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 Name : SeungMin Gil (Signature)	Technical Manager Name : JaeJin Lee (Signature)

2024 . 08 . 14 .

Dt&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to 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

CONTENTS

1. General Information

1.1. Description of EUT

FCC ID	SS4S50F1
Product Name	Enterprise Full Touch Handheld Computer
Model Name(s)	S50, S70
FVIN(Firmware Version Identification Number)	R1.00
EUT Serial Number	S50XXXXXXXE315F9A9, S50XXXXXXX15B0C478
Supplying power	DC 3.85 V
Modulation Technique	OFDM, OFDMA
Antenna Information	Internal Antenna ANT 8 NII-5: 1.50 dBi NII-6: 0.94 dBi NII-7: 1.51 dBi NII-8: 0.25 dBi ANT 9 NII-5: -0.82 dBi NII-6: -7.91 dBi NII-7: -5.07 dBi NII-8: -2.55 dBi

1.2. Declaration by the applicant / manufacturer

N/A

1.3. Testing Laboratory

Dt&C Co., Ltd.		
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**		
www.dtnc.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

1.4. Testing Environment

Ambient Condition	
▪ Temperature	+24 ℃ ~ +25 ℃
▪ 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 (yy/mm/dd)	Next.Cal.Date (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 mothed.

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 Commissions 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 Note 1
15.407(a)(10)	Emission Bandwidth (26 dB Bandwidth)	< 320 MHz	Conducted	C
2.1049	Occupied Bandwidth (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) (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.

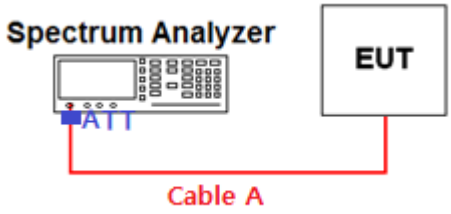
Occupied BW (99 %)

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 ≥ 3 x 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 26dB BW (MHz)	ANT 2 26dB BW (MHz)	ANT 1 99% dB BW (MHz)	ANT 2 99% dB BW (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

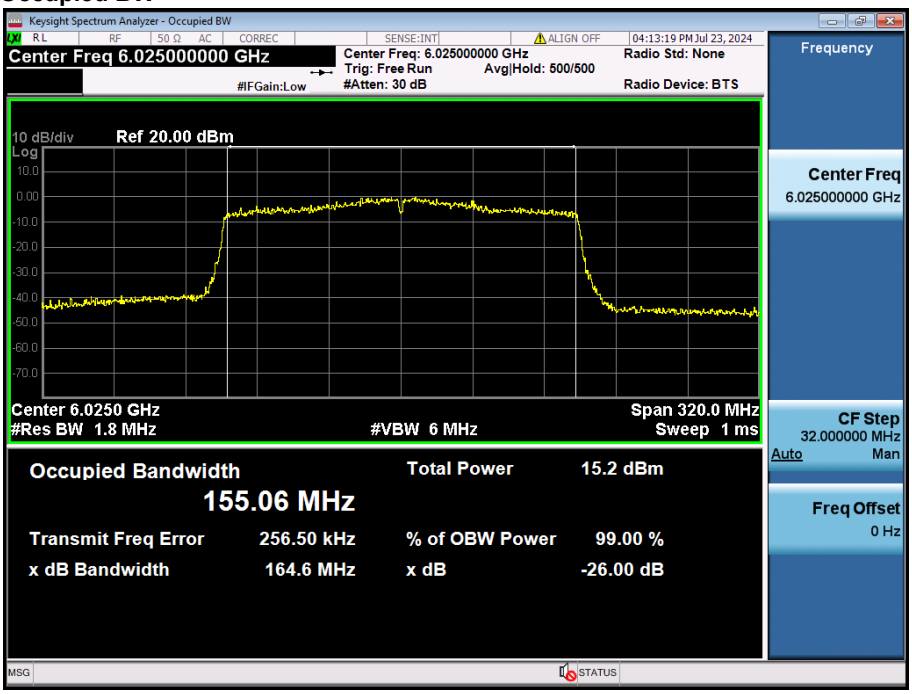
Test Mode: LPI & 802.11ax(HE160)_MIMO

Band	Mode	CH	Frequency (MHz)	Tones	RU Index	ANT 1 26dB BW (MHz)	ANT 2 26dB BW (MHz)	ANT 1 99% dB BW (MHz)	ANT 2 99% dB BW (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.

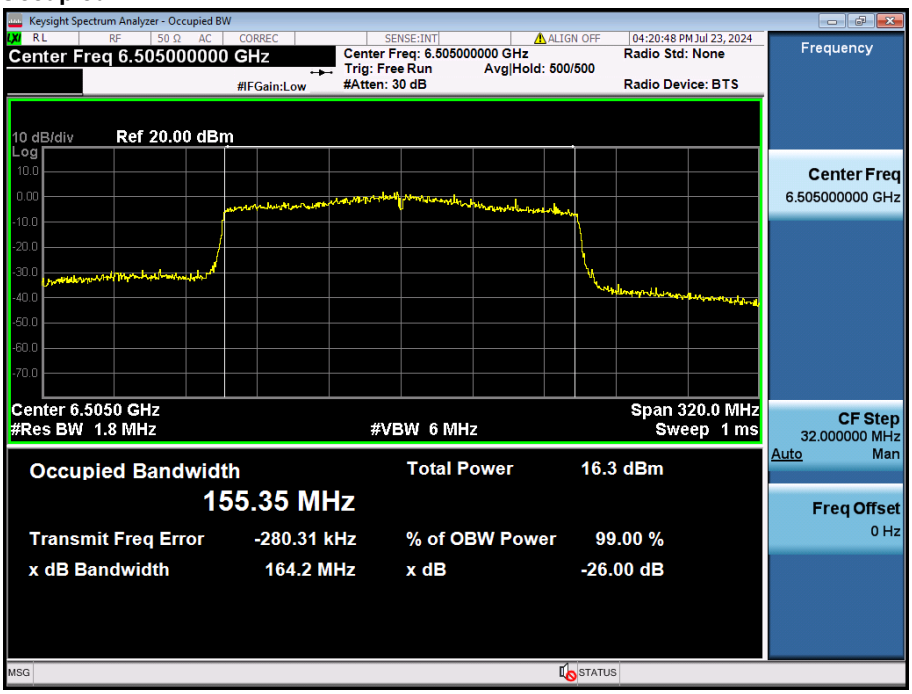
SISO
26 dB Bandwidth & Occupied BW

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



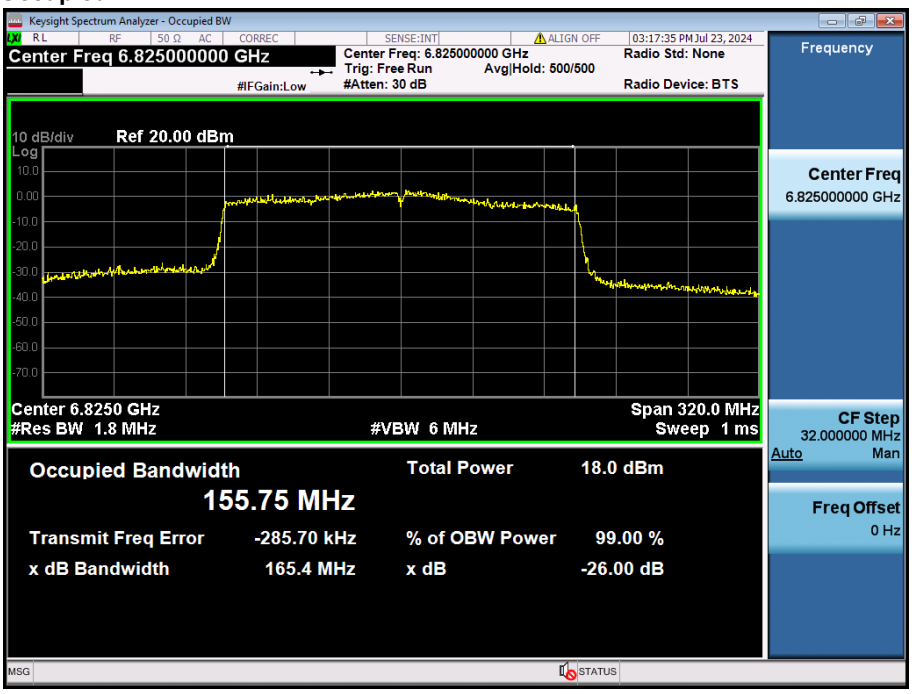
SISO
26 dB Bandwidth & Occupied BW

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



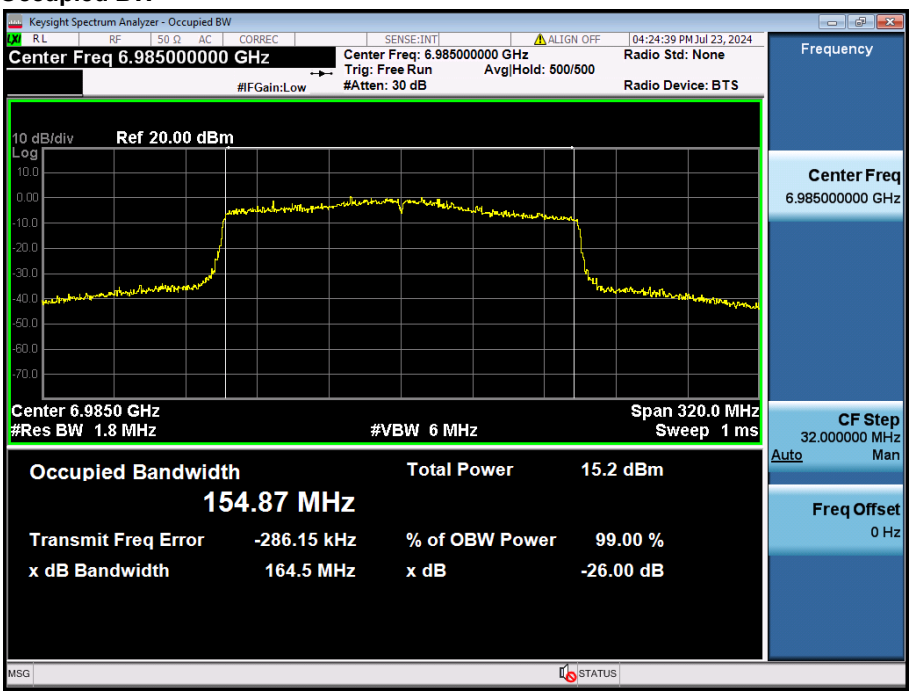
SISO
26 dB Bandwidth & Occupied BW

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



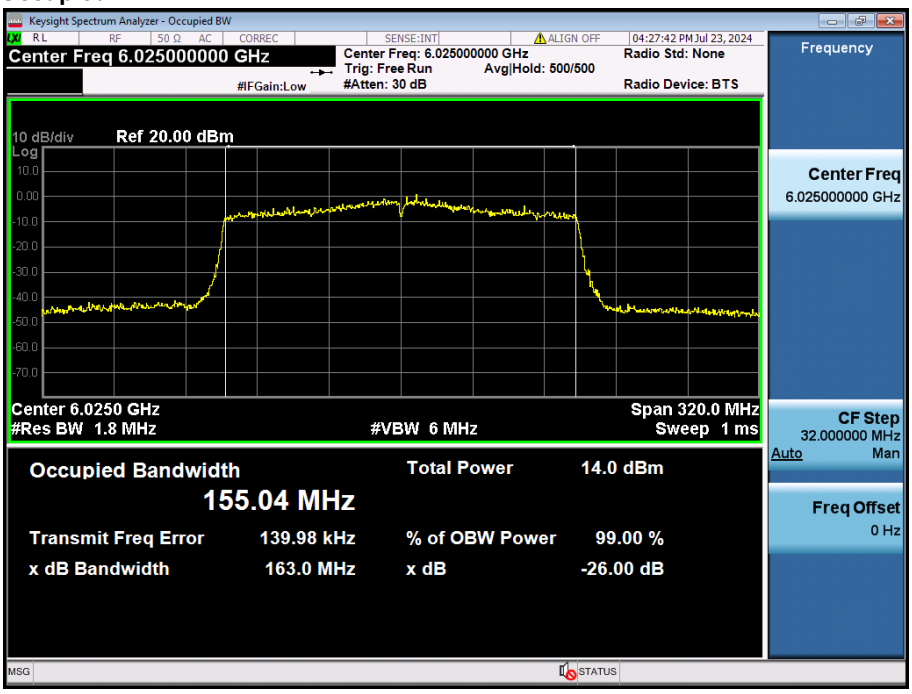
SISO
26 dB Bandwidth & Occupied BW

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



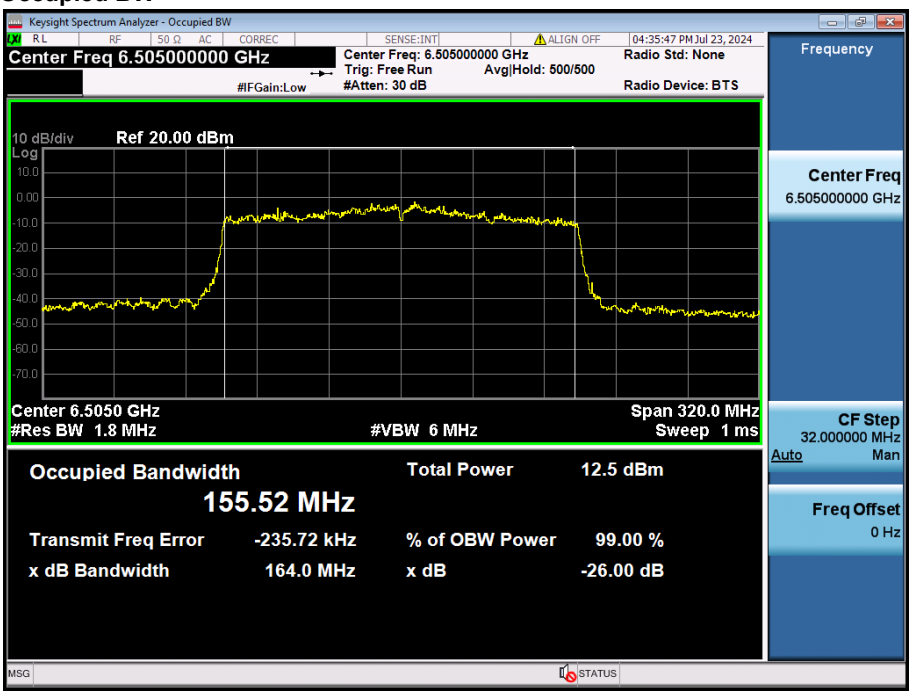
MIMO
26 dB Bandwidth & Occupied BW

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



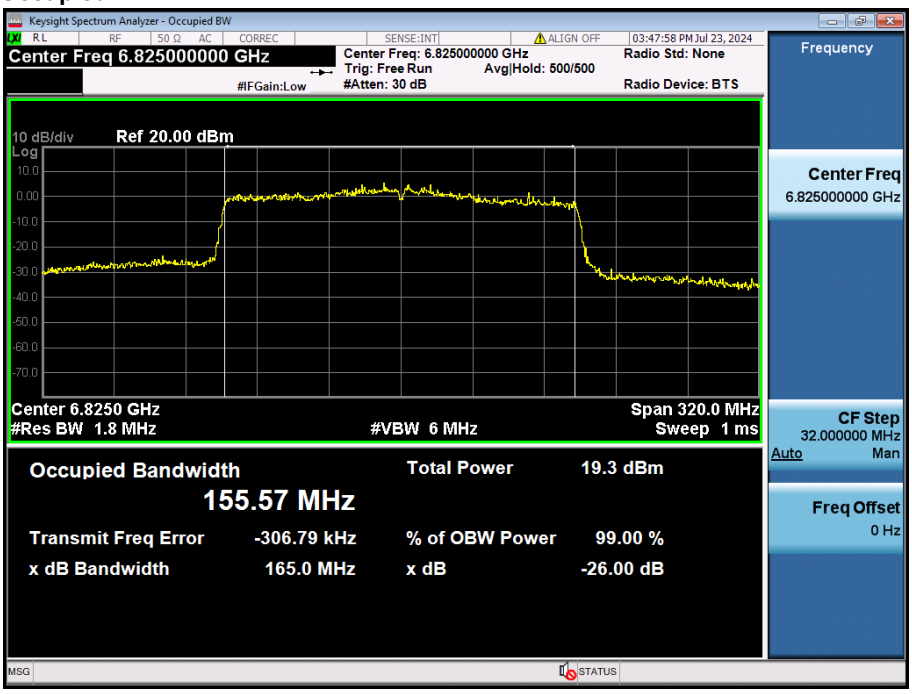
MIMO
26 dB Bandwidth & Occupied BW

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



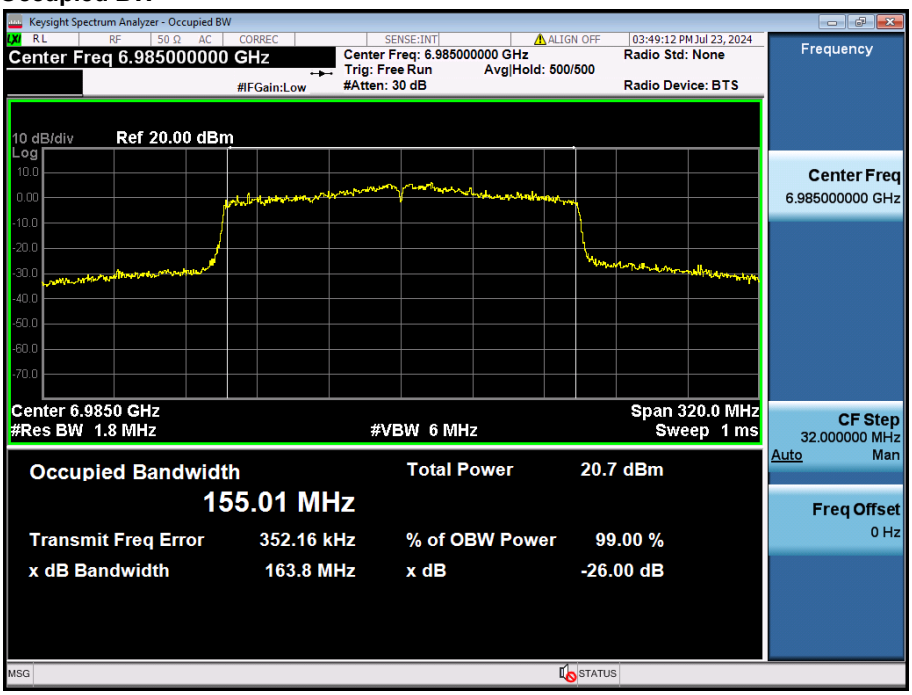
MIMO
26 dB Bandwidth & Occupied BW

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



MIMO
26 dB Bandwidth & Occupied BW

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



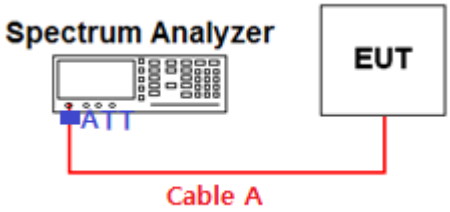
4.2. In-Band Emissions

▣ 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

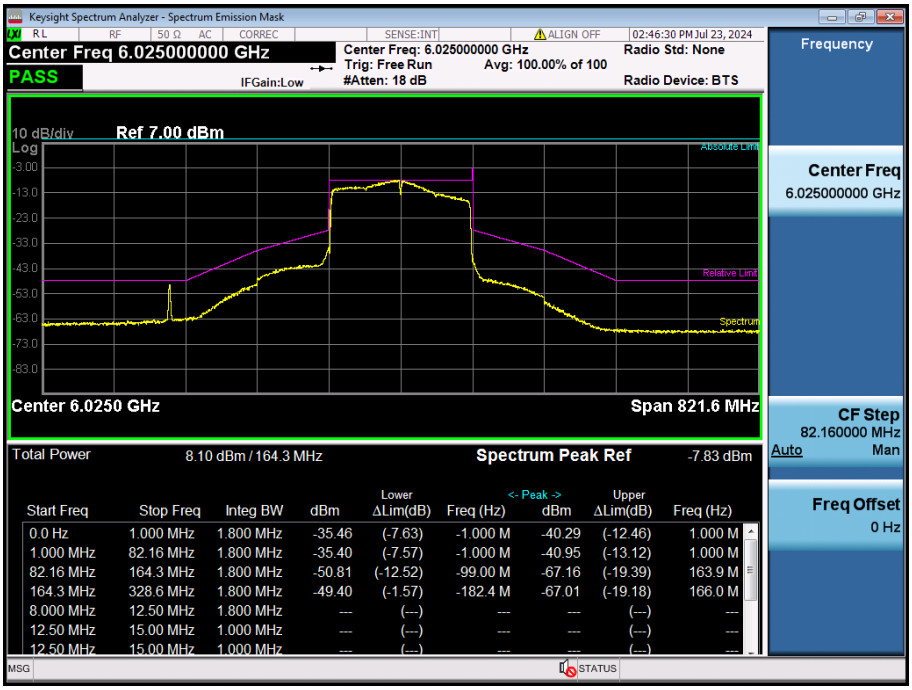
- KDB 987594 D02v01r01

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 ≥ 3 X RBW
   d) Number of points in sweep ≥ [2 X span / 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.

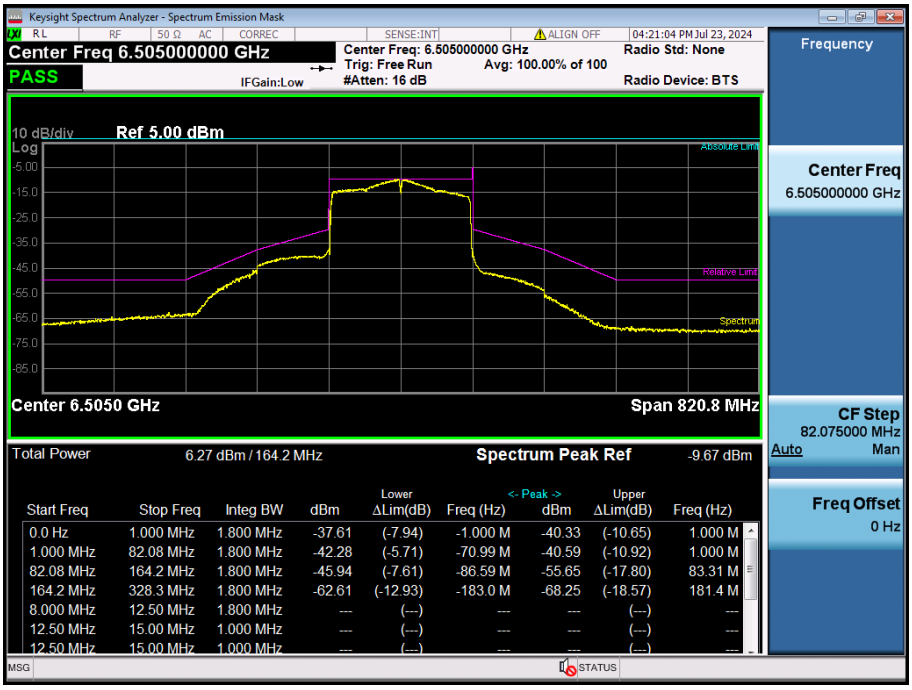
SISO
In-Band Emissions

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



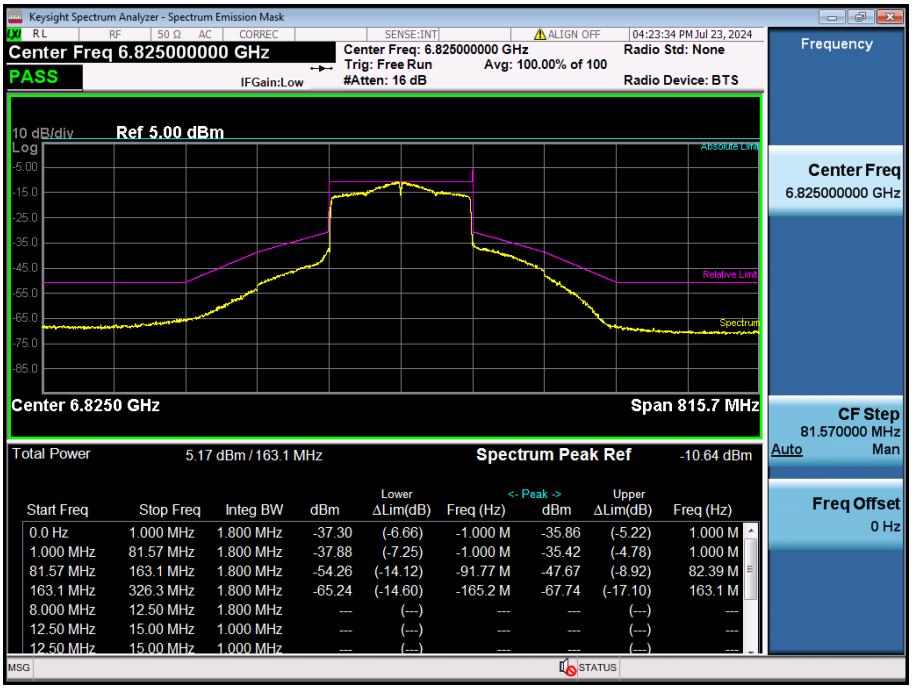
SISO
In-Band Emissions

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



SISO
In-Band Emissions

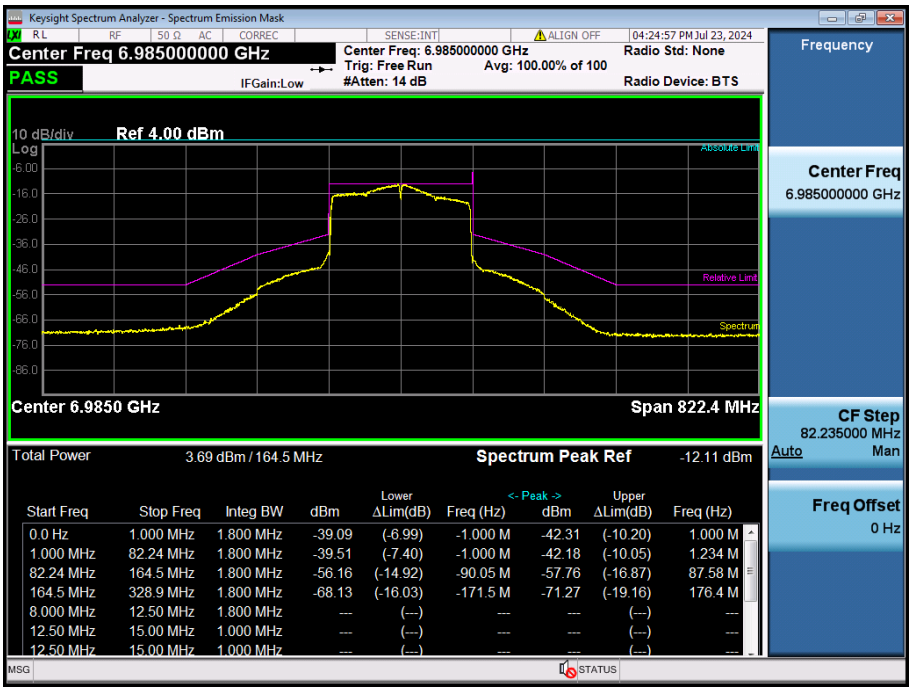
Test Mode: LPI & U-NII 7 & 802.11ax(HE160) & 6825 MHz & SU & ANT2



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	1.000 MHz	1.800 MHz	-37.30	(-6.66)	-1.000 M	-35.86	(-5.22)	1.000 M
1.000 MHz	81.57 MHz	1.800 MHz	-37.88	(-7.25)	-1.000 M	-35.42	(-4.78)	1.000 M
81.57 MHz	163.1 MHz	1.800 MHz	-54.26	(-14.12)	-91.77 M	-47.67	(-8.92)	82.39 M
163.1 MHz	326.3 MHz	1.800 MHz	-65.24	(-14.60)	-165.2 M	-67.74	(-17.10)	163.1 M
8.000 MHz	12.50 MHz	1.800 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

SISO
In-Band Emissions

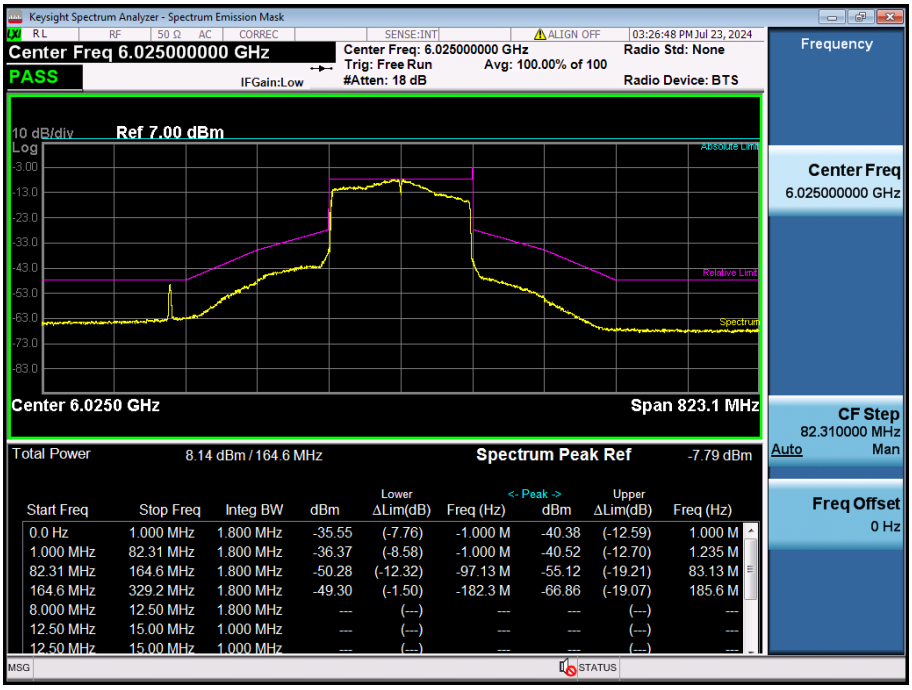
Test Mode: LPI & U-NII 8 & 802.11ax(HE160) & 6985 MHz & SU & ANT2



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	1.000 MHz	1.800 MHz	-39.09	(-6.99)	-1.000 M	-42.31	(-10.20)	1.000 M
1.000 MHz	82.24 MHz	1.800 MHz	-39.51	(-7.40)	-1.000 M	-42.18	(-10.05)	1.234 M
82.24 MHz	164.5 MHz	1.800 MHz	-56.16	(-14.92)	-90.05 M	-57.76	(-16.87)	87.58 M
164.5 MHz	328.9 MHz	1.800 MHz	-68.13	(-16.03)	-171.5 M	-71.27	(-19.16)	176.4 M
8.000 MHz	12.50 MHz	1.800 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

MIMO
In-Band Emissions

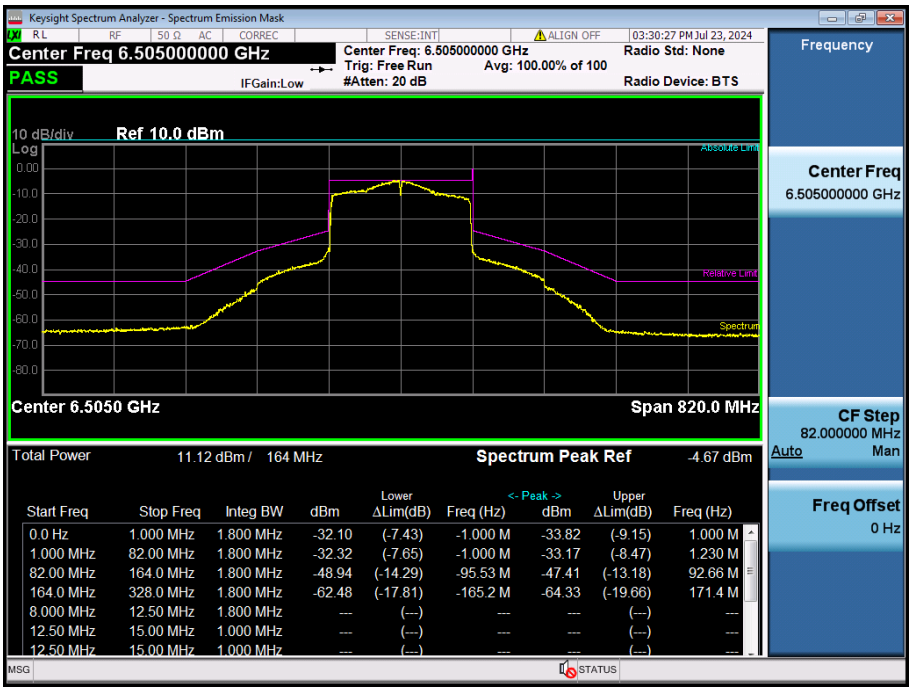
Test Mode: LPI & U-NII 5 & 802.11ax(HE160) & 6025 MHz & SU & ANT1



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	1.000 MHz	1.800 MHz	-35.55	(-7.76)	-1.000 M	-40.38	(-12.59)	1.000 M
1.000 MHz	82.31 MHz	1.800 MHz	-36.37	(-8.58)	-1.000 M	-40.52	(-12.70)	1.235 M
82.31 MHz	164.6 MHz	1.800 MHz	-50.28	(-12.32)	-97.13 M	-55.12	(-19.21)	83.13 M
164.6 MHz	329.2 MHz	1.800 MHz	-49.30	(-1.50)	-182.3 M	-66.86	(-19.07)	185.6 M
8.000 MHz	12.50 MHz	1.800 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

MIMO
In-Band Emissions

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



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	1.000 MHz	1.800 MHz	-32.10	(-7.43)	-1.000 M	-33.82	(-9.15)	1.000 M
1.000 MHz	82.00 MHz	1.800 MHz	-32.32	(-7.65)	-1.000 M	-33.17	(-8.47)	1.230 M
82.00 MHz	164.0 MHz	1.800 MHz	-48.94	(-14.29)	-95.53 M	-47.41	(-13.18)	92.66 M
164.0 MHz	328.0 MHz	1.800 MHz	-62.48	(-17.81)	-165.2 M	-64.33	(-19.66)	171.4 M
8.000 MHz	12.50 MHz	1.800 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

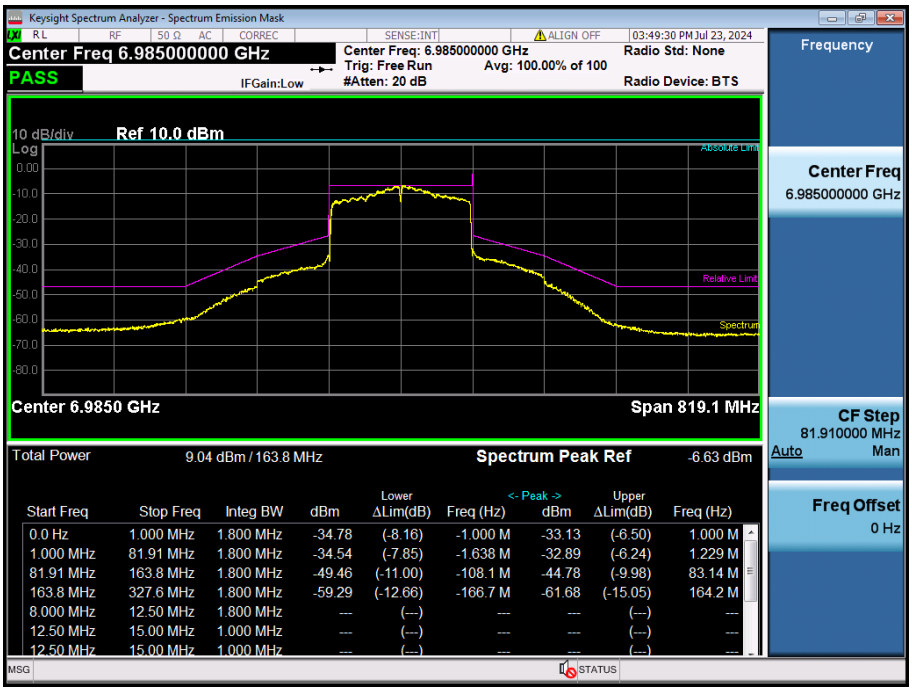
MIMO
In-Band Emissions

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

Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	1.000 MHz	1.800 MHz	-34.49	(-6.93)	-1.000 M	-38.41	(-10.85)	1.000 M
1.000 MHz	82.48 MHz	1.800 MHz	-37.36	(-3.66)	-63.51 M	-37.67	(-10.11)	1.000 M
82.48 MHz	165.0 MHz	1.800 MHz	-42.07	(-5.18)	-91.55 M	-48.27	(-12.47)	84.13 M
165.0 MHz	329.9 MHz	1.800 MHz	-58.13	(-10.57)	-165.8 M	-61.96	(-14.39)	165.4 M
8.000 MHz	12.50 MHz	1.800 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

MIMO
In-Band Emissions

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



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	1.000 MHz	1.800 MHz	-34.78	(-8.16)	-1.000 M	-33.13	(-6.50)	1.000 M
1.000 MHz	81.91 MHz	1.800 MHz	-34.54	(-7.85)	-1.638 M	-32.89	(-6.24)	1.229 M
81.91 MHz	163.8 MHz	1.800 MHz	-49.46	(-11.00)	-108.1 M	-44.78	(-9.98)	83.14 M
163.8 MHz	327.6 MHz	1.800 MHz	-59.29	(-12.66)	-166.7 M	-61.68	(-15.05)	164.2 M
8.000 MHz	12.50 MHz	1.800 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

4.3. Contention-based protocol

▣ Test Requirements and limit

15.407(d)(6)

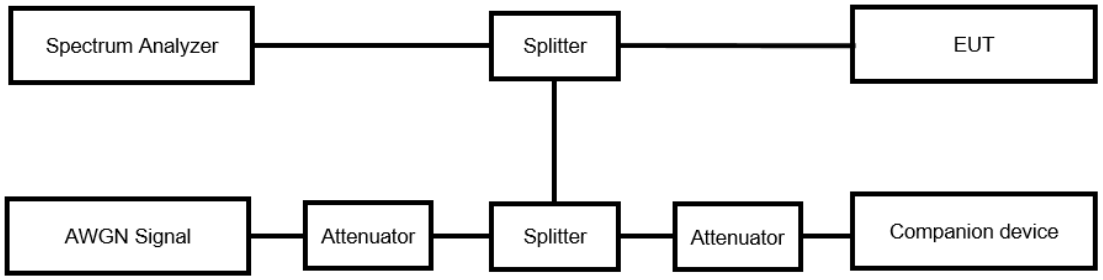
Indoor access points, subordinate devices and client devices operating in the 5.925-7.125 GHz band must employ a contention-based protocol.

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)1. 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

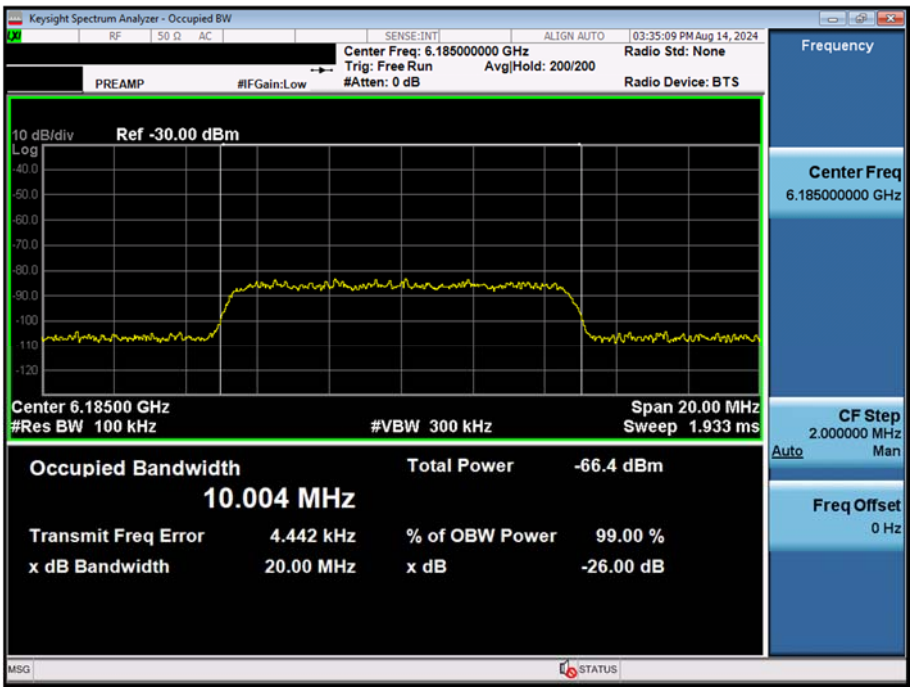
Note: Contention based protocol was tested with receiver with the lowest antenna gain.
Adjusted power(dBm) = AWGN Power(dBm) – Antenna gain(dBi)

Detection Probability

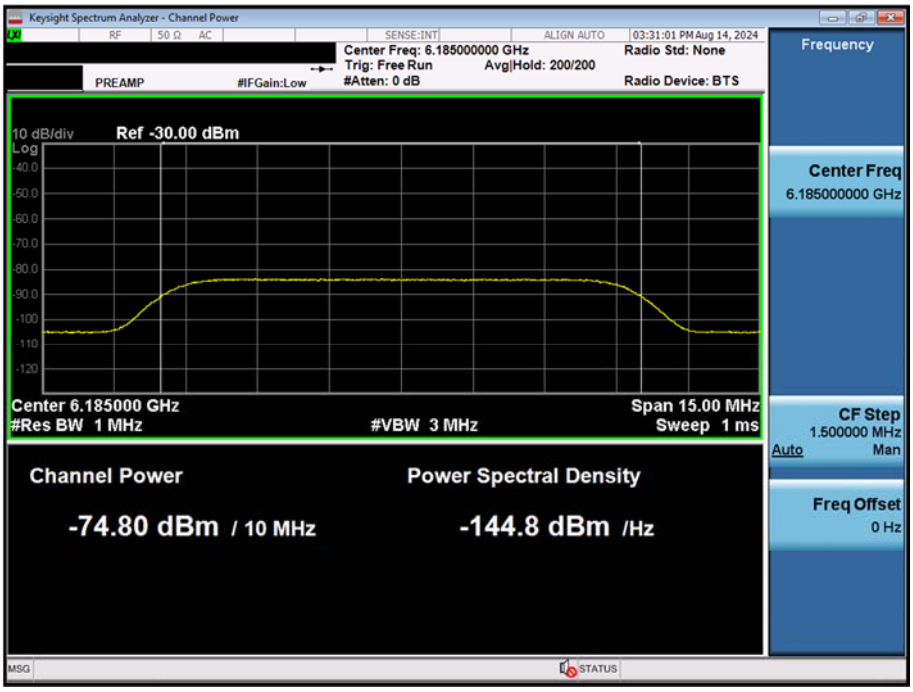
Band	Channel BW (MHz)	Channel	EUT Frequency (MHz)	AWGN Frequency (MHz)	1	2	3	4	5	6	7	8	9	10	Detection probability (%)
NII-5	160	47	6185	6110	O	O	O	O	O	O	O	O	O	O	100
NII-5	160	47	6185	6185	O	O	O	O	O	O	O	O	O	O	100
NII-5	160	47	6185	6260	O	O	O	O	O	O	O	O	O	O	100
NII-6	160	111	6505	6430	O	O	O	O	O	O	O	O	O	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)

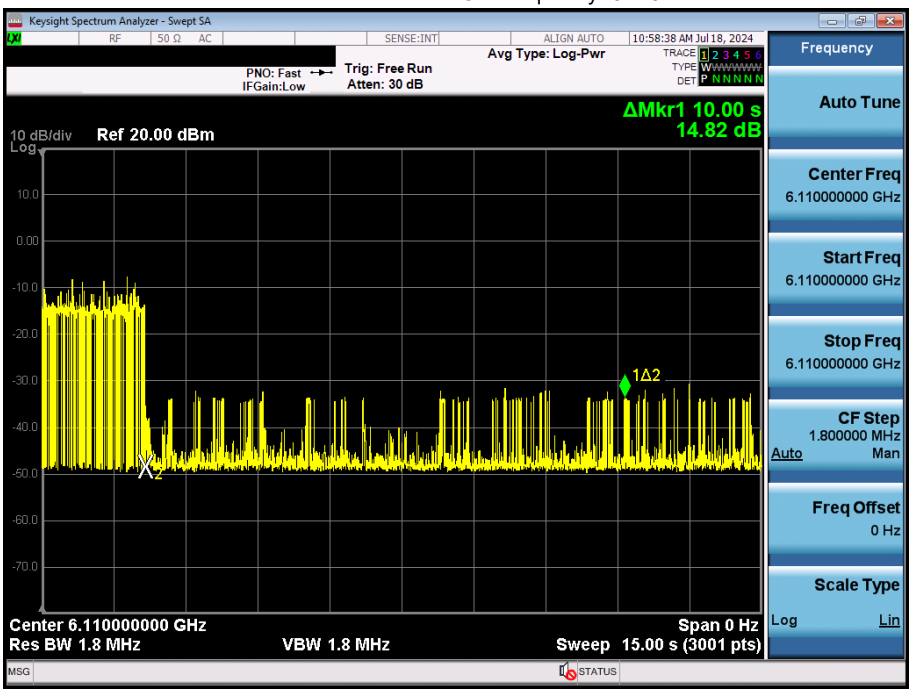


AWGN Signal (AWGN Power)



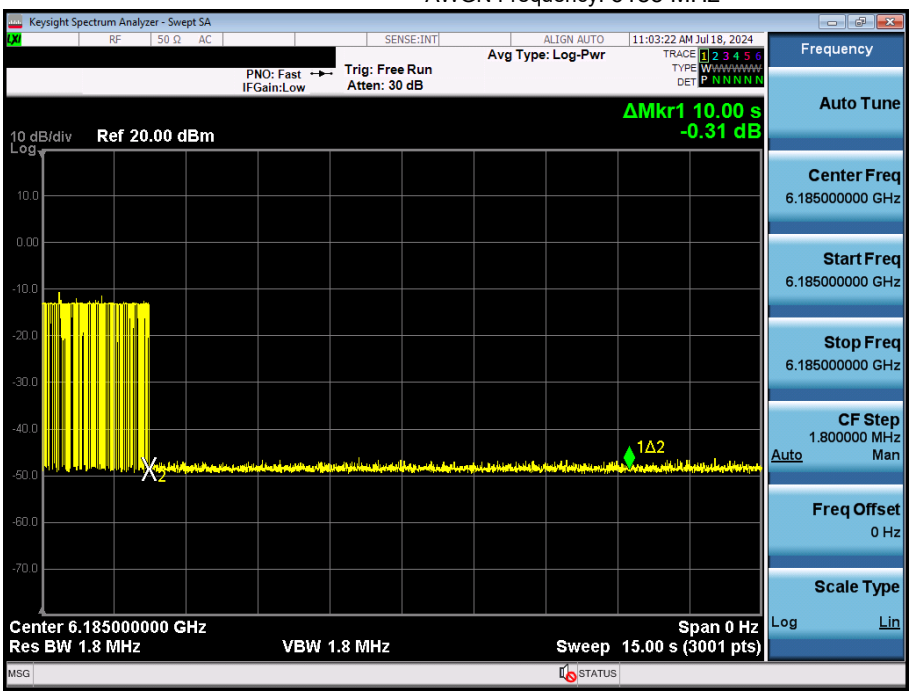
Timing Plot

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



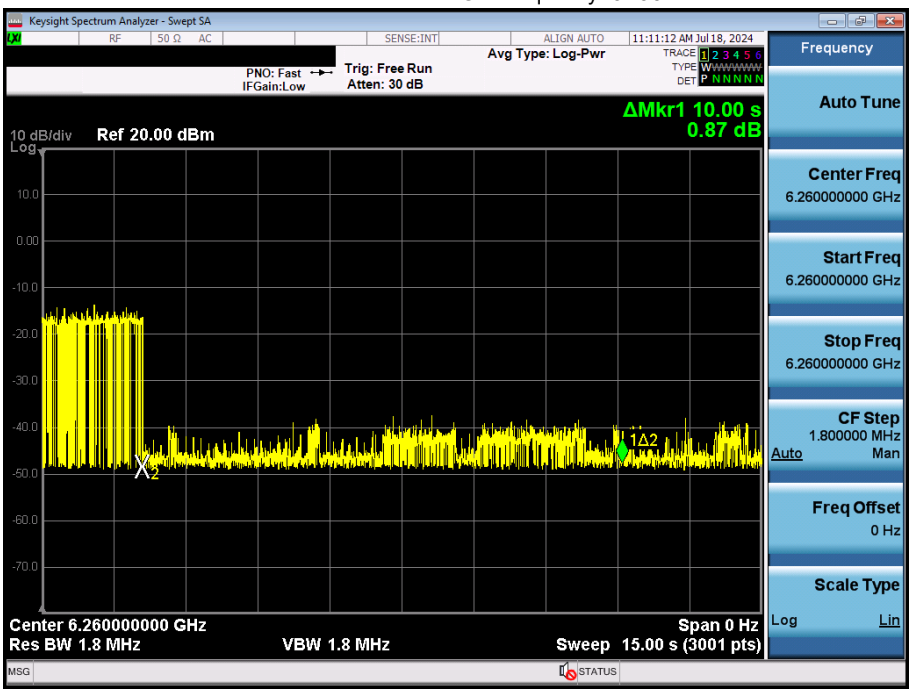
Timing Plot

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



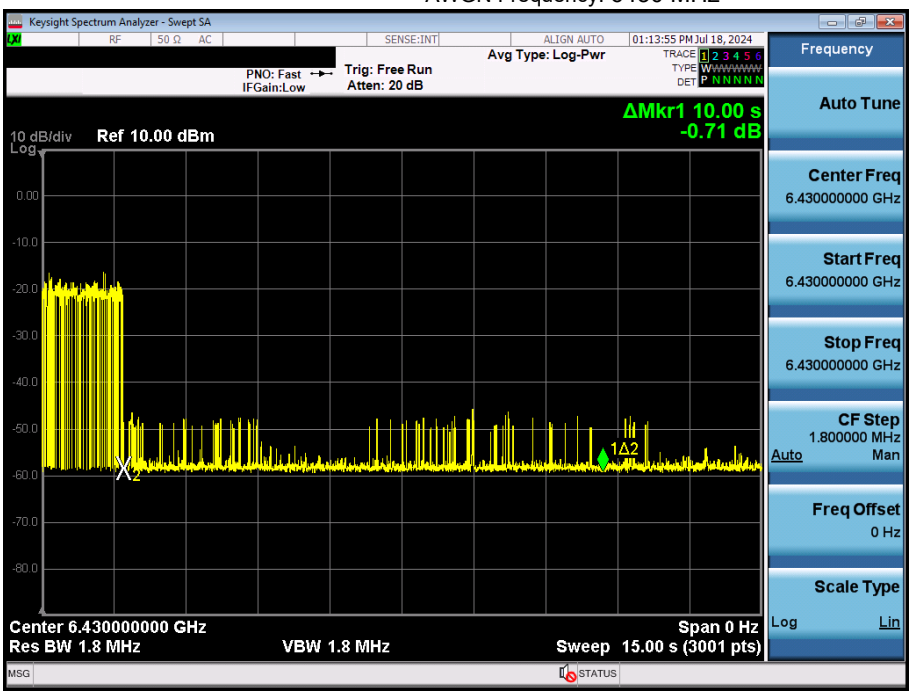
Timing Plot

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



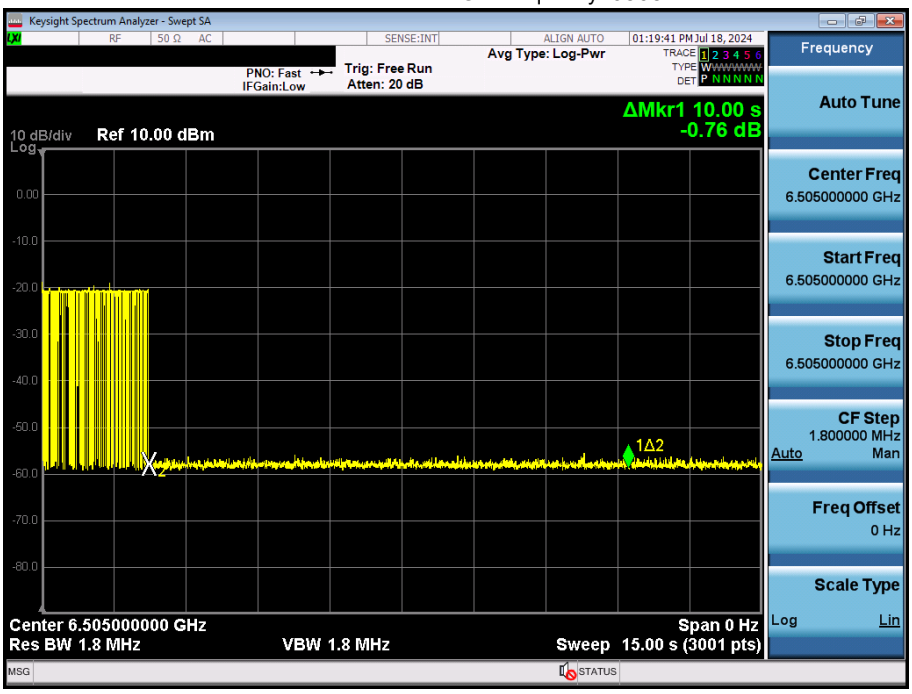
Timing Plot

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



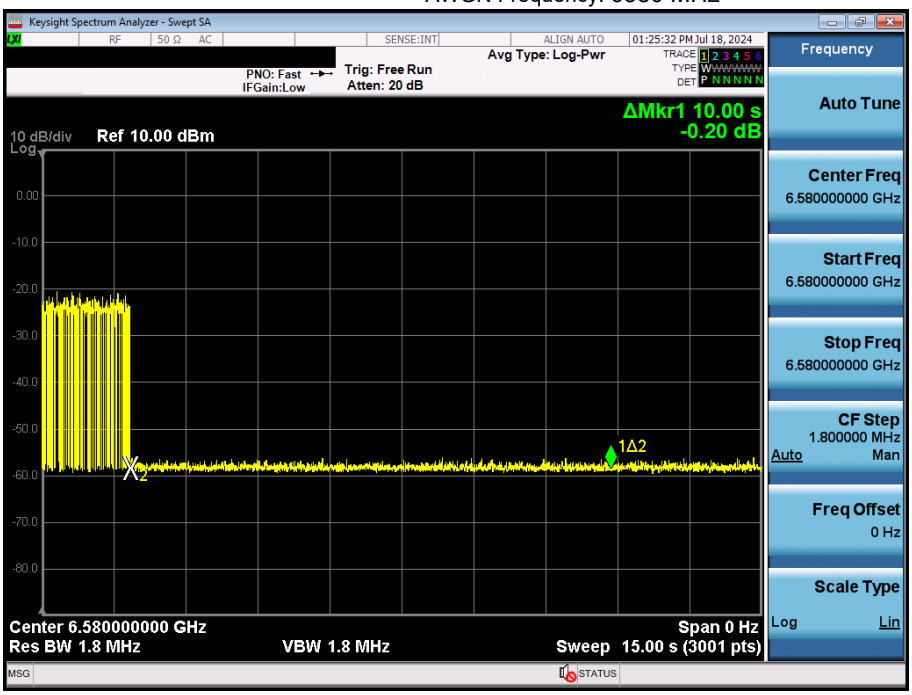
Timing Plot

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

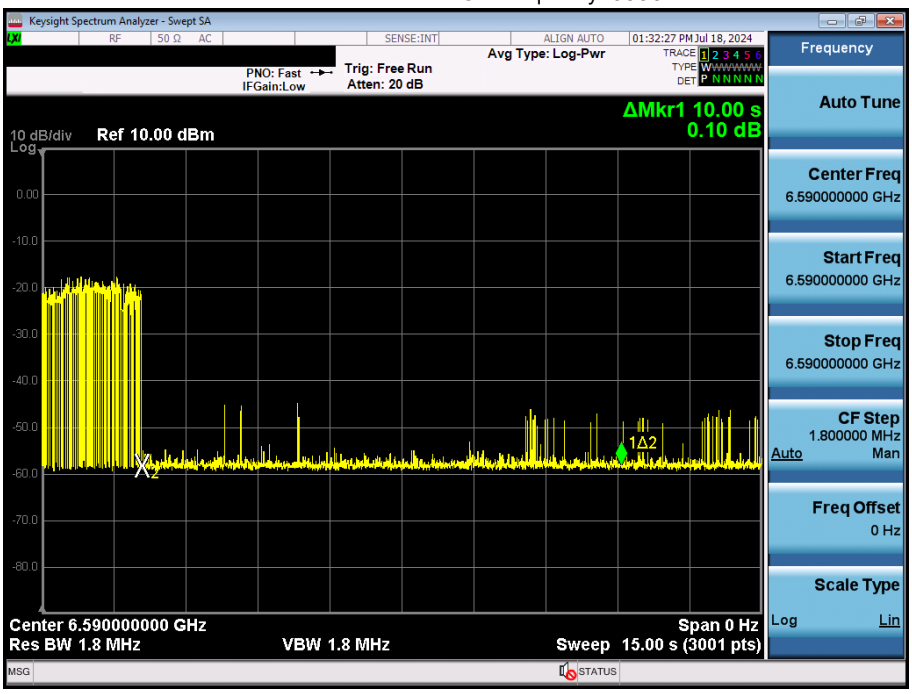


Timing Plot

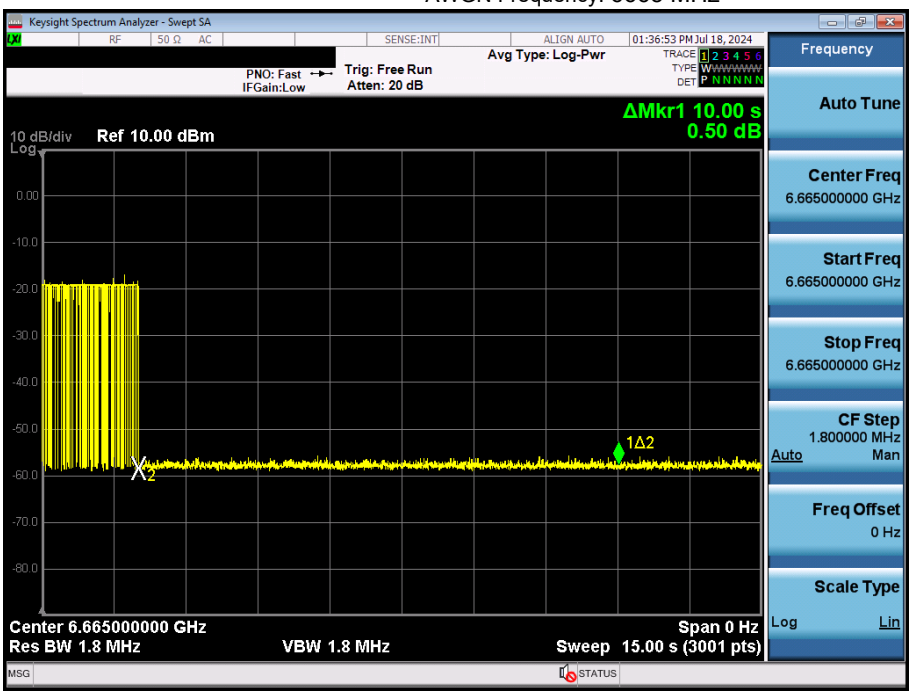
Test Mode: U-NII 6 & Channel BW: 160 MHz & EUT Frequency: 6505 MHz
AWGN Frequency: 6580 MHz



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

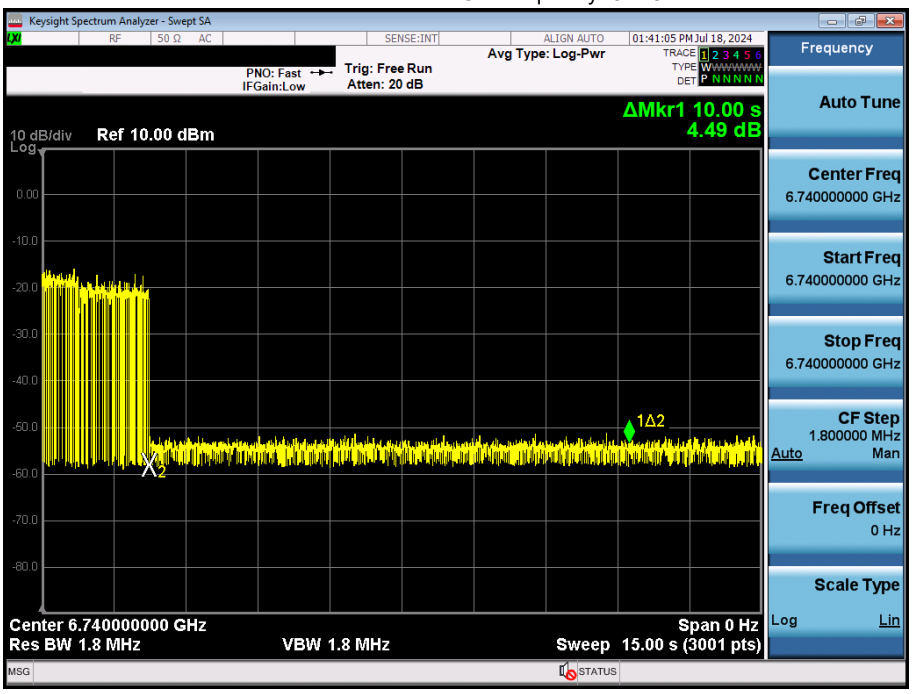


Timing Plot Test Mode: U-NII 7 & Channel BW: 160 MHz & EUT Frequency: 6665 MHz
AWGN Frequency: 6665 MHz



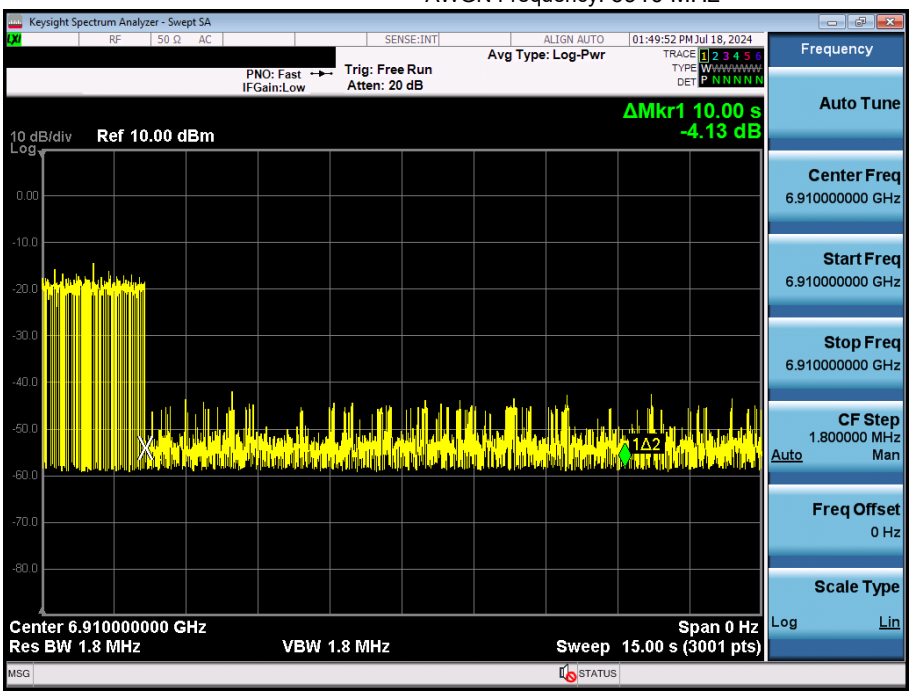
Timing Plot

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



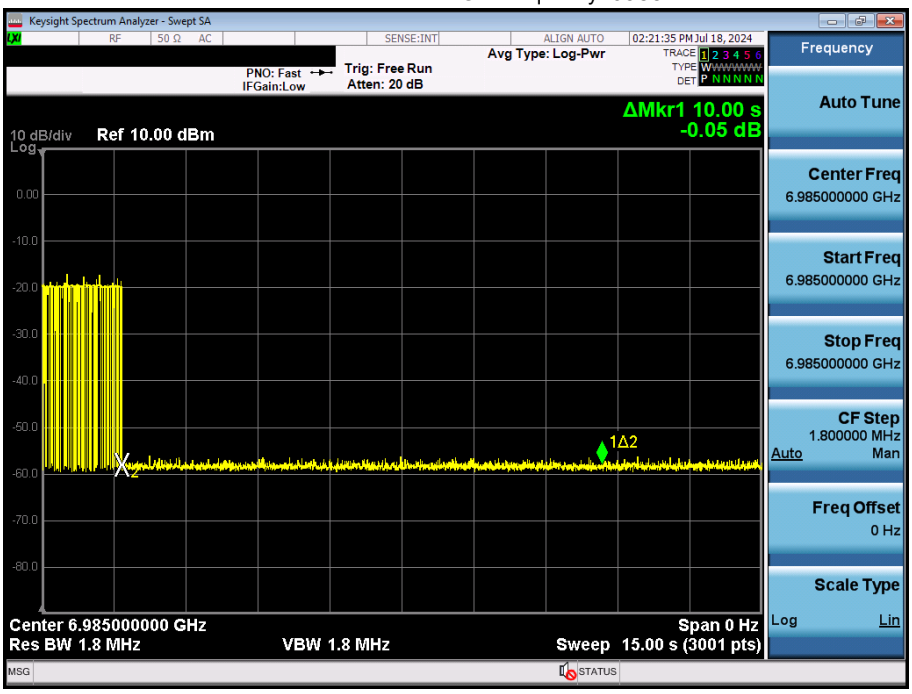
Timing Plot

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