | 143     | 6665                | 6740                 | -80.0            | -5.07             | -74.9                | -62.0                 | Minimal       |
| NII-7 | 160              | 143     | 6665                | 6740                 | -90.1            | -5.07             | -85.0                | -62.0                 | ON            |
| NII-8 | 160              | 207     | 6985                | 6910                 | -74.4            | -2.55             | -71.8                | -62.0                 | OFF           |
| NII-8 | 160              | 207     | 6985                | 6910                 | -76.7            | -2.55             | -74.1                | -62.0                 | Minimal       |
| NII-8 | 160              | 207     | 6985                | 6910                 | -87.6            | -2.55             | -85.0                | -62.0                 | ON            |
| NII-8 | 160              | 207     | 6985                | 6985                 | -71.2            | -2.55             | -68.7                | -62.0                 | OFF           |
| NII-8 | 160              | 207     | 6985                | 6985                 | -71.9            | -2.55             | -69.4                | -62.0                 | Minimal       |
| NII-8 | 160              | 207     | 6985                | 6985                 | -87.5            | -2.55             | -85.0                | -62.0                 | ON            |
| NII-8 | 160              | 207     | 6985                | 7060                 | -74.9            | -2.55             | -72.3                | -62.0                 | OFF           |
| NII-8 | 160              | 207     | 6985                | 7060                 | -76.7            | -2.55             | -74.1                | -62.0                 | Minimal       |
| NII-8 | 160              | 207     | 6985                | 7060                 | -87.6            | -2.55             | -85.0                | -62.0                 | ON            |

Note: Contention based protocol was tested with receiver with the lowest antenna gain.

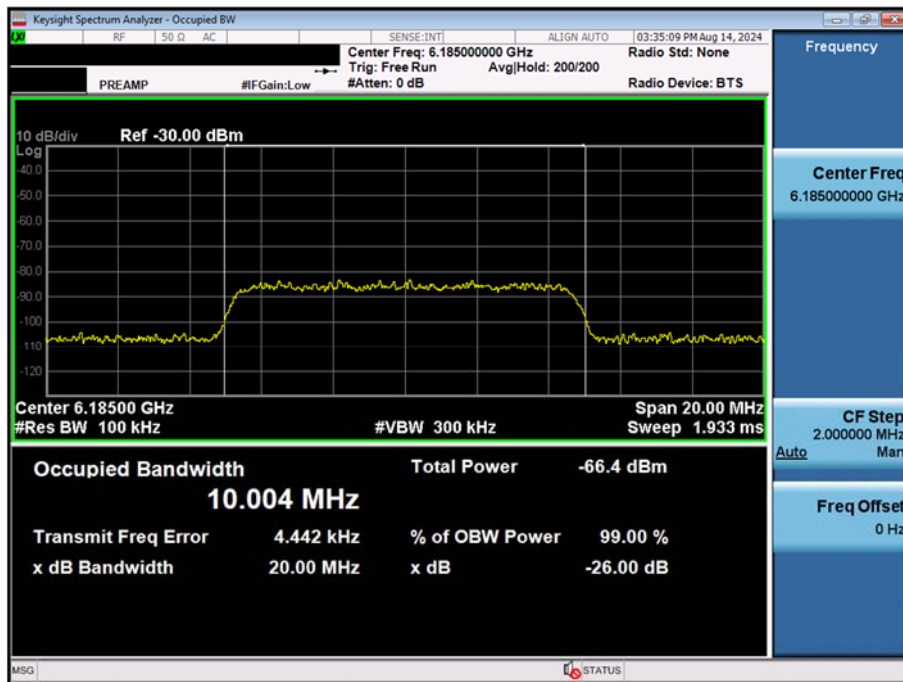
Adjusted power(dBm) = AWGN Power(dBm) – Antenna gain(dBi)

### Detection Probability

| Band  | Channel BW (MHz) | Channel | EUT Frequency (MHz) | AWGN Frequency (MHz) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Detection probability (%) |
|-------|------------------|---------|---------------------|----------------------|---|---|---|---|---|---|---|---|---|----|---------------------------|
| NII-5 | 160              | 47      | 6185                | 6110                 | O | O | O | O | O | O | O | O | O | O  | 100                       |
| NII-5 | 160              | 47      | 6185                | 6185                 | O | O | O | O | O | O | O | O | O | O  | 100                       |
| NII-5 | 160              | 47      | 6185                | 6260                 | O | O | O | O | O | O | O | O | O | O  | 100                       |
| NII-6 | 160              | 111     | 6505                | 6430                 | O | O | O | O | O | O | O | O | O | O  | 100                       |
| NII-6 | 160              | 111     | 6505                | 6505                 | O | O | O | O | O | O | O | O | O | O  | 100                       |
| NII-6 | 160              | 111     | 6505                | 6580                 | O | O | O | O | O | O | O | O | O | O  | 100                       |
| NII-7 | 160              | 143     | 6665                | 6590                 | O | O | O | O | O | O | O | O | O | O  | 100                       |
| NII-7 | 160              | 143     | 6665                | 6665                 | O | O | O | O | O | O | O | O | O | O  | 100                       |
| NII-7 | 160              | 143     | 6665                | 6740                 | O | O | O | O | O | O | O | O | O | O  | 100                       |
| NII-8 | 160              | 207     | 6985                | 6910                 | O | O | O | O | O | O | O | O | O | O  | 100                       |
| NII-8 | 160              | 207     | 6985                | 6985                 | O | O | O | O | O | O | O | O | O | O  | 100                       |
| NII-8 | 160              | 207     | 6985                | 7060                 | O | O | O | O | O | O | O | O | O | O  | 100                       |

## Test Plots

### AWGN Signal (AWGN OBW)

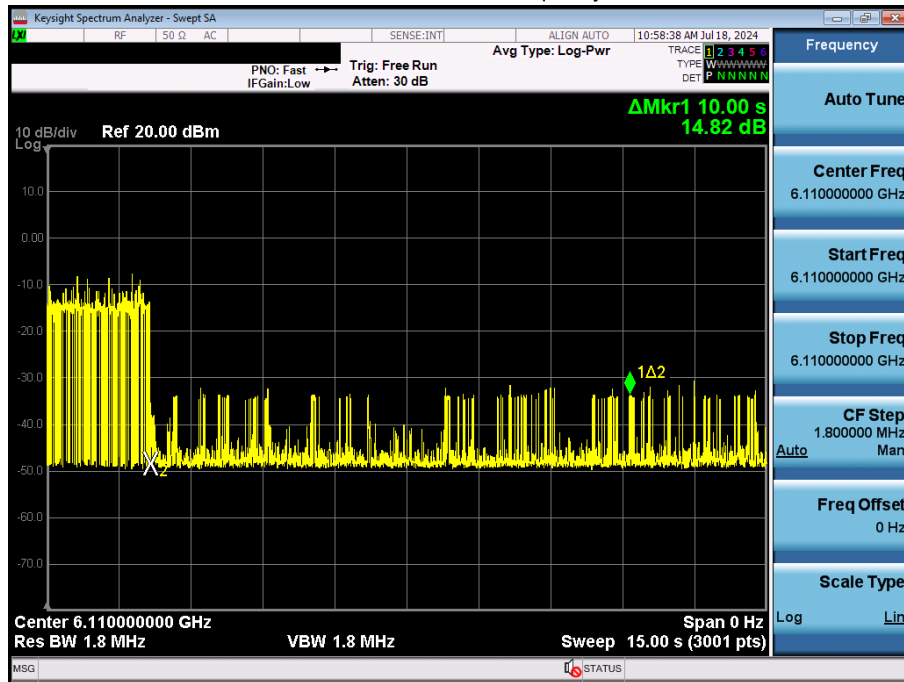


### AWGN Signal (AWGN Power)



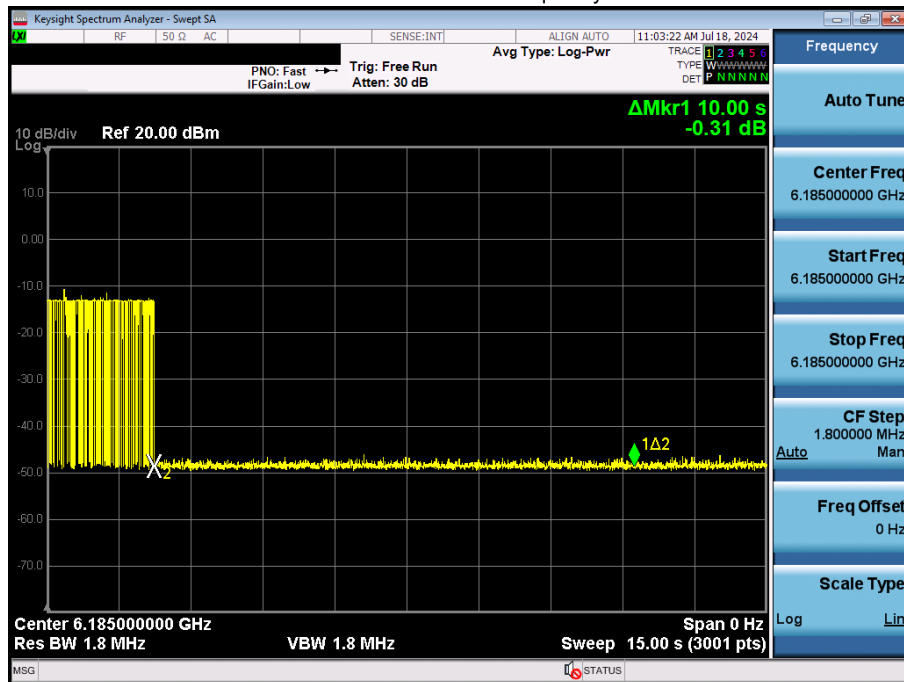
## Timing Plot

Test Mode: U-NII 5 & Channel BW: 160 MHz & EUT Frequency: 6185 MHz  
AWGN Frequency: 6110 MHz



## Timing Plot

Test Mode: U-NII 5 & Channel BW: 160 MHz & EUT Frequency: 6185 MHz  
AWGN Frequency: 6185 MHz



Test Mode: U-NII 5 & Channel BW: 160 MHz & EUT Frequency: 6185 MHz  
AWGN Frequency: 6260 MHz

Test Mode: U-NII 6 & Channel BW: 160 MHz & EUT Frequency: 6505 MHz  
AWGN Frequency: 6430 MHz

Test Mode: U-NII 6 & Channel BW: 160 MHz & EUT Frequency: 6505 MHz  
AWGN Frequency: 6505 MHz

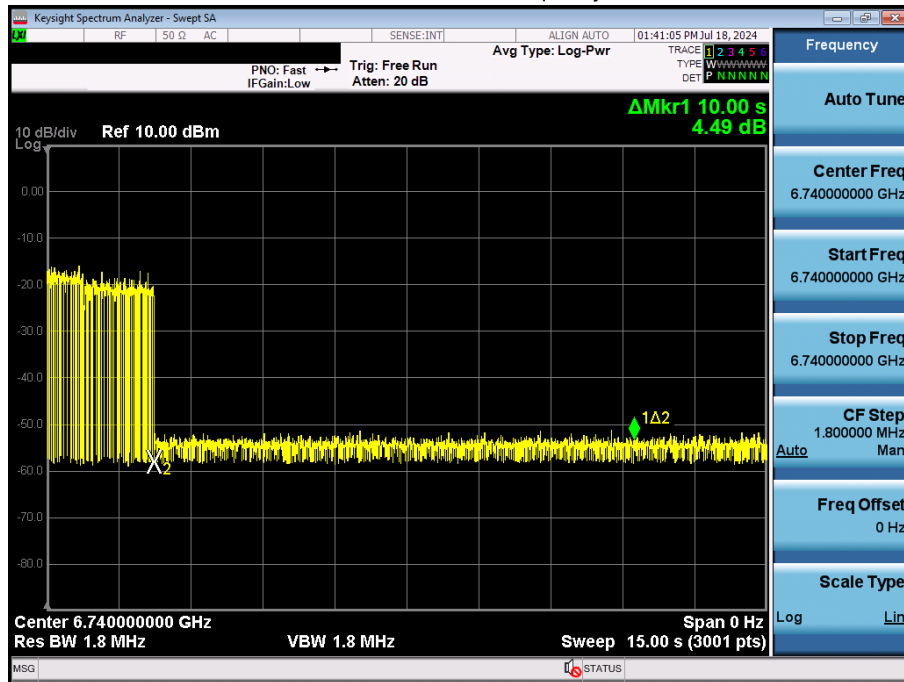
Test Mode: U-NII 6 & Channel BW: 160 MHz & EUT Frequency: 6505 MHz  
AWGN Frequency: 6580 MHz

Test Mode: U-NII 7 & Channel BW: 160 MHz & EUT Frequency: 6665 MHz  
AWGN Frequency: 6590 MHz

Test Mode: U-NII 7 & Channel BW: 160 MHz & EUT Frequency: 6665 MHz  
AWGN Frequency: 6665 MHz

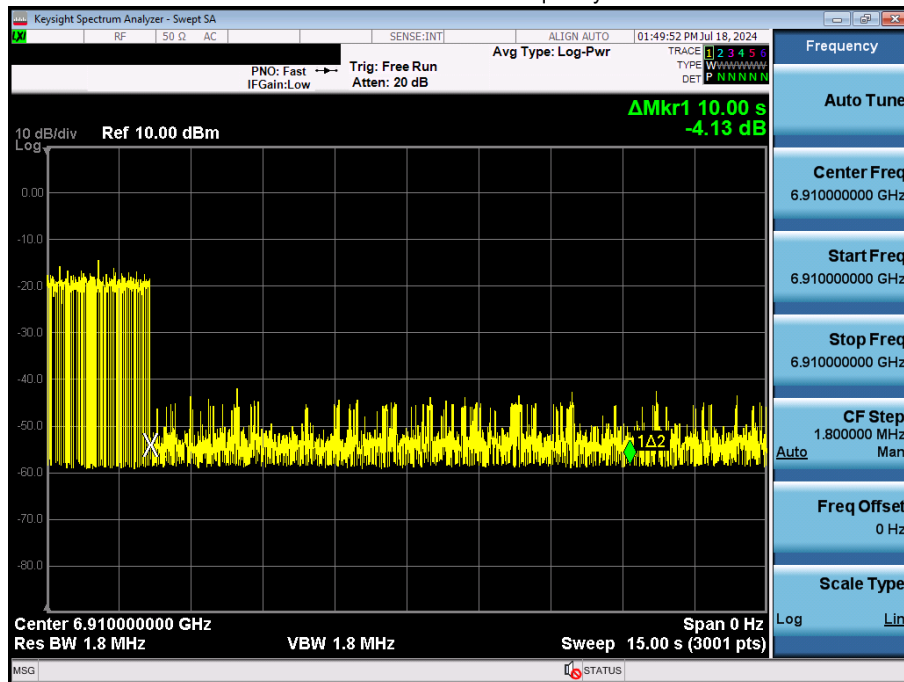
## Timing Plot

Test Mode: U-NII 7 & Channel BW: 160 MHz & EUT Frequency: 6665 MHz  
AWGN Frequency: 6740 MHz



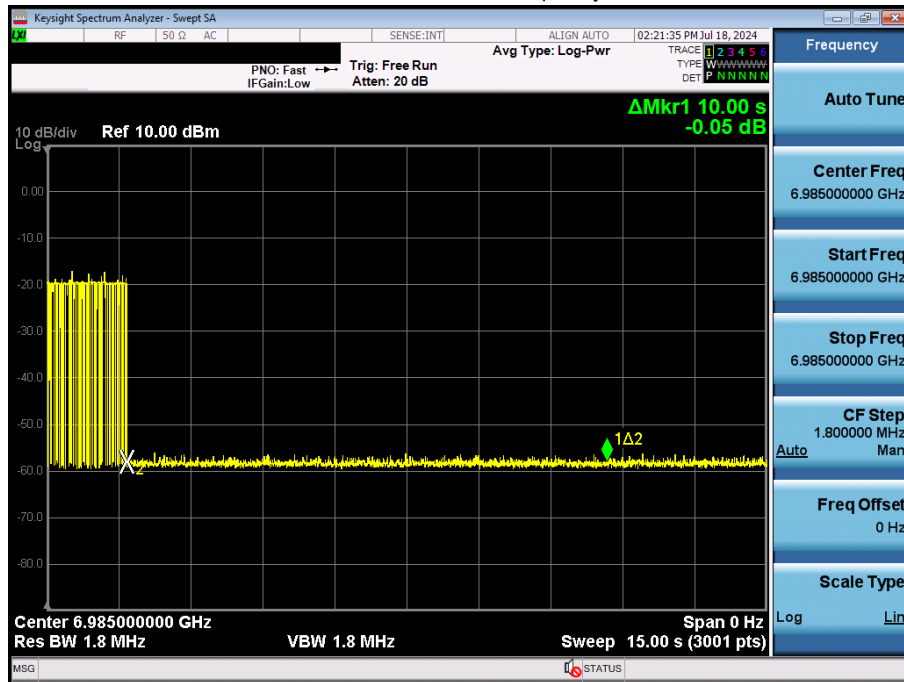
## Timing Plot

Test Mode: U-NII 8 & Channel BW: 160 MHz & EUT Frequency: 6985 MHz  
AWGN Frequency: 6910 MHz



## Timing Plot

Test Mode: U-NII 8 & Channel BW: 160 MHz & EUT Frequency: 6985 MHz  
AWGN Frequency: 6985 MHz



## Timing Plot

Test Mode: U-NII 8 & Channel BW: 160 MHz & EUT Frequency: 6985 MHz  
AWGN Frequency: 7060 MHz

