

# RF MEASUREMENT REPORT

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**FCC ID:** HD5-CW45X0N  
**Applicant:** Honeywell International Inc.  
Honeywell Safety and Productivity Solutions  
**Product:** Mobile Computer  
**Model No.:** CW45-X0N  
**Brand Name:** Honeywell  
**FCC Classification:** Digital Transmission System (DTS)  
**FCC Rule Part(s):** Part 15 Subpart C (Section 15.247)  
**Result:** Complies  
**Test Date:** 2022-09-28 ~ 2022-10-27

**Reviewed By:**

\_\_\_\_\_  
Jame Yuan

**Approved By:**

\_\_\_\_\_  
Robin Wu



The test results relate only to the samples tested.

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 ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

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### Revision History

Report No.	Version	Description	Issue Date	Note
2209RSU040-U5	Rev. 01	Initial Report	2022-10-28	Valid

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## 1. General Information

### 1.1. Applicant

Honeywell International Inc  
 Honeywell Safety and Productivity Solutions  
 9680 Old Bailes Road, Fort Mill, SC 29707 United States

### 1.2. Manufacturer

Honeywell International Inc  
 Honeywell Safety and Productivity Solutions  
 9680 Old Bailes Road, Fort Mill, SC 29707 United States

### 1.3. Testing Facility

<input checked="" type="checkbox"/>	<p><b>Test Site – MRT Suzhou Laboratory</b></p> <p><b>Laboratory Location (Suzhou - Wuzhong)</b>                  D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China</p> <p><b>Laboratory Location (Suzhou - SIP)</b>                  4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China</p> <p><b>Laboratory Accreditations</b></p> <p>A2LA: 3628.01 <span style="float: right;">CNAS: L10551</span></p> <p>FCC: CN1166 <span style="float: right;">ISED: CN0001</span></p> <p>VCCI:           <input type="checkbox"/>R-20025           <input type="checkbox"/>G-20034           <input type="checkbox"/>C-20020           <input type="checkbox"/>T-20020</p> <p style="margin-left: 180px;"><input type="checkbox"/>R-20141           <input type="checkbox"/>G-20134           <input type="checkbox"/>C-20103           <input type="checkbox"/>T-20104</p>
<input type="checkbox"/>	<p><b>Test Site – MRT Shenzhen Laboratory</b></p> <p><b>Laboratory Location (Shenzhen)</b>                  1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China</p> <p><b>Laboratory Accreditations</b></p> <p>A2LA: 3628.02 <span style="float: right;">CNAS: L10551</span></p> <p>FCC: CN1284 <span style="float: right;">ISED: CN0105</span></p>
<input type="checkbox"/>	<p><b>Test Site – MRT Taiwan Laboratory</b></p> <p><b>Laboratory Location (Taiwan)</b>                  No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)</p> <p><b>Laboratory Accreditations</b></p> <p>TAF: L3261-190725</p> <p>FCC: 291082, TW3261 <span style="float: right;">ISED: TW3261</span></p>

#### 1.4. Product Information

Product Name	Mobile Computer
Model No.	CW45-X0N
EUT Identification No.	20220916Sample#18
Wi-Fi Specification	802.11a/b/g/n/ac/ax
Bluetooth Specification	V5.1 dual mode
NFC Specification	13.56MHz
Antenna Information	Refer to section 1.6
Working Voltage	3.3 ~ 4.1Vdc, typical 3.6Vdc
Operating Temp.	-20 ~ 50°C
Accessories	
Rechargeable Li-ion Battery	Model No.: CW45-BAT-S Rated Capacity: 3400mAh, 12.24Wh Rated Voltage: 3.6Vdc
Remark: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

#### 1.5. Radio Specification under Test

Frequency Range	802.11b/g/n-HT20/VHT20/ax-HE20: 2412 ~ 2462MHz 802.11n-HT40/VHT40/ax-HE40: 2422 ~ 2452MHz
Channel Number	802.11b/g/n-HT20/VHT20/ax-HE20: 11 802.11n-HT40/VHT40/ax-HE40: 7
Resource Units	802.11ax-HE20 (RU 26/52/106/242) 802.11ax-HE40 (RU 26/52/106/242/484)
Type of Modulation	802.11b: DSSS 802.11g/n/VHT: OFDM 802.11ax: OFDMA
Data Rate	802.11b: 1/2/5.5/11Mbps 802.11g: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 300Mbps VHT: up to 400Mbps 802.11ax: up to 574Mbps
Remark: Wi-Fi specification support SISO and MIMO function.	

### 1.6. Antenna Details

Antenna Type	Frequency Band (GHz)	Ant 1 Max Peak Gain (dBi)	Ant 2 Max Peak Gain (dBi)	Directional Gain (dBi)	
				For Power	For PSD
Wi-Fi Antenna (2*2 MIMO)					
PIFA	2.4 ~ 2.5	1.10	0.90	1.10	4.11
	5.15 ~ 5.25	2.20	1.50	2.20	5.21
	5.25 ~ 5.35	2.20	1.50	2.20	5.21
	5.47 ~ 5.725	2.20	1.50	2.20	5.21
	5.725 ~ 5.85	2.20	1.50	2.20	5.21

Note 1: The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.

For CDD transmissions, directional gain is calculated as follows,  $N_{ANT} = 2$ ,  $N_{SS} = 1$ .

If all antennas have the same gain,  $G_{ANT}$ , Directional gain =  $G_{ANT} + \text{Array Gain}$ , where Array Gain is as follows.

- For power spectral density (PSD) measurements on all devices,  
 $\text{Array Gain} = 10 \log (N_{ANT} / N_{SS}) \text{ dB} = 3.01$ ;
- For power measurements on IEEE 802.11 devices,  
 $\text{Array Gain} = 0 \text{ dB}$  for  $N_{ANT} \leq 4$ ;

Note 2: The EUT also supports Beam Forming mode, and the Beam Forming support 802.11n/ac/ax, not include 802.11a/b/g. Beamforming Directional Gain = CDD Directional Gain of PSD.

Note 3: For beamforming operation, software automatically backs power down based on a factor based on CDD power. Therefore, only the CDD mode was evaluated in this report.

### 1.7. Working Frequencies

802.11b/g/n-HT20/VHT20/ax-HE20

Channel	Frequency	Channel	Frequency	Channel	Frequency
01	2412 MHz	02	2417 MHz	03	2422 MHz
04	2427 MHz	05	2432 MHz	06	2437 MHz
07	2442 MHz	08	2447 MHz	09	2452 MHz
10	2457 MHz	11	2462 MHz	--	--

802.11n-HT40/VHT40/ax-HE40

Channel	Frequency	Channel	Frequency	Channel	Frequency
03	2422 MHz	04	2427 MHz	05	2432 MHz
06	2437 MHz	07	2442 MHz	08	2447 MHz
09	2452 MHz	--	--	--	--

## 2. Test Configuration

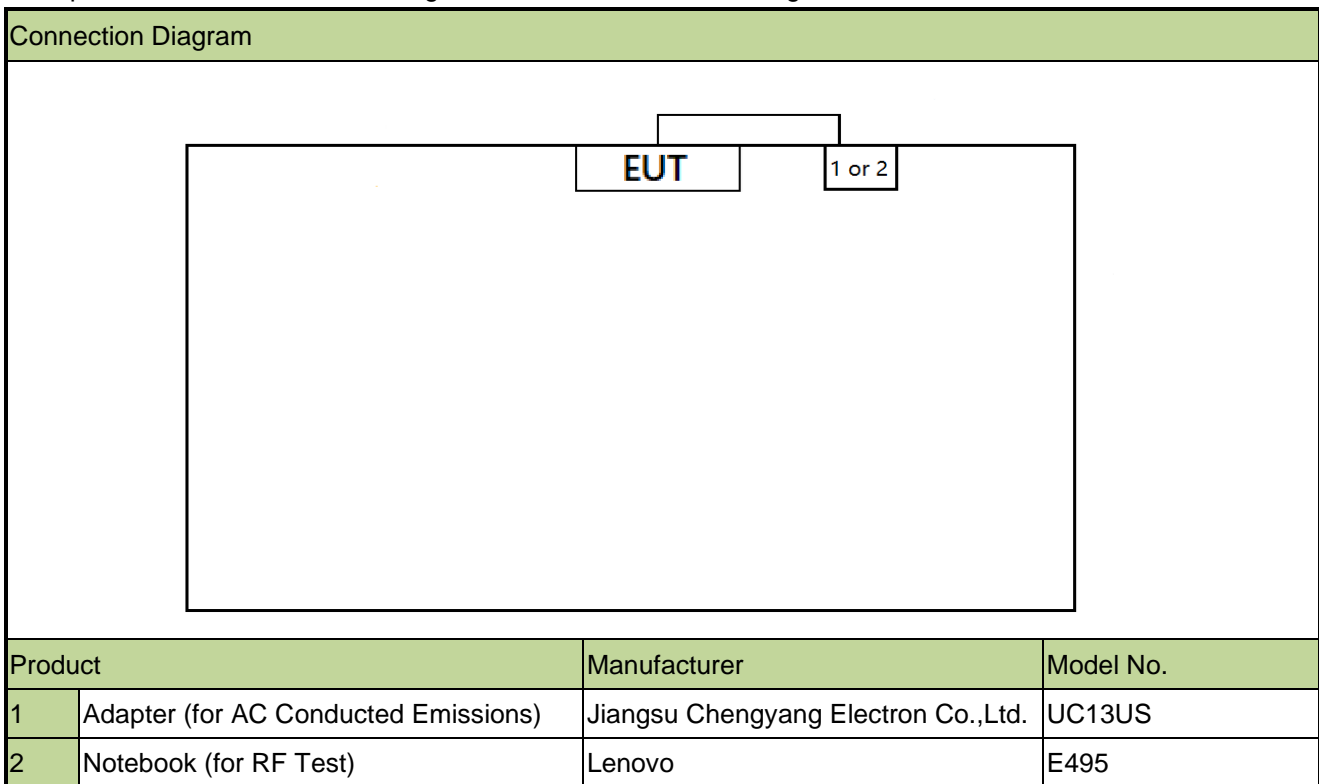
### 2.1. Test Mode

Mode 1: Transmit by 802.11b (1Mbps) (SISO Mode)
Mode 2: Transmit by 802.11g (6Mbps) (SISO Mode)
Mode 3: Transmit by 802.11n-HT20 (MCS0) (MIMO Mode)
Mode 4: Transmit by 802.11n-HT40 (MCS0) (MIMO Mode)
Mode 5: Transmit by VHT20 (MCS0) (MIMO Mode)
Mode 6: Transmit by VHT40 (MCS0) (MIMO Mode)
Mode 7: Transmit by 802.11ax-HE20 (MCS0) (MIMO Mode)
Mode 8: Transmit by 802.11ax-HE40 (MCS0) (MIMO Mode)

Note: All modes of operation and data rates were investigated, so all RF test requirements shall be executed at the worst data rate.

### 2.2. Test System Connection Diagram

The device was tested per the guidance ANSI C63.10: 2013 was used to reference the appropriate EUT setup for radiated emissions testing and AC line conducted testing.



### 2.3. Test Software

The test utility software used during testing was “adb.exe”.



#### 2.4. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15.247
- KDB 558074 D01v05r02
- ANSI C63.10-2013

#### 2.5. Test Environment Condition

Ambient Temperature	15 ~ 35°C
Relative Humidity	20 ~ 75%RH

### 3. Antenna Requirements

**Excerpt from §15.203 of the FCC Rules/Regulations:**

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- The antenna of the device is **permanently attached**.
- There are no provisions for connection to an external antenna.

**Conclusion:**

The unit complies with the requirement of §15.203.

#### 4. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2022-12-29	SIP-AC3
Loop Antenna	Schwarzbeck	FMZB 1519 B	MRTSUE06937	1 year	2023-03-14	SIP-AC3
Signal Analyzer	Keysight	N9010B	MRTSUE06559	1 year	2023-06-01	SIP-AC3
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06599	1 year	2023-10-13	SIP-AC3
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2023-06-08	SIP-AC3
Horn Antenna	R&S	HF907	MRTSUE06611	1 year	2023-07-30	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06619	1 year	2022-11-02	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06622	1 year	2022-11-28	SIP-AC3
Preamplifier	EMCI	EMC012645SE	MRTSUE06642	1 year	2023-01-13	SIP-AC3
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06646	1 year	2023-08-16	SIP-AC3
Anechoic Chamber	RIKEN	SIP-AC3	MRTSUE06782	1 year	2022-12-23	SIP-AC3
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2023-06-01	SIP-SR2
EMI Test Receiver	R&S	ESR3	MRTSUE06612	1 year	2023-06-01	SIP-SR2
Thermohygrometer	testo	608-H1	MRTSUE06621	1 year	2022-11-28	SIP-SR2
Shielding Room	MIX-BEP	SIP-SR2	MRTSUE06949	5 years	2024-10-23	SIP-SR2
Signal Analyzer	Keysight	N9010B	MRTSUE06558	1 year	2023-06-01	SIP-TR1
Thermohygrometer	testo	608-H1	MRTSUE11022	1 year	2022-11-02	SIP-TR1
USB Power Sensor	Keysight	U2021XA	MRTSUE06596	1 year	2023-08-23	SIP-TR1
Signal Generator	Keysight	N5182B	MRTSUE06605	1 year	2022-10-31	SIP-TR1

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software
Controller_MF 7802BS	1.02	RE Antenna & Turntable
Agilent Power Panel	V R03.09.00	Power

## 5. Decision Rules and Measurement Uncertainty

### 5.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 5.2. Measurement Uncertainty

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

<b>AC Conducted Emission Measurement</b>
Measurement Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 9kHz~150kHz: 3.74dB 150kHz~30MHz: 3.44dB
<b>Radiated Disturbance</b>
Measurement Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): Horizontal: 30MHz~300MHz: 5.04dB 300MHz~1GHz: 4.95dB 1GHz~40GHz: 6.40dB Vertical: 30MHz~300MHz: 5.24dB 300MHz~1GHz: 6.03dB 1GHz~40GHz: 6.40dB
<b>Spurious Emissions, Conducted</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 0.78dB
<b>Output Power</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 1.13dB
<b>Power Spectrum Density</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 1.15dB
<b>Occupied Bandwidth</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 0.28%

## 6. Test Result

### 6.1. Summary

FCC Section(s)	Test Description	Test Condition	Verdict
15.247(a)(2)	6dB Bandwidth	Conducted	Pass
15.247(b)(3)	Output Power		Pass
15.247(e)	Power Spectral Density		Pass
15.247(d)	Band Edge / Out-of-Band Emissions		Pass
15.205 15.209	General Field Strength (Restricted Bands and Radiated Emission)	Radiated	Pass
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	Pass

#### Notes:

- The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- For radiated emission tests, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.

## 6.2. 6dB Bandwidth Measurement

### 6.2.1. Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

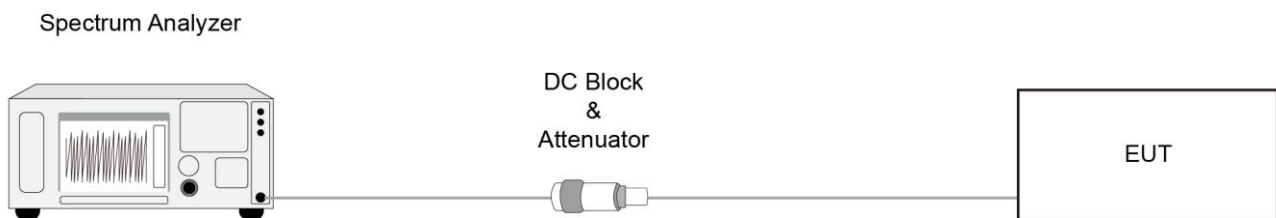
### 6.2.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.8

### 6.2.3. Test Setting

1. The Spectrum's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to  $X = 6$ . The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. Set RBW = 100 kHz
3.  $VBW \geq 3 \times RBW$
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace to stabilize

### 6.2.4. Test Setup



### 6.2.5. Test Result

Refer to Appendix A.2.

### 6.3. Output Power Measurement

#### 6.3.1. Test Limit

The maximum output power shall be less 1 Watt (30dBm).

The conducted output power limit specified in paragraph FCC Part 15.247(b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs FCC Part 15.247(b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### 6.3.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.9.2.3.2

#### 6.3.3. Test Setting

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

#### 6.3.4. Test Setup



#### 6.3.5. Test Result

Refer to Appendix A.3.

## 6.4. Power Spectral Density Measurement

### 6.4.1. Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band.

The same method of determining the conducted output power shall be used to determine the power spectral density.

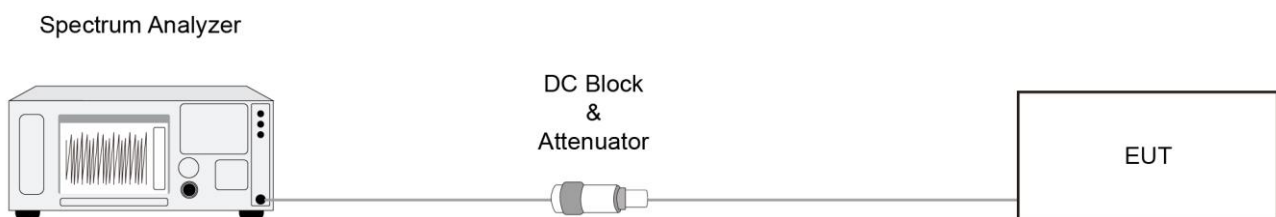
### 6.4.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.10.5

### 6.4.3. Test Setting

1. Measure the duty cycle (x) of the transmitter output signal.
2. Set instrument center frequency to DTS channel center frequency.
3. Set span to at least 1.5 times the OBW.
4. RBW = 10 kHz.
5. VBW = 30 kHz.
6. Detector = RMS.
7. Ensure that the number of measurement points in the sweep  $\geq 2 \times \text{span}/\text{RBW}$ .
8. Sweep time = auto couple.
9. Don't use sweep triggering. Allow sweep to "free run".
10. Employ trace averaging (RMS) mode over a minimum of 100 traces.
11. Use the peak marker function to determine the maximum amplitude level.
12. Add  $10 \log (1/x)$ , where x is the duty cycle measured in step (a), to the measured PSD to compute the average PSD during the actual transmission time. If measured value exceeds requirement specified by regulatory agency, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).

### 6.4.4. Test Setup





#### **6.4.5. Test Result**

Refer to Appendix A.4.

## **6.5. Conducted Band Edge and Out-of-Band Emissions Measurement**

### **6.5.1. Test Limit**

The limit for out-of-band spurious emissions at the band edge is 30dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth per the PSD procedure.

### **6.5.2. Test Procedure**

ANSI C63.10-2013 - Section 11.11

### **6.5.3. Test Setting**

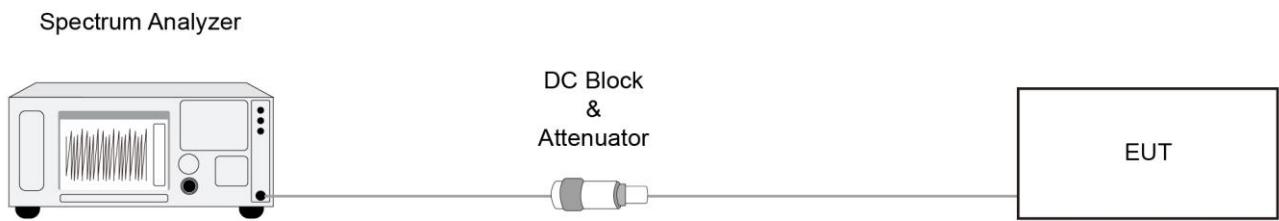
#### **Reference level measurement**

1. Set instrument center frequency to DTS channel center frequency
2. Set the span to  $\geq 1.5$  times the DTS bandwidth
3. Set the RBW = 100 kHz
4. Set the VBW  $\geq 3 \times$  RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize

#### **Emission level measurement**

1. Set the center frequency and span to encompass frequency range to be measured
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

#### 6.5.4. Test Setup



#### 6.5.5. Test Result

Refer to Appendix A.5.

## 6.6. Radiated Spurious Emission Measurement

### 6.6.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

### 6.6.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.11 & 11.12

ANSI C63.10 - 2013 - Section 6.3 (General Requirements)

ANSI C63.10 - 2013 - Section 6.4 (Standard test method below 30MHz)

ANSI C63.10 - 2013 - Section 6.5 (Standard test method above 30MHz to 1GHz)

ANSI C63.10 - 2013 - Section 6.6 (Standard test method above 1GHz)

### 6.6.3. Test Setting

**Table 1 - RBW as a function of frequency**

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000MHz	1MHz

**Quasi-Peak Measurements below 1GHz**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1MHz
3. RBW = as specified in Table 1
4. Detector = CISPR quasi-peak
5. Sweep time = auto couple
6. Trace was allowed to stabilize

**Peak Measurements above 1GHz**

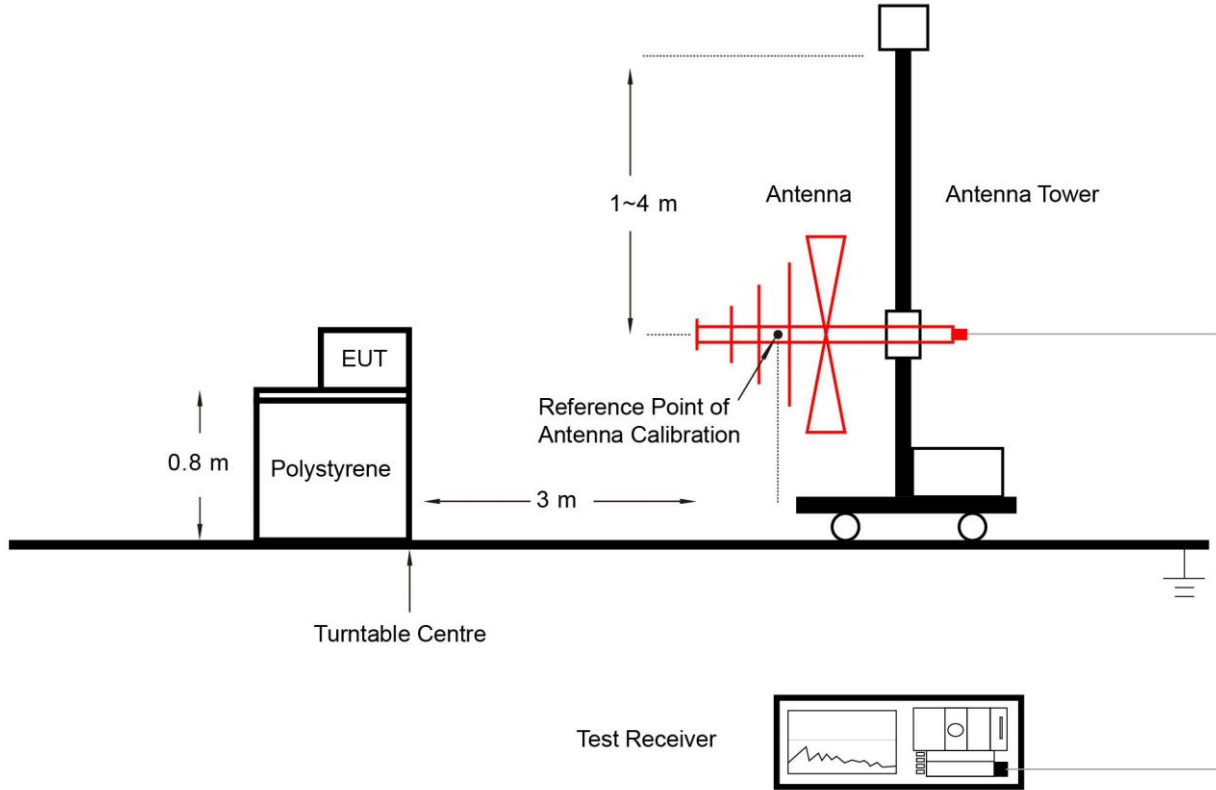
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

**Average Measurements above 1GHz (Method VB)**

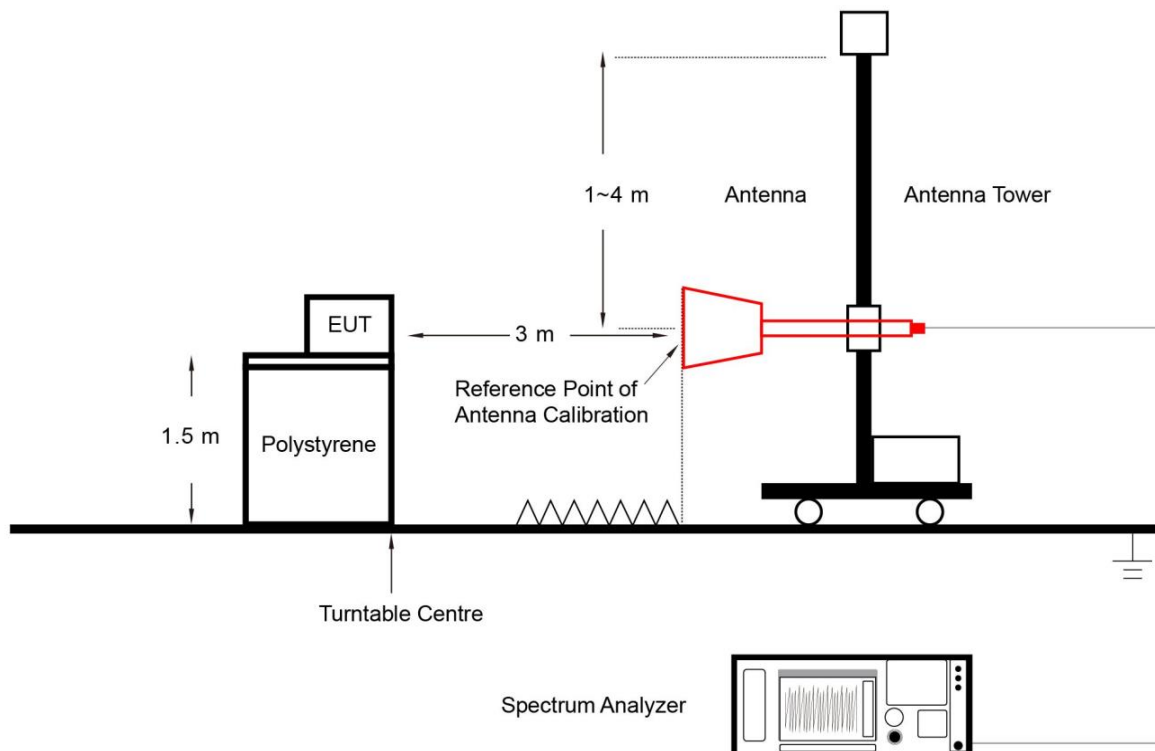
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle  $\geq 98\%$ , set VBW = 10 Hz.  
If the EUT duty cycle is  $< 98\%$ , set VBW  $\geq 1/T$ . T is the minimum transmission duration.
4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize

### 6.6.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



### **6.6.5. Test Result**

Refer to Appendix A.6.

## 6.7. Radiated Restricted Band Edge Measurement

### 6.7.1. Test Limit

#### For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41	--	--	--



All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

### 6.7.2. Test Procedure

ANSI C63.10-2013 Section 6.3 & 6.6 & 11.13

### 6.7.3. Test Setting

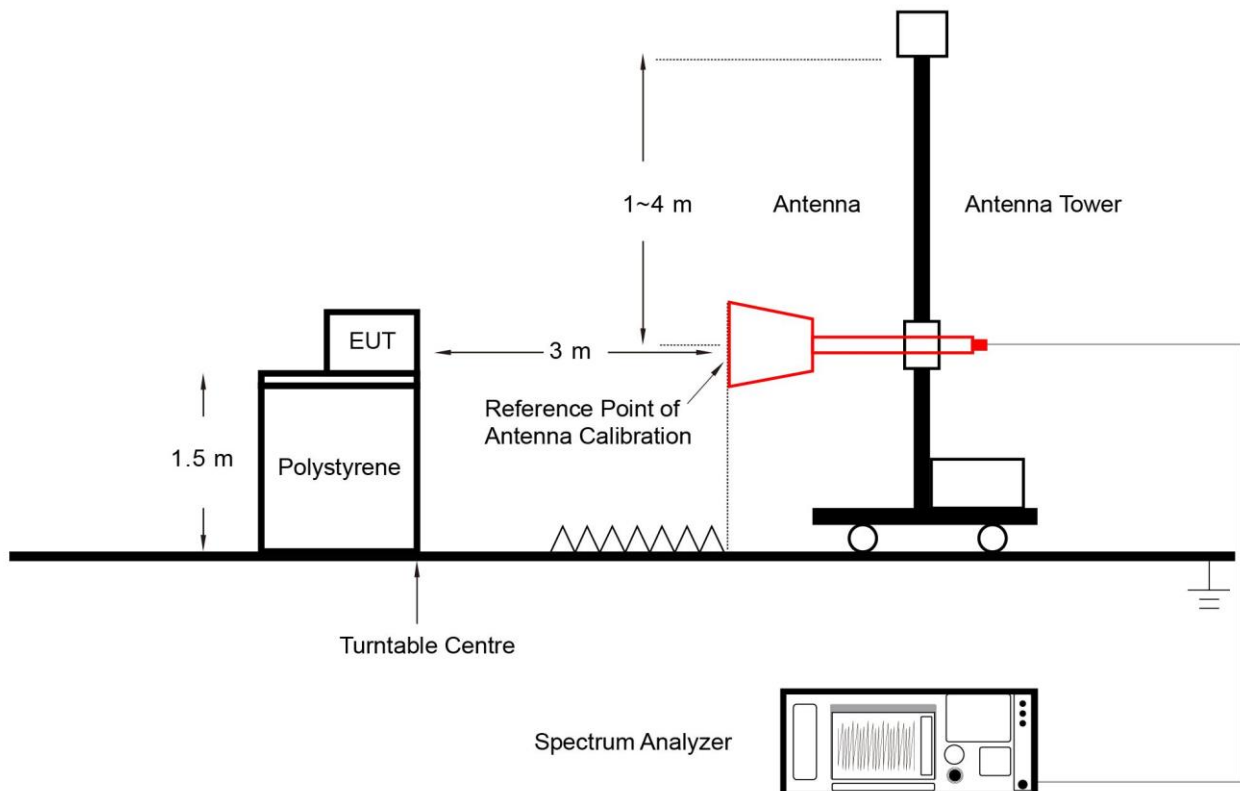
#### Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

### Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW  $\geq 1/T$
4. As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode
5. Detector = Peak
6. Sweep time = auto
7. Trace mode = max hold
8. Allow max hold to run for at least 50 times (1/duty cycle) traces

#### 6.7.4. Test Setup



#### 6.7.5. Test Result

Refer to Appendix A.7.

## 6.8. AC Conducted Emissions Measurement

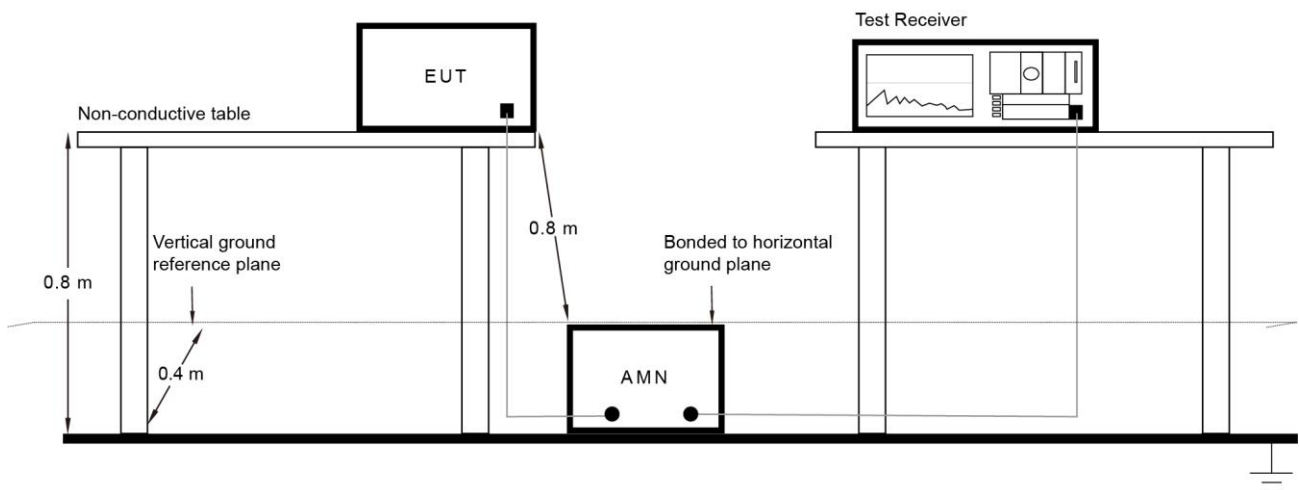
### 6.8.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

### 6.8.2. Test Setup



### 6.8.3. Test Result

Refer to Appendix A.8.

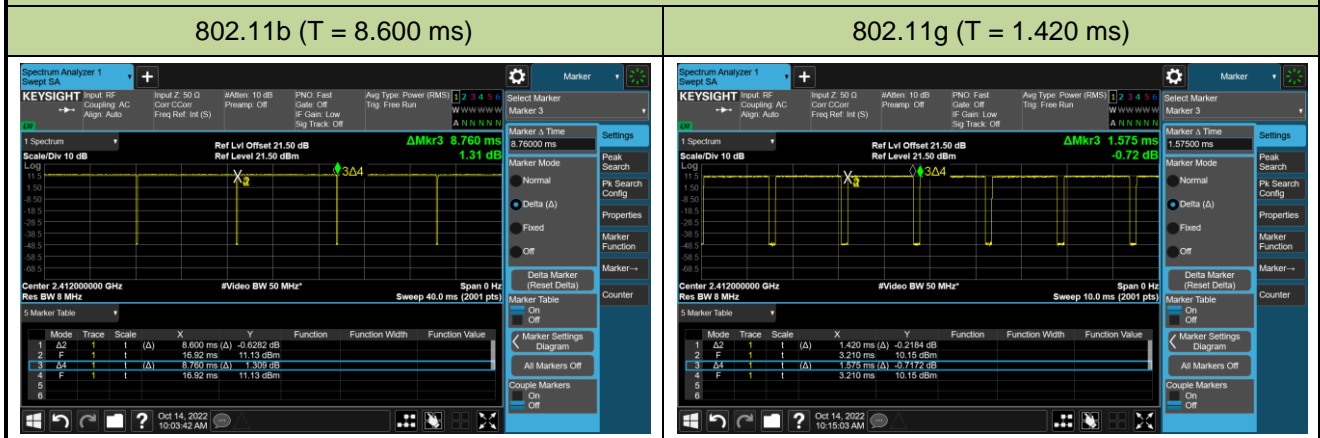
## Appendix A – Test Result

### A.1 Duty Cycle Test Result

Test Site	SIP-TR1	Test Engineer	Nandy Zhang
Test Date	2022-10-14		

Test Mode	Duty Cycle	Test Mode	Duty Cycle
802.11b	98.17%	802.11g	90.16%

Duty Cycle (T = Transmission Duration)

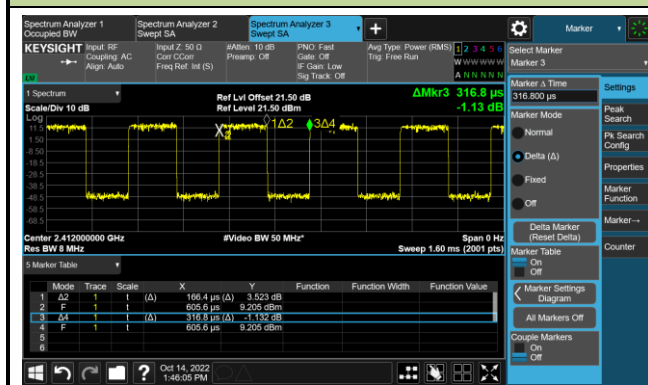


Test Site	SIP-TR1	Test Engineer	Nandy Zhang
Test Date	2022-10-14		

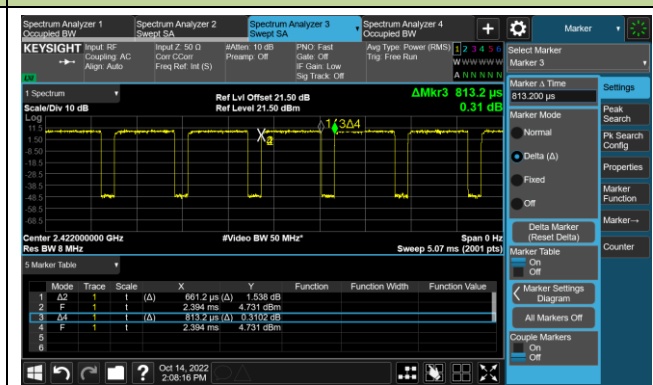
Test Mode	Duty Cycle	Test Mode	Duty Cycle
802.11n-HT20	52.53%	VHT40	81.68%
802.11n-HT40	81.31%	802.11ax-HE20	74.13%
VHT20	89.62%	802.11ax-HE40	78.50%

Duty Cycle (T = Transmission Duration)

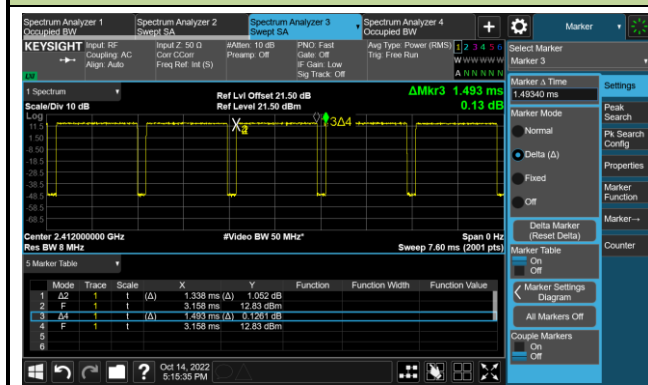
802.11n-HT20 (T = 166.4  $\mu$ s)



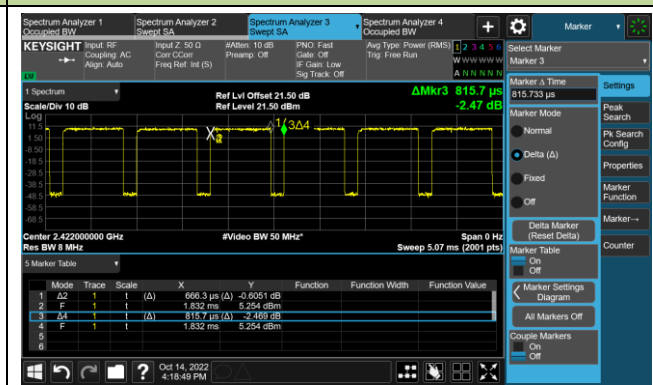
802.11n-HT40 (T = 661.2  $\mu$ s)



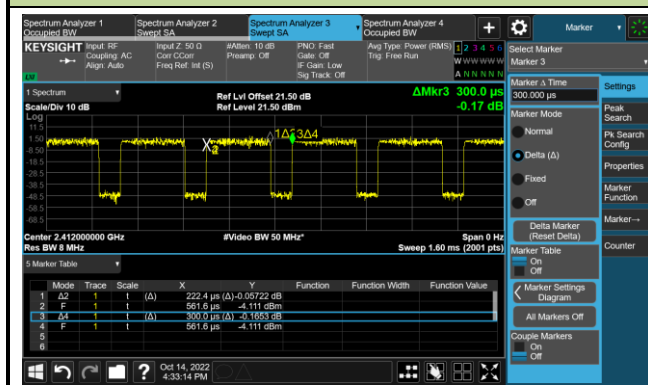
VHT20 (T = 1.338 ms)



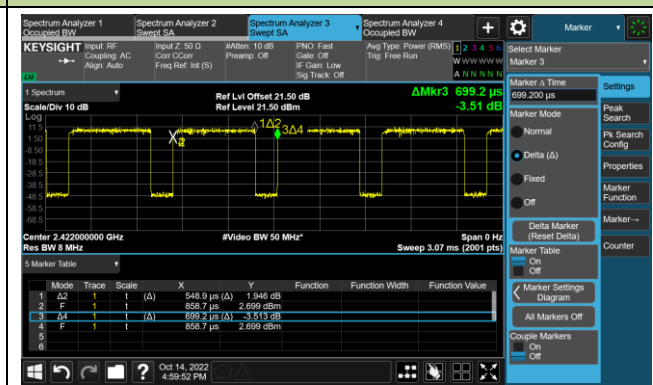
VHT40 (T = 666.3  $\mu$ s)



802.11ax-HE20 (T = 222.4  $\mu$ s)



802.11ax-HE40 (T = 548.9  $\mu$ s)

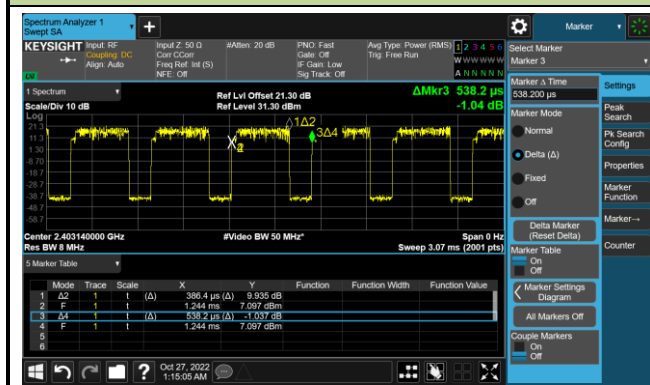


Test Site	SIP-TR1	Test Engineer	Nandy Zhang
Test Date	2022-10-27		
Test Mode	802.11ax-HE, Partial RU		

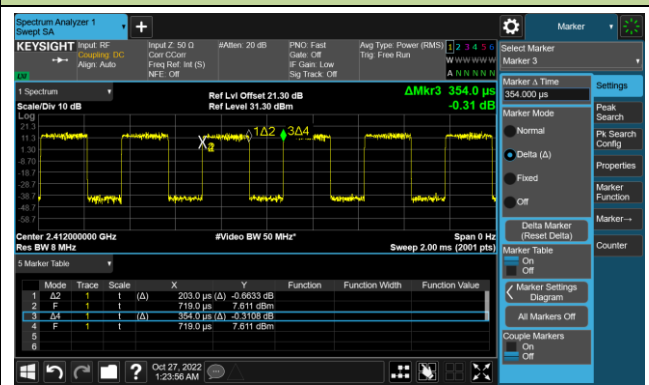
Test Mode	Duty Cycle	Test Mode	Duty Cycle
802.11ax-HE20 – 26Tone	71.79%	802.11ax-HE40– 26Tone	71.60%
802.11ax-HE20 – 242Tone	57.34%	802.11ax-HE40– 484Tone	56.86%

Duty Cycle (T = Transmission Duration)

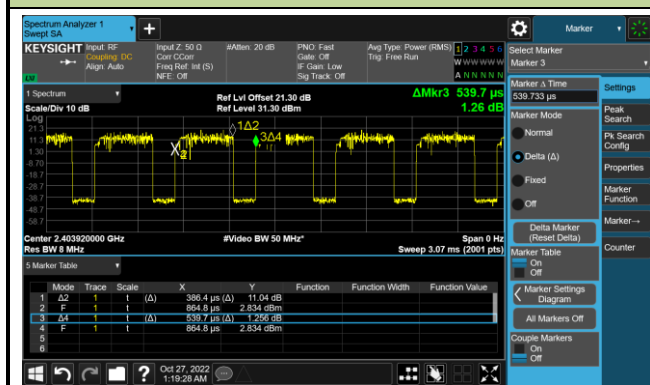
802.11ax-HE20 - 26 Tone (T = 386.4 $\mu$ s)



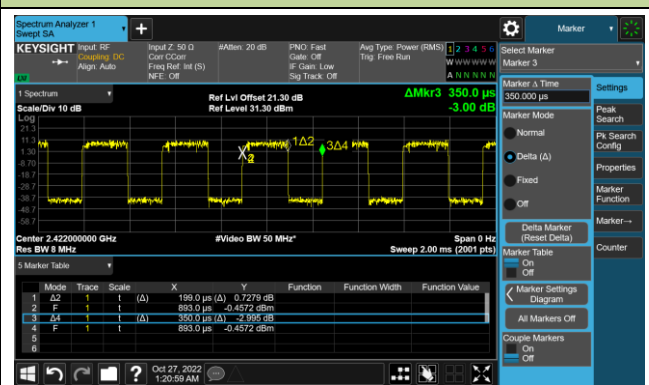
802.11ax-HE20 - 242 Tone (T = 203.0 $\mu$ s)



802.11ax-HE40 - 26 Tone (T = 386.4 $\mu$ s)



802.11ax-HE40 - 484 Tone (T = 199.0 $\mu$ s)



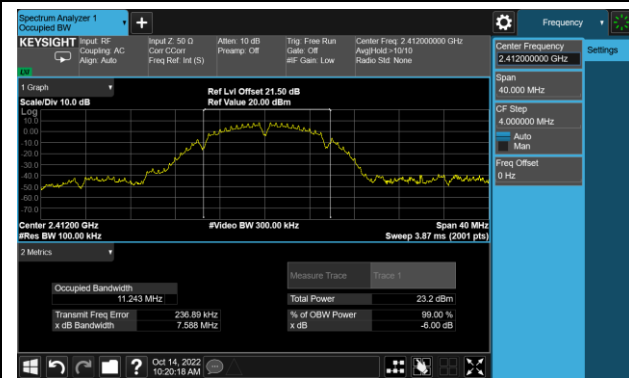
**A.2 6dB Bandwidth Test Result**

Test Site	SIP-TR1	Test Engineer	Nandy Zhang
Test Date	2022-10-14	Test Mode	SISO Mode

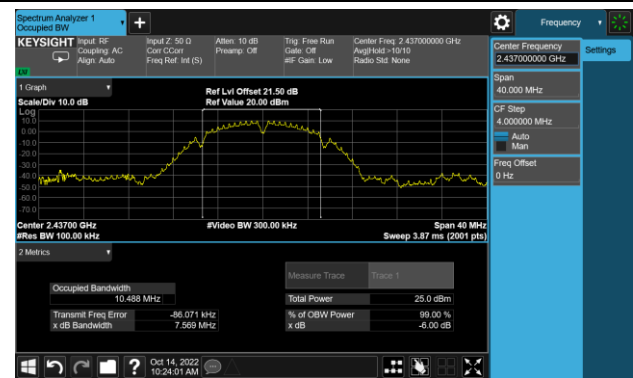
Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
<b>SISO Mode Ant 1</b>					
11b	1Mbps	01	2412	7.588	≥ 0.5
11b	1Mbps	06	2437	7.569	≥ 0.5
11b	1Mbps	11	2462	7.578	≥ 0.5
11g	6Mbps	01	2412	16.37	≥ 0.5
11g	6Mbps	06	2437	16.36	≥ 0.5
11g	6Mbps	11	2462	16.13	≥ 0.5
<b>SISO Mode Ant 2</b>					
11b	1Mbps	01	2412	7.578	≥ 0.5
11b	1Mbps	06	2437	7.594	≥ 0.5
11b	1Mbps	11	2462	7.068	≥ 0.5
11g	6Mbps	01	2412	15.71	≥ 0.5
11g	6Mbps	06	2437	15.99	≥ 0.5
11g	6Mbps	11	2462	15.68	≥ 0.5

802.11b 6dB Bandwidth - SISO Mode Ant 1

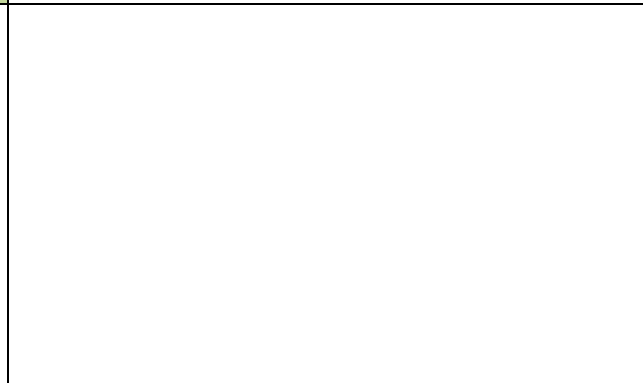
Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)



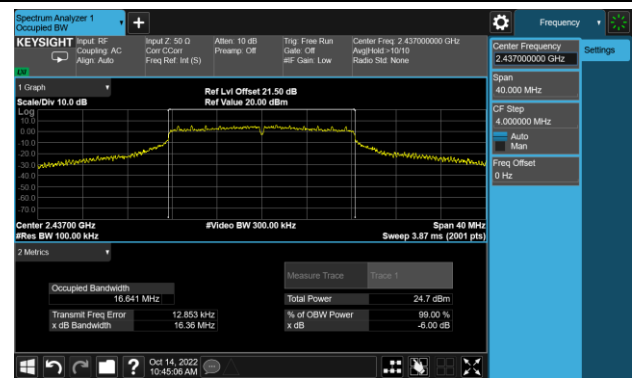


802.11g 6dB Bandwidth - SISO Mode Ant 1

Channel 01 (2412MHz)



Channel 06 (2437MHz)

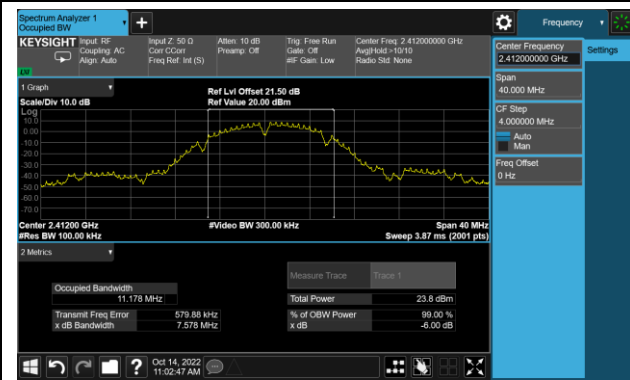


Channel 11 (2462MHz)

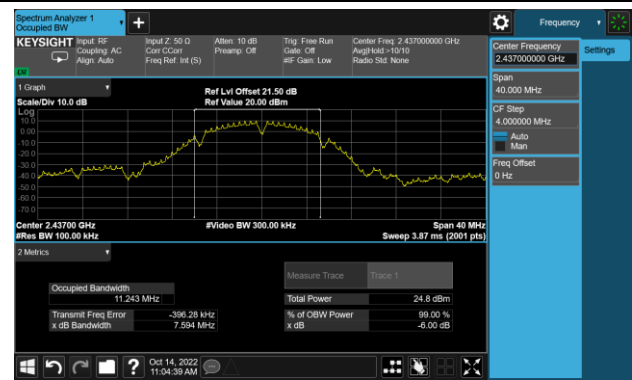


802.11b 6dB Bandwidth - SISO Mode Ant 2

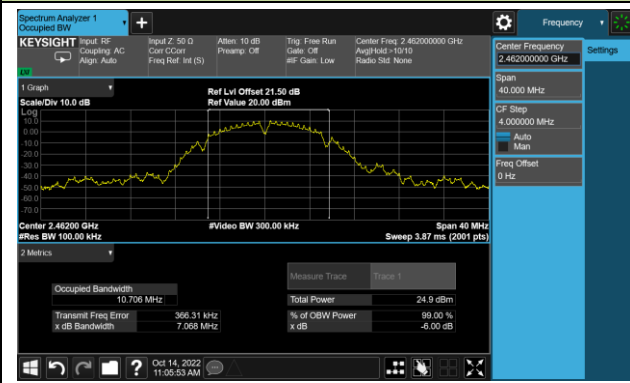
Channel 01 (2412MHz)



Channel 06 (2437MHz)

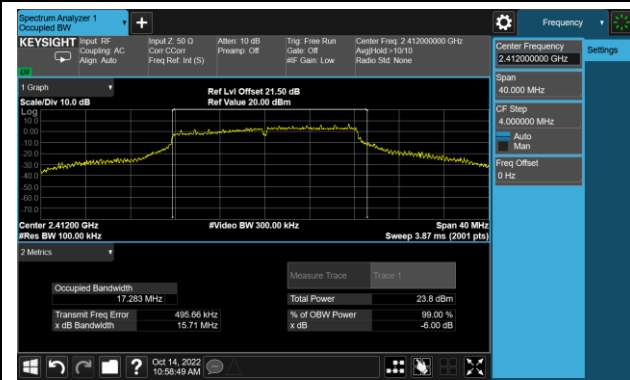


Channel 11 (2462MHz)

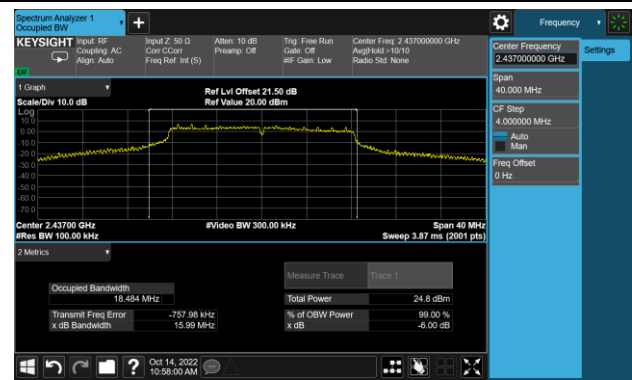


802.11g 6dB Bandwidth - SISO Mode Ant 2

Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)

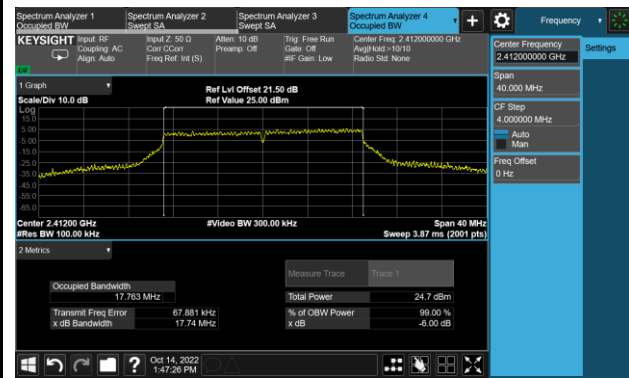


Test Site	SIP-TR1	Test Engineer	Nandy Zhang
Test Date	2022-10-14	Test Mode	MIMO Mode

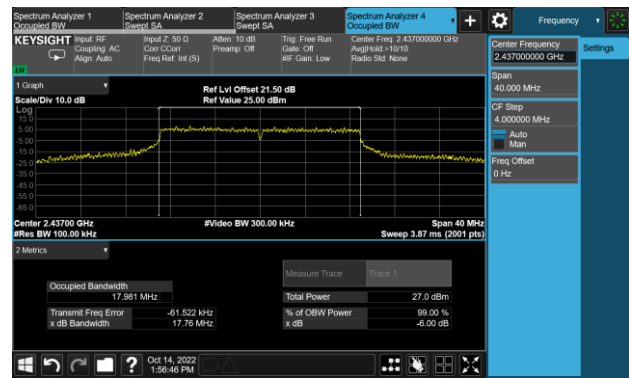
Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
11n-HT20	MCS0	01	2412	17.74	≥ 0.5
11n-HT20	MCS0	06	2437	17.76	≥ 0.5
11n-HT20	MCS0	11	2462	17.74	≥ 0.5
11n-HT40	MCS0	01	2412	35.69	≥ 0.5
11n-HT40	MCS0	06	2437	36.52	≥ 0.5
11n-HT40	MCS0	11	2462	35.80	≥ 0.5
VHT20	MCS0	01	2412	16.38	≥ 0.5
VHT20	MCS0	06	2437	17.40	≥ 0.5
VHT20	MCS0	11	2462	16.56	≥ 0.5
VHT40	MCS0	03	2422	35.72	≥ 0.5
VHT40	MCS0	06	2437	36.48	≥ 0.5
VHT40	MCS0	09	2452	36.12	≥ 0.5
11ax-HE20	MCS0	01	2412	19.11	≥ 0.5
11ax-HE20	MCS0	06	2437	19.16	≥ 0.5
11ax-HE20	MCS0	11	2462	19.09	≥ 0.5
11ax-HE40	MCS0	03	2422	36.84	≥ 0.5
11ax-HE40	MCS0	06	2437	37.94	≥ 0.5
11ax-HE40	MCS0	09	2452	37.66	≥ 0.5

802.11n-HT20 6dB Bandwidth

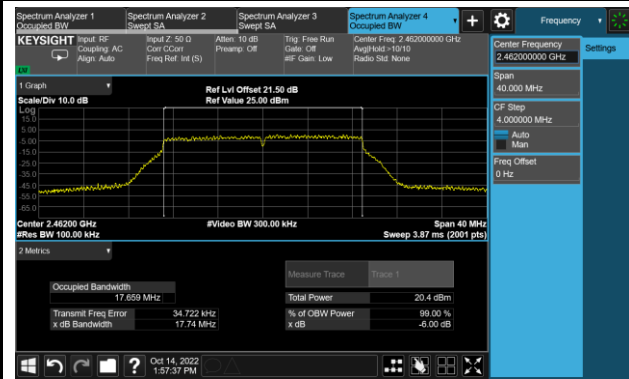
Channel 01 (2412MHz)



Channel 06 (2437MHz)

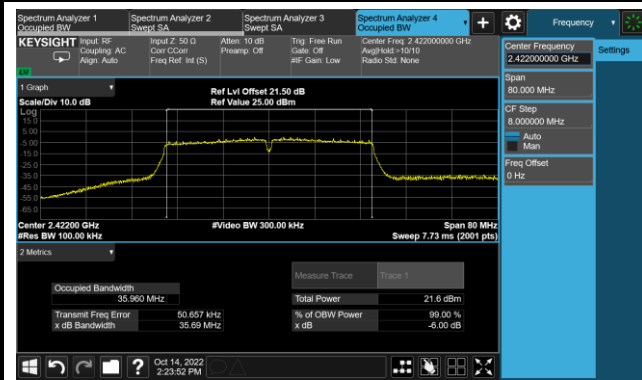


Channel 11 (2462MHz)

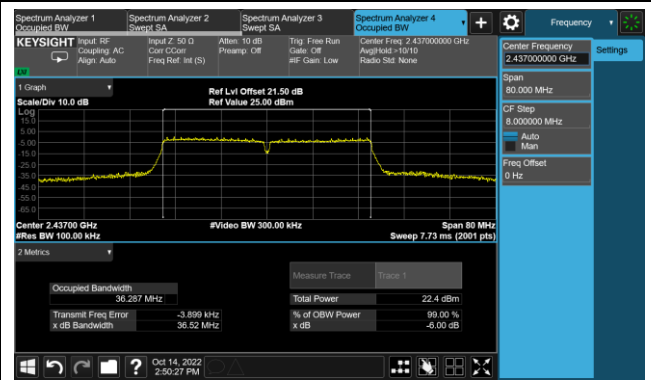


802.11n-HT40 6dB Bandwidth

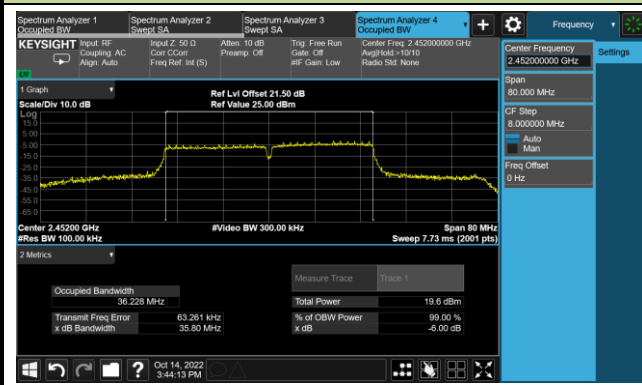
Channel 03 (2422MHz)



Channel 06 (2437MHz)

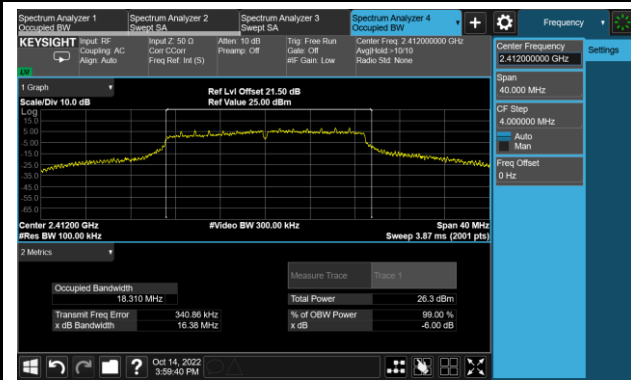


Channel 09 (2452MHz)

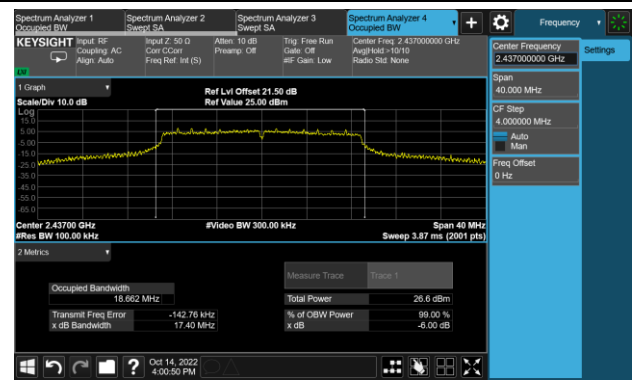


VHT20 6dB Bandwidth

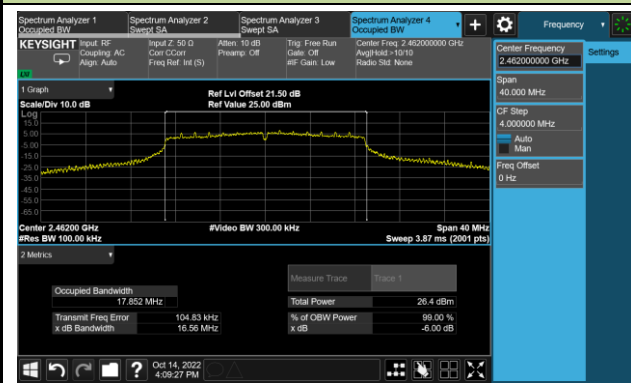
Channel 01 (2412MHz)

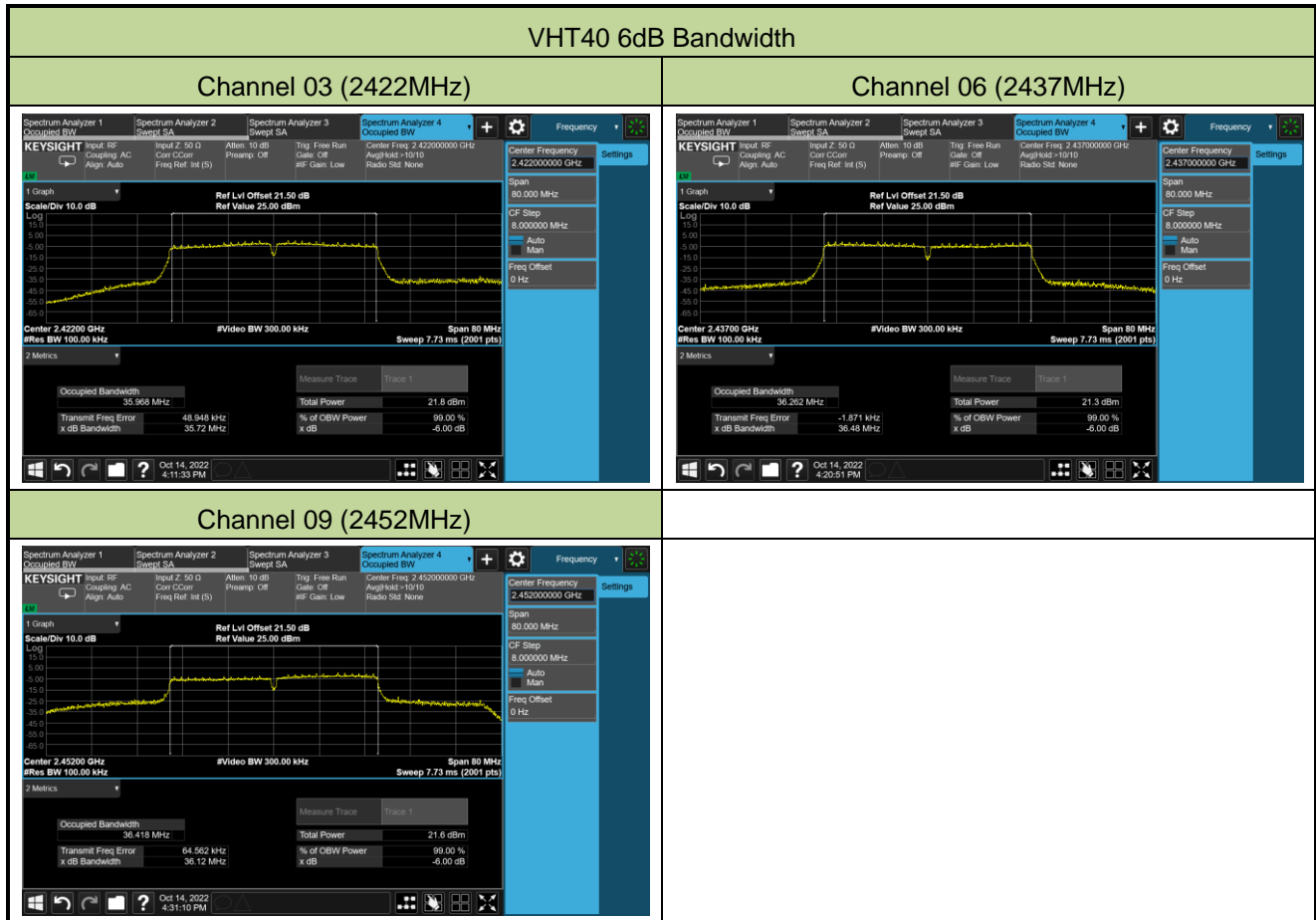


Channel 06 (2437MHz)



Channel 11 (2462MHz)

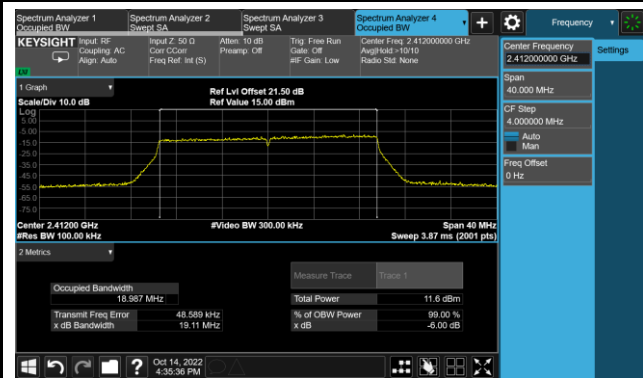




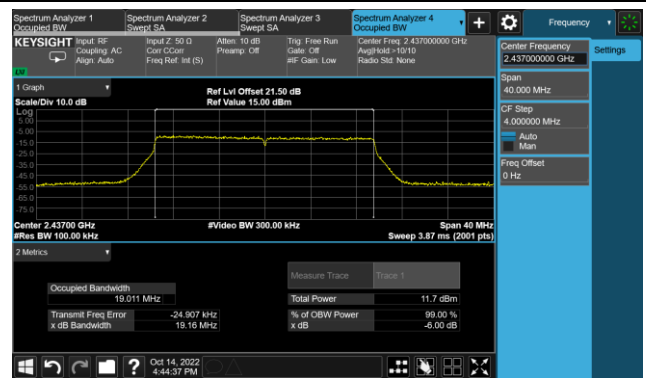


## 802.11ax-HE20 6dB Bandwidth

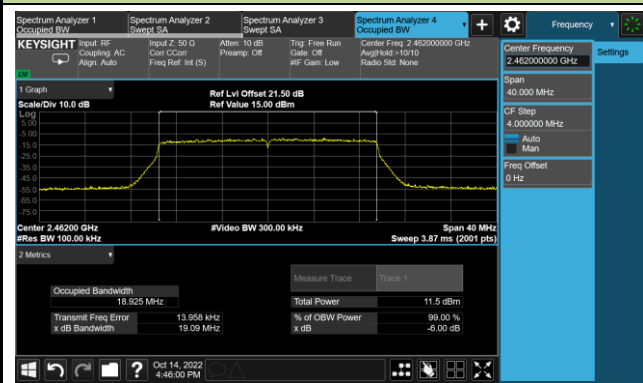
## Channel 01 (2412MHz)



## Channel 06 (2437MHz)

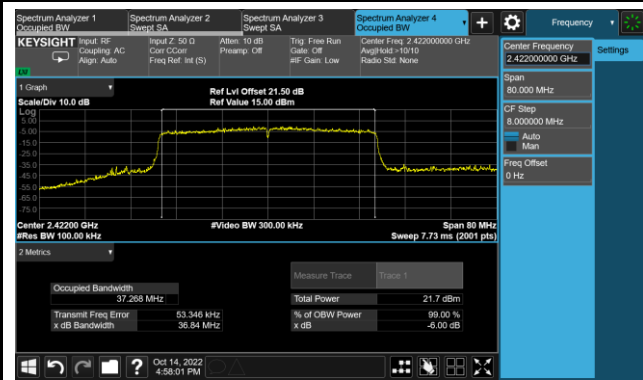


## Channel 11 (2462MHz)

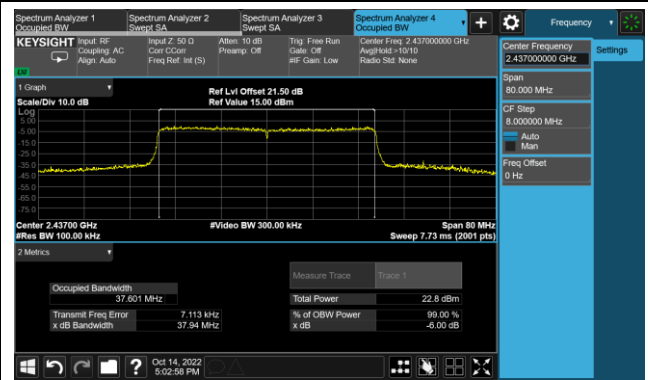


802.11ax-HE40 6dB Bandwidth

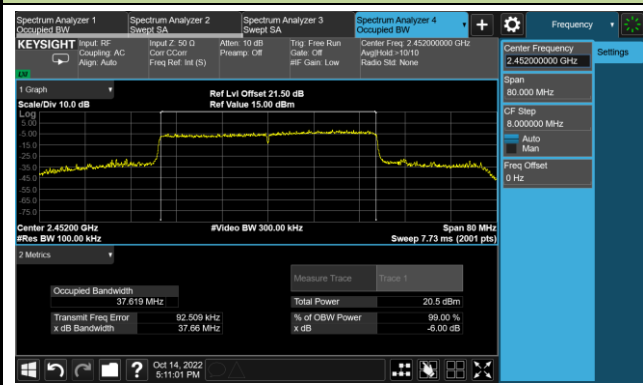
Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)

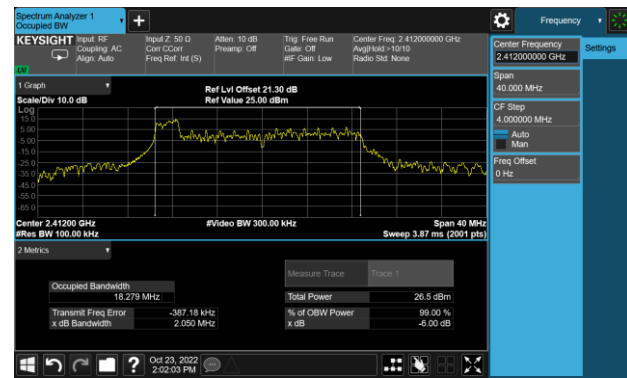


Test Site	SIP-TR1	Test Engineer	Nandy Zhang
Test Date	2022-10-23		
Test Mode	802.11ax-HE, Partial RU		

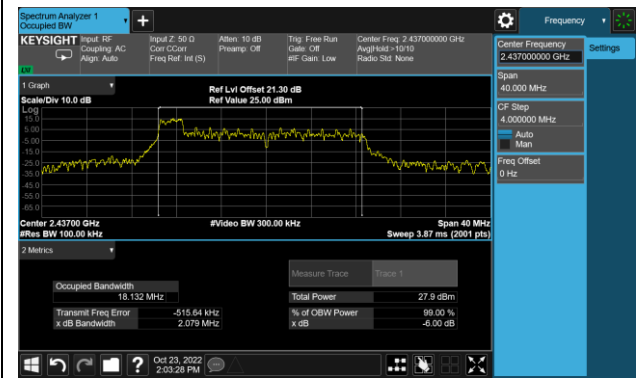
Test Mode	RU Size	RU Index	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
11ax-HE20	26 Tone	RU 0	01	2412	2.050	≥ 0.5
			06	2437	2.079	≥ 0.5
			11	2462	2.104	≥ 0.5
		RU 4	01	2412	2.702	≥ 0.5
			06	2437	2.694	≥ 0.5
			11	2462	2.712	≥ 0.5
		RU 8	01	2412	2.135	≥ 0.5
			06	2437	17.07	≥ 0.5
			11	2462	2.062	≥ 0.5
	242 Tone	RU 61	01	2412	19.00	≥ 0.5
			06	2437	18.92	≥ 0.5
			11	2462	18.87	≥ 0.5
11ax-HE40	26 Tone	RU 0	03	2422	2.066	≥ 0.5
			06	2437	1.994	≥ 0.5
			09	2452	2.097	≥ 0.5
		RU 8	03	2422	2.037	≥ 0.5
			06	2437	16.01	≥ 0.5
			09	2452	2.084	≥ 0.5
		RU 17	03	2422	16.53	≥ 0.5
			06	2437	1.973	≥ 0.5
			09	2452	2.009	≥ 0.5
	484 Tone	RU 65	03	2422	32.56	≥ 0.5
			06	2437	37.19	≥ 0.5
			09	2452	35.96	≥ 0.5

802.11ax-HE20 6dB Bandwidth - Ant 1 - 26 Tone RU 0

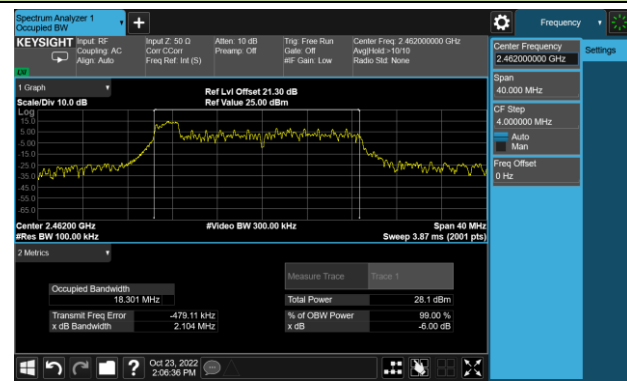
Channel 01 (2412MHz)



Channel 06 (2437MHz)

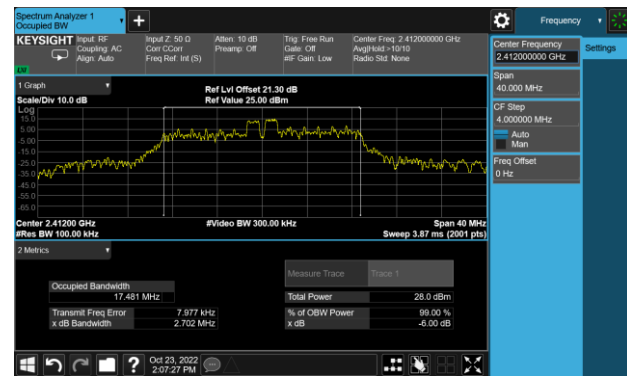


Channel 11 (2462MHz)

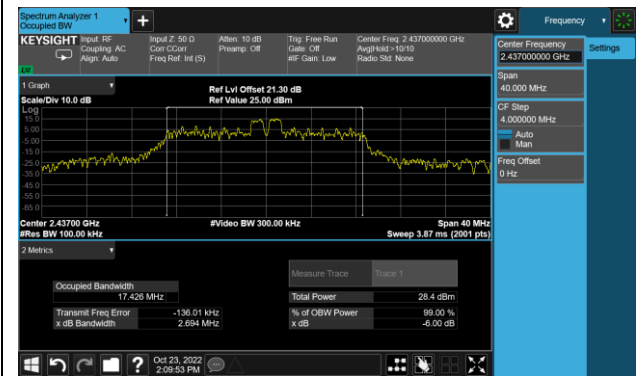


802.11ax-HE20 6dB Bandwidth - Ant 1 - 26 Tone RU 4

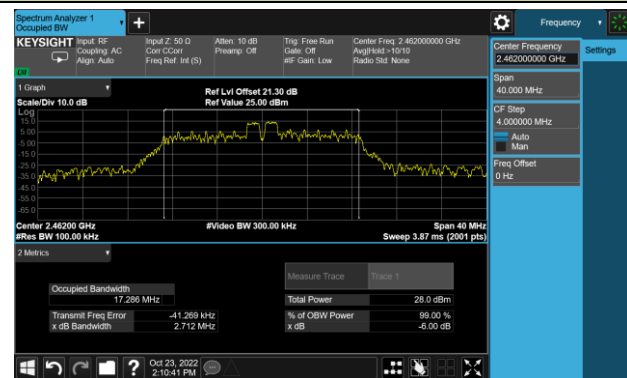
Channel 01 (2412MHz)



Channel 06 (2437MHz)

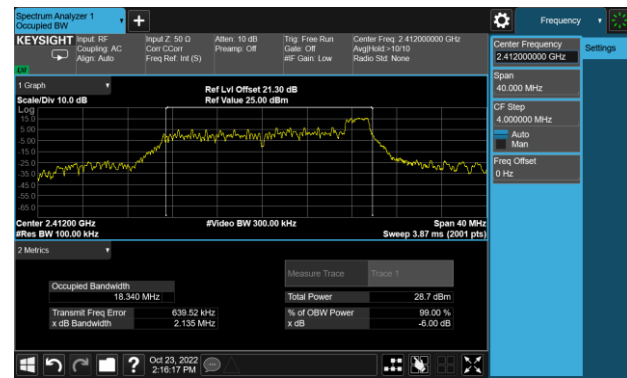


Channel 11 (2462MHz)

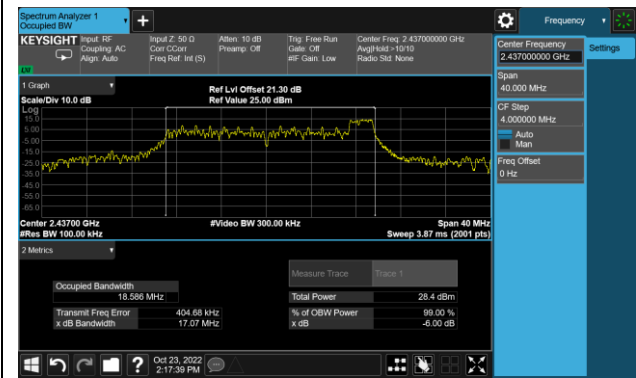


802.11ax-HE20 6dB Bandwidth - Ant 1 - 26 Tone RU 8

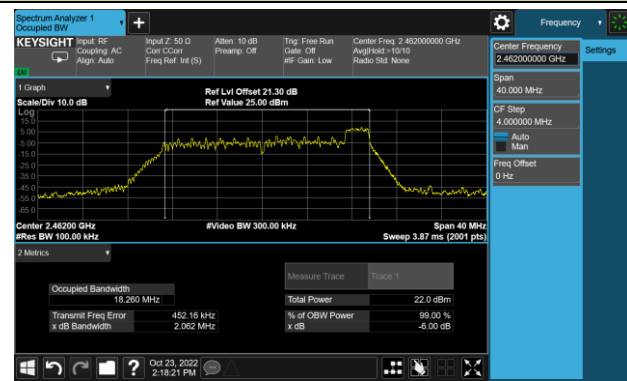
Channel 01 (2412MHz)



Channel 06 (2437MHz)

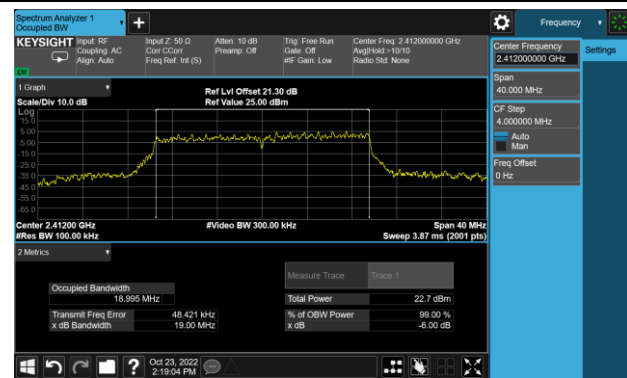


Channel 11 (2462MHz)

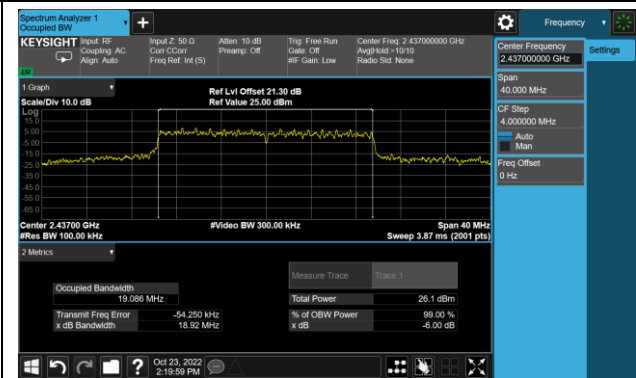


802.11ax-HE20 6dB Bandwidth - Ant 1 - 242 Tone RU 61

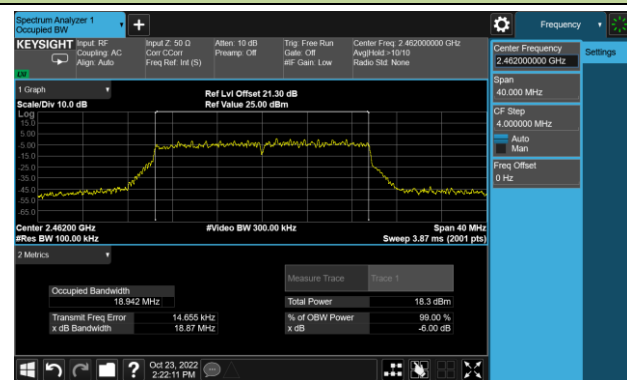
Channel 01 (2412MHz)



Channel 06 (2437MHz)

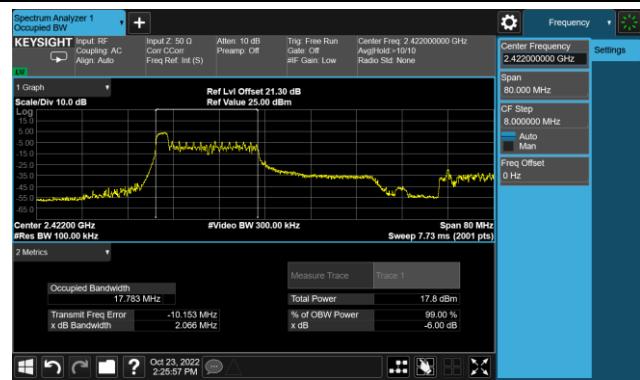


Channel 11 (2462MHz)

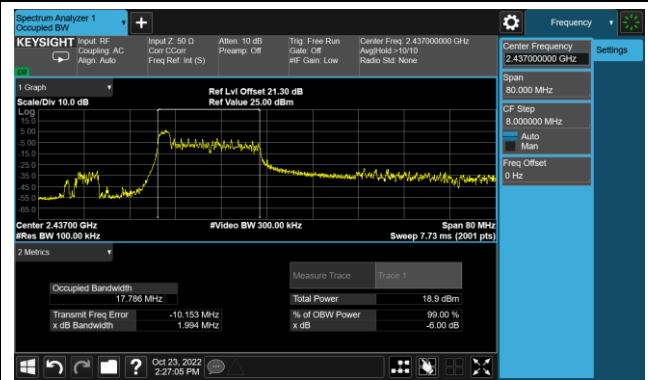


802.11ax-HE40 6dB Bandwidth - Ant 1 - 26 Tone RU 0

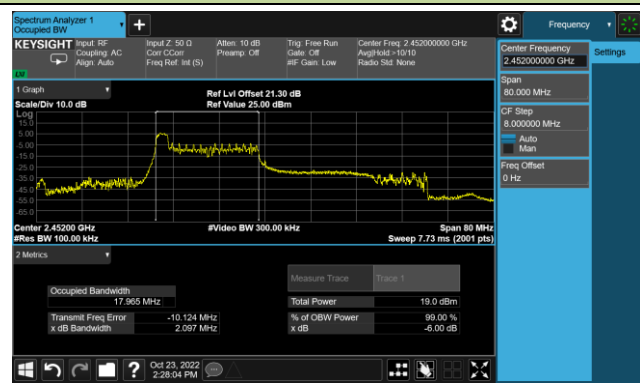
Channel 03 (2422MHz)



Channel 06 (2437MHz)



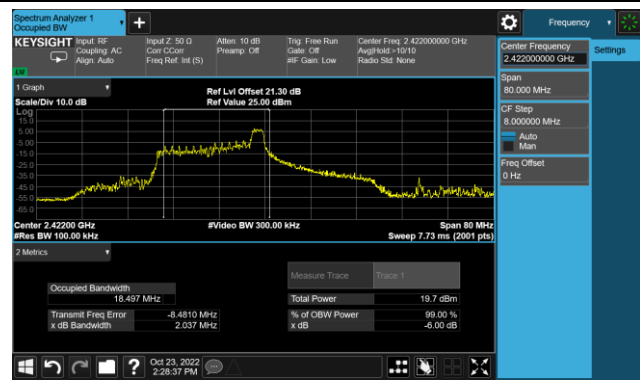
Channel 09 (2452MHz)



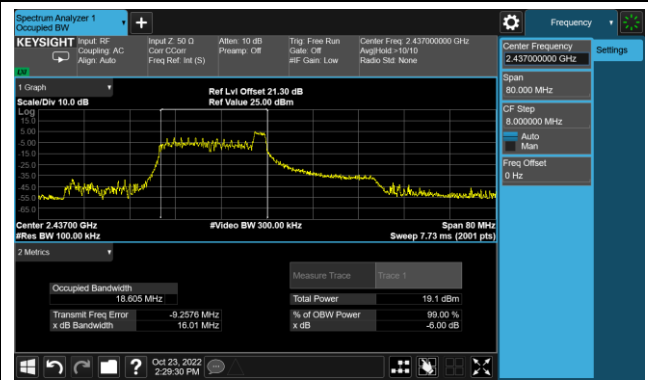


802.11ax-HE40 6dB Bandwidth - Ant 1 - 26 Tone RU 8

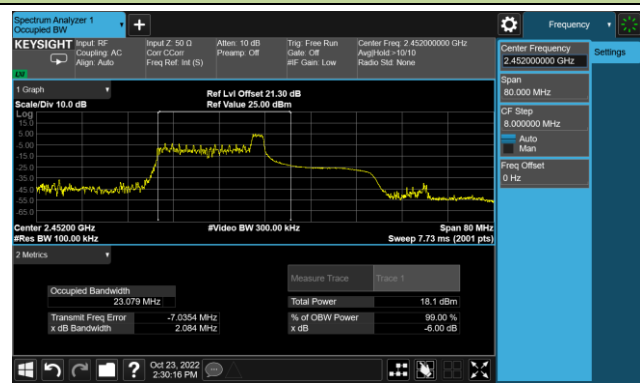
Channel 03 (2422MHz)



Channel 06 (2437MHz)

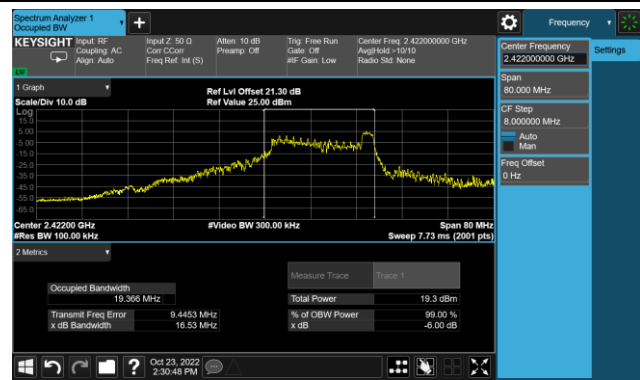


Channel 09 (2452MHz)

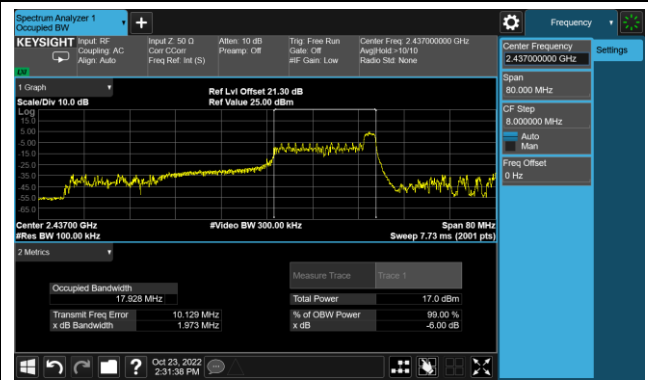


802.11ax-HE40 6dB Bandwidth - Ant 1 - 26 Tone RU 17

Channel 03 (2422MHz)



Channel 06 (2437MHz)

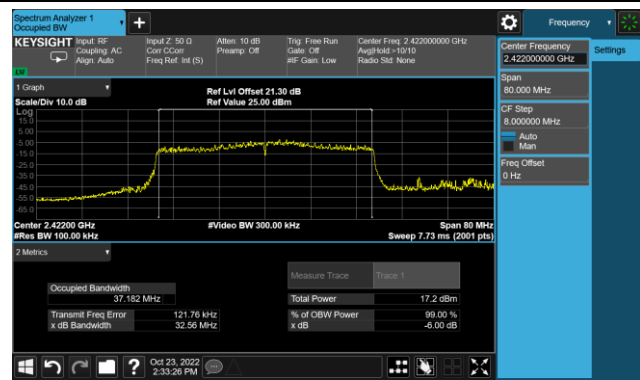


Channel 09 (2452MHz)

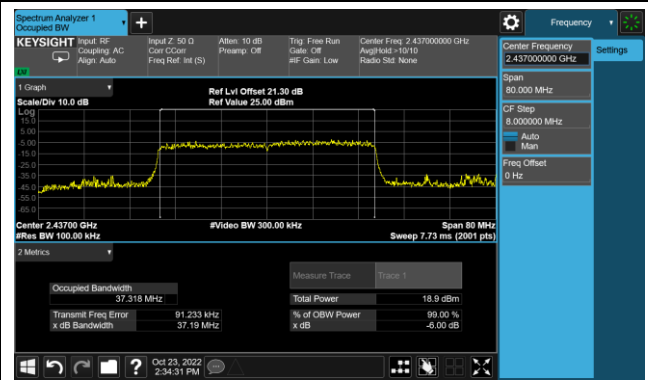


802.11ax-HE40 6dB Bandwidth - Ant 1 - 484 Tone RU 65

Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)



**A.3 Output Power Test Result**

Test Site	SIP-TR1	Test Engineer	Nandy Zhang
Test Date	2022-09-28	Test Mode	SISO Mode

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Average Power (dBm)		Limit (dBm)
				Ant 1	Ant 2	
802.11b	1Mbps	01	2412	18.84	18.76	≤ 30.00
802.11b	1Mbps	06	2437	18.72	19.00	≤ 30.00
802.11b	1Mbps	11	2462	19.21	19.31	≤ 30.00
802.11g	6Mbps	01	2412	17.88	18.92	≤ 30.00
802.11g	6Mbps	06	2437	18.85	18.84	≤ 30.00
802.11g	6Mbps	11	2462	15.42	15.81	≤ 30.00

Test Site	SIP-TR1	Test Engineer	Nandy Zhang
Test Date	2022-09-28	Test Mode	MIMO Mode

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Average Power (dBm)		Total Power (dBm)	Limit (dBm)
				Ant 1	Ant 2		
802.11n-HT20	MCS0	01	2412	16.67	16.00	19.36	≤ 30.00
802.11n-HT20	MCS0	06	2437	19.02	17.70	21.42	≤ 30.00
802.11n-HT20	MCS0	11	2462	12.13	12.27	15.21	≤ 30.00
802.11n-HT40	MCS0	03	2422	13.91	12.98	16.48	≤ 30.00
802.11n-HT40	MCS0	06	2437	14.24	13.43	16.86	≤ 30.00
802.11n-HT40	MCS0	09	2452	11.99	11.51	14.77	≤ 30.00
VHT20	MCS0	01	2412	17.81	17.37	20.61	≤ 30.00
VHT20	MCS0	06	2437	19.00	17.57	21.35	≤ 30.00
VHT20	MCS0	11	2462	19.10	19.16	22.14	≤ 30.00
VHT40	MCS0	03	2422	14.05	13.37	16.73	≤ 30.00
VHT40	MCS0	06	2437	13.55	12.67	16.14	≤ 30.00
VHT40	MCS0	09	2452	13.67	13.12	16.41	≤ 30.00
802.11ax-HE20	MCS0	01	2412	18.03	17.70	20.88	≤ 30.00
802.11ax-HE20	MCS0	06	2437	19.13	17.21	21.29	≤ 30.00
802.11ax-HE20	MCS0	11	2462	19.09	19.24	22.18	≤ 30.00
802.11ax-HE40	MCS0	03	2422	13.11	13.24	16.19	≤ 30.00
802.11ax-HE40	MCS0	06	2437	14.46	13.65	17.08	≤ 30.00
802.11ax-HE40	MCS0	09	2452	11.82	11.70	14.77	≤ 30.00

Note: Total Power (dBm) =  $10 \cdot \log \{10^{(\text{Ant 1 Average Power} / 10)} + 10^{(\text{Ant 2 Average Power} / 10)}\}$ .

Test Site	SIP-TR1	Test Engineer	Nandy Zhang
Test Date	2022-10-27	Test Mode	MIMO Mode

Test Mode	RU Size	RU Index	Channel No.	Freq. (MHz)	Average Power (dBm)		Total Power (dBm)	Limit (dBm)
					Ant 1	Ant 2		
11ax-HE20	26 Tone	RU 0	01	2412	16.87	14.83	18.98	≤ 30.00
			06	2437	18.98	17.57	21.34	≤ 30.00
			11	2462	18.86	18.60	21.74	≤ 30.00
		RU 4	01	2412	19.24	18.51	21.90	≤ 30.00
			06	2437	19.06	16.96	21.15	≤ 30.00
			11	2462	18.89	19.02	21.97	≤ 30.00
		RU 8	01	2412	19.06	18.74	21.91	≤ 30.00
			06	2437	19.12	17.03	21.21	≤ 30.00
			11	2462	12.42	10.85	14.72	≤ 30.00
	242 Tone	RU 61	01	2412	15.72	15.38	18.56	≤ 30.00
			06	2437	19.19	17.81	21.56	≤ 30.00
			11	2462	10.88	9.98	13.46	≤ 30.00
11ax-HE40	26 Tone	RU 0	03	2422	14.27	12.95	16.67	≤ 30.00
			06	2437	13.52	14.18	16.87	≤ 30.00
			09	2452	13.93	13.10	16.55	≤ 30.00
		RU 8	03	2422	14.14	13.93	17.05	≤ 30.00
			06	2437	14.04	12.60	16.39	≤ 30.00
			09	2452	14.15	13.97	17.07	≤ 30.00
		RU 17	03	2422	13.73	13.94	16.85	≤ 30.00
			06	2437	14.01	13.86	16.95	≤ 30.00
			09	2452	14.12	13.43	16.80	≤ 30.00
	484 Tone	RU 65	03	2422	13.48	12.05	15.83	≤ 30.00
			06	2437	14.20	13.16	16.72	≤ 30.00
			09	2452	13.05	11.46	15.34	≤ 30.00

Note: Total Power (dBm) =  $10 \cdot \log \{10^{(\text{Ant 1 Average Power} / 10)} + 10^{(\text{Ant 2 Average Power} / 10)}\}$

**A.4 Power Spectral Density Test Result**

Test Site	SIP-TR1	Test Engineer	Nandy Zhang
Test Date	2022-10-14	Test Mode	SISO Mode

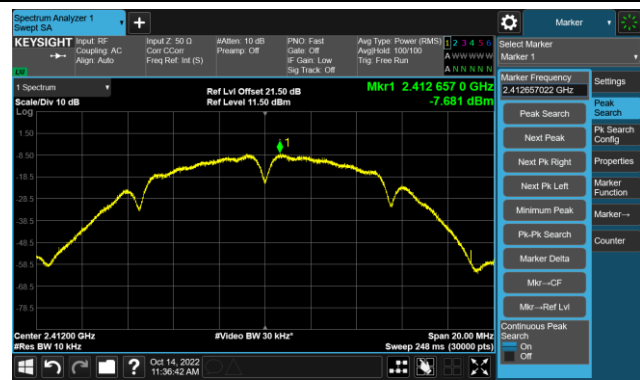
Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	PSD (dBm/10kHz)		Final PSD (dBm/10kHz)		Limit (dBm / 3kHz)	Result
				Ant 1	Ant 2	Ant 1	Ant 2		
802.11b	1Mbps	01	2412	-7.68	-8.61	-7.68	-8.61	≤ 8.00	Pass
802.11b	1Mbps	06	2437	-7.93	-7.71	-7.93	-7.71	≤ 8.00	Pass
802.11b	1Mbps	11	2462	-8.36	-7.78	-8.36	-7.78	≤ 8.00	Pass
802.11g	6Mbps	01	2412	-10.67	-10.77	-10.22	-10.32	≤ 8.00	Pass
802.11g	6Mbps	06	2437	-9.78	-10.36	-9.33	-9.91	≤ 8.00	Pass
802.11g	6Mbps	11	2462	-14.82	-12.30	-14.37	-11.85	≤ 8.00	Pass

Note: When EUT duty cycle < 98%, Final AVGPDS =  $10 \cdot \log \{10^{(\text{Per Chain AVGPDS}/10)} + 10 \cdot \log (1/\text{Duty Cycle})\}$ .

When EUT duty cycle ≥ 98%, Final AVGPDS =  $10 \cdot \log \{10^{(\text{Per Chain AVGPDS}/10)}\}$ .

802.11b - PSD - SISO Mode Ant 1

Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)

