

UN6GHZ PRE-APPROVAL GUIDANCE CHECKLIST

1. Antennas

1.1 Information for all the antennas, i.e., type, gain and relative positions within host, must be included in the filing.

Please refer to page 10 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part1_Rev01” for antenna information.

Please refer to document “EUT Internal Photo” for the antenna positions.

1.2 Show how the (aggregate, if applicable) antenna gain was computed/measured (as in TCB Workshop Presentation Aggregate Antenna Gain Review, April 2021). Provide equation(s) used to calculate Directional Gain and provide example calculation showing how the DG was calculated with the antenna gain of individual antennas. Provide details (references or attached documents) on how the individual antenna gains were derived, i.e., declared by the host manufacturer, based on data sheet, or measured. Since the CBP needs to detect a small signal, the worst case scenario to consider is when the receiver has the lowest antenna gain.

Please refer to page 10 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part1_Rev01” for antenna information.

According to FCC KDB 662911 D01v02r01:

CDD Mode

For power measurements: Array Gain = 0 dB for $N_{ANT} \leq 4$, the directional gain = max antenna gain + array gain

For power spectral density (PSD) measurements:

the directional gain = max antenna gain + array gain; Array Gain = $10 \log (N_{ANT}/N_{SS})$ dB

The CBP was performed by conducted test. The antenna gains of each band (NII-5/-6/-7/-8) (as follow picture) and the Ant 0 RF port was selected to perform CBP test. Please refer to page 103 (Master) of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6” for CBP test result.

Antenna Type	Frequency Band (MHz)	Tx Paths	Number of spatial streams	Antenna Gain (dBi)	CDD Directional Gain (dBi)	
					For Power	For PSD
Dipole Antenna	5925~7125	2	1	1.00	1.00	4.01
		2	2	1.00	1.00	1.00

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

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

- For power spectral density (PSD) measurements on all devices,

Array Gain = $10 \log (N_{ANT}/N_{SS})$ dB;

- For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB for $N_{ANT} \leq 4$;

1.3 For conducted test in MIMO cases, show that the testing was done for that path that has the lowest antenna gain.

The CBP was performed by conducted test. The antenna gains of each band (NII-5/-6/-7/-8) (as follow picture) and the Ant 0 RF port was selected to perform CBP test. Please refer to page 103 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6” for CBP test result.

Antenna Type	Frequency Band (MHz)	Tx Paths	Number of spatial streams	Antenna Gain (dBi)	CDD Directional Gain (dBi)	
					For Power	For PSD
Dipole Antenna	5925~7125	2	1	1.00	1.00	4.01
		2	2	1.00	1.00	1.00

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

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

- For power spectral density (PSD) measurements on all devices,

$$\text{Array Gain} = 10 \log (N_{ANT} / N_{SS}) \text{ dB};$$
- For power measurements on IEEE 802.11 devices,

$$\text{Array Gain} = 0 \text{ dB for } N_{ANT} \leq 4;$$

2. Contention Based Protocol (CBP)

2.1 CBP testing shall be performed on one channel in each sub-band of operation for both narrowest and widest bandwidths.

Please refer to page 103 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6” for the test channel and bandwidth information as follows. The narrowest and widest bandwidths were test for each UNII band.

Test Site	SR5	Test Engineer	Peter
Test Mode	Master	Test Date	2022/10/17~2022/10/18

Test Channel	Bandwidth (MHz)	Freq. (MHz)	AWGN Freq. (MHz)	AWGN Power (dBm)	Ant. Gain (dBi)	Adjust Power (dBm)	Detection Limit (dBm)	Detected Number	Detection Probability (%)	Limit (%)	Test Result
Operation Band: U-NII 5											
37	20	6135	6135	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
47	160	6185	6110	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
47	160	6185	6185	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
47	160	6185	6260	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
Operation Band: U-NII 6											
101	20	6455	6455	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
103	80	6465	6430	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
103	80	6465	6465	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
103	80	6465	6500	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
Operation Band: U-NII 7											
133	20	6615	6615	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
143	160	6665	6620	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
143	160	6665	6695	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
143	160	6665	6770	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
Operation Band: U-NII 8											
197	20	6935	6935	-65.0	1.0	-66.0	≤ -62.0	10	100	90	Pass
207	160	6985	6940	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
207	160	6985	7015	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
207	160	6985	7090	-64.0	1.0	-65.0	≤ -62.0	10	100	90	Pass

Note 1: Adjust Power (dBm) = AWGN Power (dBm) – Antenna Gain (dBi).

Note 2: Conducted measurements are used.

2.2 Use three separate 10 MHz AWGN signals when testing a 160 MHz channel. The simulated incumbent signal must be a 10 MHz wide AWGN signal

Please refer to page 103 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6” for the test summary information.

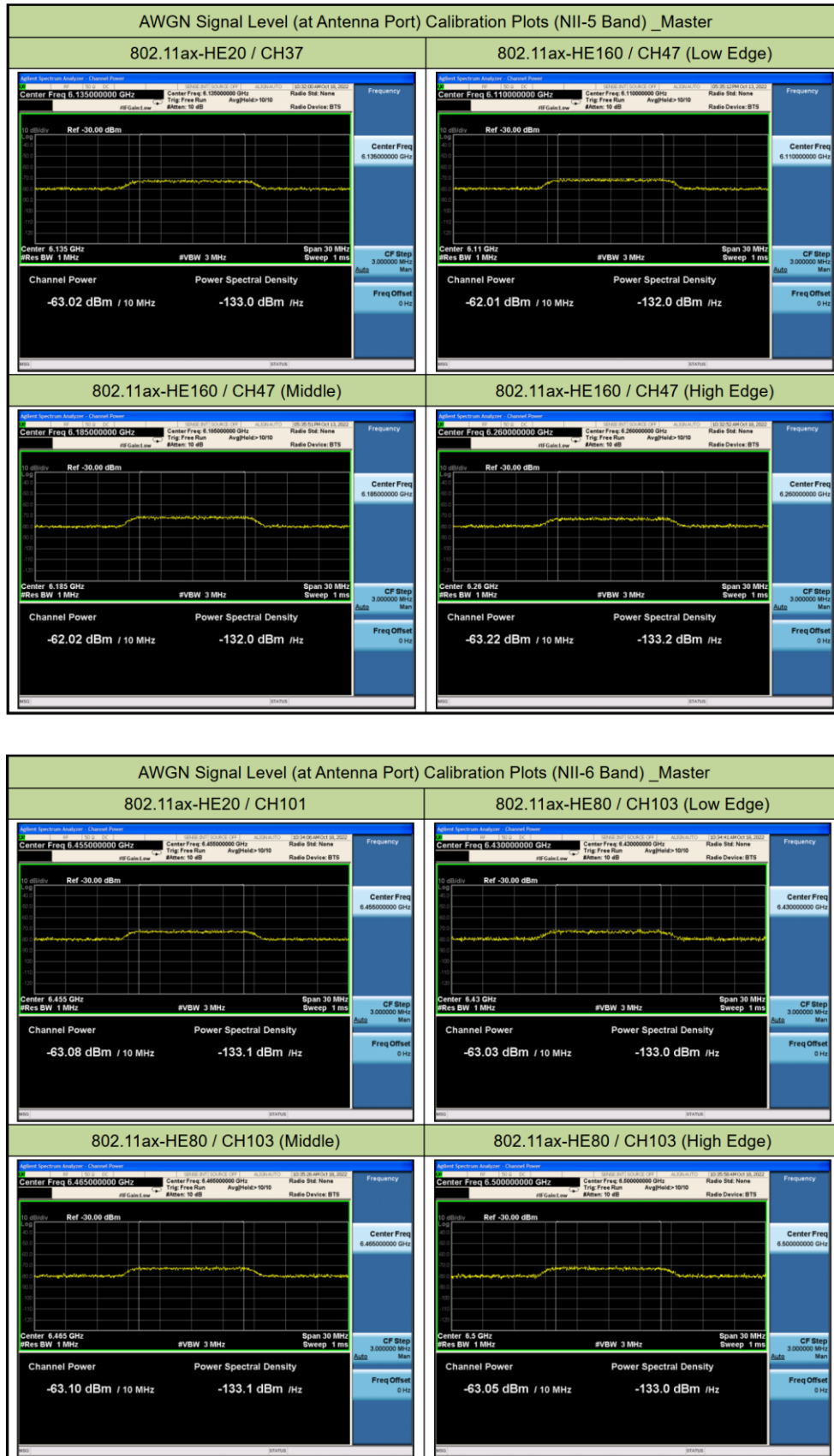
Test Site	SR5	Test Engineer	Peter
Test Mode	Master	Test Date	2022/10/17~2022/10/18

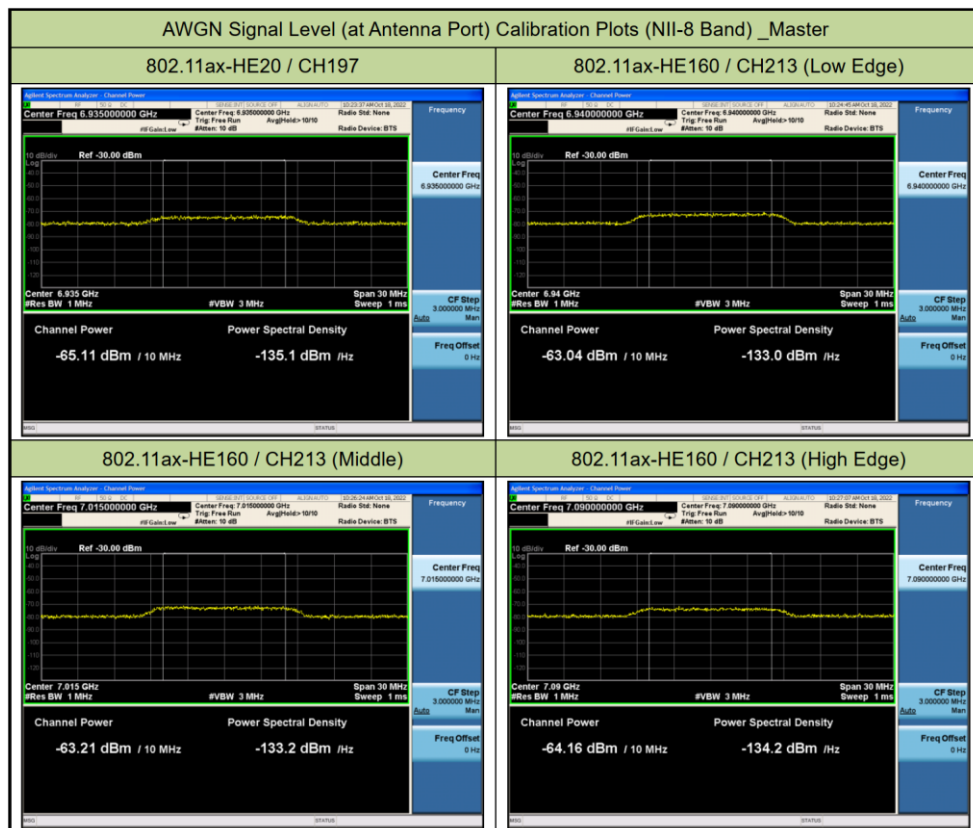
Test Channel	Bandwidth (MHz)	Freq. (MHz)	AWGN Freq. (MHz)	AWGN Power (dBm)	Ant. Gain (dBi)	Adjust Power (dBm)	Detection Limit (dBm)	Detected Number	Detection Probability (%)	Limit (%)	Test Result
Operation Band: U-NII 5											
37	20	6135	6135	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
47	160	6185	6110	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
47	160	6185	6185	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
47	160	6185	6260	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
Operation Band: U-NII 6											
101	20	6455	6455	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
103	80	6465	6430	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
103	80	6465	6465	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
103	80	6465	6500	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
Operation Band: U-NII 7											
133	20	6615	6615	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
143	160	6665	6620	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
143	160	6665	6695	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
143	160	6665	6770	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
Operation Band: U-NII 8											
197	20	6935	6935	-65.0	1.0	-66.0	≤ -62.0	10	100	90	Pass
207	160	6985	6940	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
207	160	6985	7015	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
207	160	6985	7090	-64.0	1.0	-65.0	≤ -62.0	10	100	90	Pass

Note 1: Adjust Power (dBm) = AWGN Power (dBm) – Antenna Gain (dBi).

Note 2: Conducted measurements are used.

Please refer to page 106~109 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6” for the AWGN signal plots.





2.3 Report lowest AWGN signal detectable by EUT

Please refer to page 104~105 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6” for lowest AWGN signal detectable by EUT.

Bandwidth (MHz)	Freq. (MHz)	AWGN Freq. (MHz)	Adjust Power (dBm)	EUT Tx Status
Operation Band: U-NII 5				
20	6135	6135	-79	ON
			-65	Minimal
			-64	OFF
160	6185	6110	-79	ON
			-64	Minimal
			-63	OFF
160	6185	6185	-79	ON
			-64	Minimal
			-63	OFF
160	6185	6260	-79	ON
			-65	Minimal
			-64	OFF
Operation Band: U-NII 6				
20	6455	6455	-79	ON
			-65	Minimal
			-64	OFF
80	6465	6430	-79	ON
			-65	Minimal
			-64	OFF
80	6465	6465	-79	ON
			-65	Minimal
			-64	OFF
80	6465	6500	-79	ON
			-65	Minimal
			-64	OFF

Bandwidth (MHz)	Freq. (MHz)	AWGN Freq. (MHz)	Adjust Power (dBm)	EUT Status
Operation Band: U-NII 7				
20	6695	6695	-79	ON
			-64	Minimal
			-63	OFF
160	6665	6620	-79	ON
			-64	Minimal
			-63	OFF
160	6665	6695	-79	ON
			-64	Minimal
			-63	OFF
160	6665	6770	-79	ON
			-65	Minimal
			-64	OFF
Operation Band: U-NII 8				
20	6935	6935	-79	ON
			-67	Minimal
			-66	OFF
160	6985	6940	-79	ON
			-65	Minimal
			-64	OFF
160	6985	7015	-79	ON
			-65	Minimal
			-64	OFF
160	6985	7090	-79	ON
			-66	Minimal
			-65	OFF
Note: OFF: AWGN level at which no transmission is detected, consistently for a minimum period of 10 seconds Minimal: AWGN level at which the system begins to trigger the transmission switch-off, albeit not being kept off consistently ON: AWGN level at which no impact on the transmission is detected, consistently for a minimum period of 10 seconds				

2.4 Verify that the testing was performed with the AWGN signal set to lowest level (for example, -100 dBm) and increased until the EUT detects and stops transmitting.

The test was performed with a lowest AWGN signal level and increased until the EUT detects and stop transmission.

Please refer to page 104~105 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6” for lowest AWGN signal detectable by EUT.

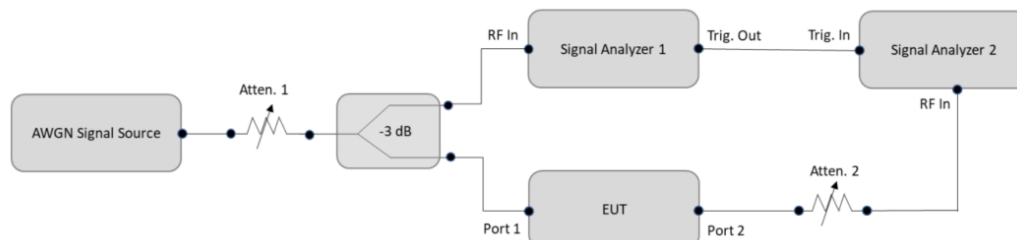
Bandwidth (MHz)	Freq. (MHz)	AWGN Freq. (MHz)	Adjust Power (dBm)	EUT Tx Status
Operation Band: U-NII 5				
20	6135	6135	-79	ON
			-65	Minimal
			-64	OFF
160	6185	6110	-79	ON
			-64	Minimal
			-63	OFF
160	6185	6185	-79	ON
			-64	Minimal
			-63	OFF
160	6185	6260	-79	ON
			-65	Minimal
			-64	OFF
Operation Band: U-NII 6				
20	6455	6455	-79	ON
			-65	Minimal
			-64	OFF
80	6465	6430	-79	ON
			-65	Minimal
			-64	OFF
80	6465	6465	-79	ON
			-65	Minimal
			-64	OFF
80	6465	6500	-79	ON
			-65	Minimal
			-64	OFF

Bandwidth (MHz)	Freq. (MHz)	AWGN Freq. (MHz)	Adjust Power (dBm)	EUT Status
Operation Band: U-NII 7				
20	6695	6695	-79	ON
			-64	Minimal
			-63	OFF
160	6665	6620	-79	ON
			-64	Minimal
			-63	OFF
160	6665	6695	-79	ON
			-64	Minimal
			-63	OFF
160	6665	6770	-79	ON
			-65	Minimal
			-64	OFF
Operation Band: U-NII 8				
20	6935	6935	-79	ON
			-67	Minimal
			-66	OFF
160	6985	6940	-79	ON
			-65	Minimal
			-64	OFF
160	6985	7015	-79	ON
			-65	Minimal
			-64	OFF
160	6985	7090	-79	ON
			-66	Minimal
			-65	OFF
Note: OFF: AWGN level at which no transmission is detected, consistently for a minimum period of 10 seconds Minimal: AWGN level at which the system begins to trigger the transmission switch-off, albeit not being kept off consistently ON: AWGN level at which no impact on the transmission is detected, consistently for a minimum period of 10 seconds				

2.5 If conducted measurements are used, the detection threshold needs to be corrected to refer to a 0 dBi gain antenna and include all the applicable losses (cables, etc.). For instance, the report should show (at least): Detection Level = Injected AWGN Power (dBm) – Antenna Gain (dBi) + Path Loss (dB)

Conducted test is performed for this device.

Please refer to page 102 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6” for the test setup diagram as below.



Please refer to page 103 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6” for the test result summary.

The antenna gains of each band (NII-5/-6/-7/-8) (as follow picture) and the Ant 0 RF port was selected to perform CBP test.

Adjust Power (dBm) = AWGN Power (dBm) – Antenna Gain (dBi).

Adjust Power (dBm) ≤ Detection Limit (-62dBm)

All Detection Power in the report comply with the -62dBm threshold.

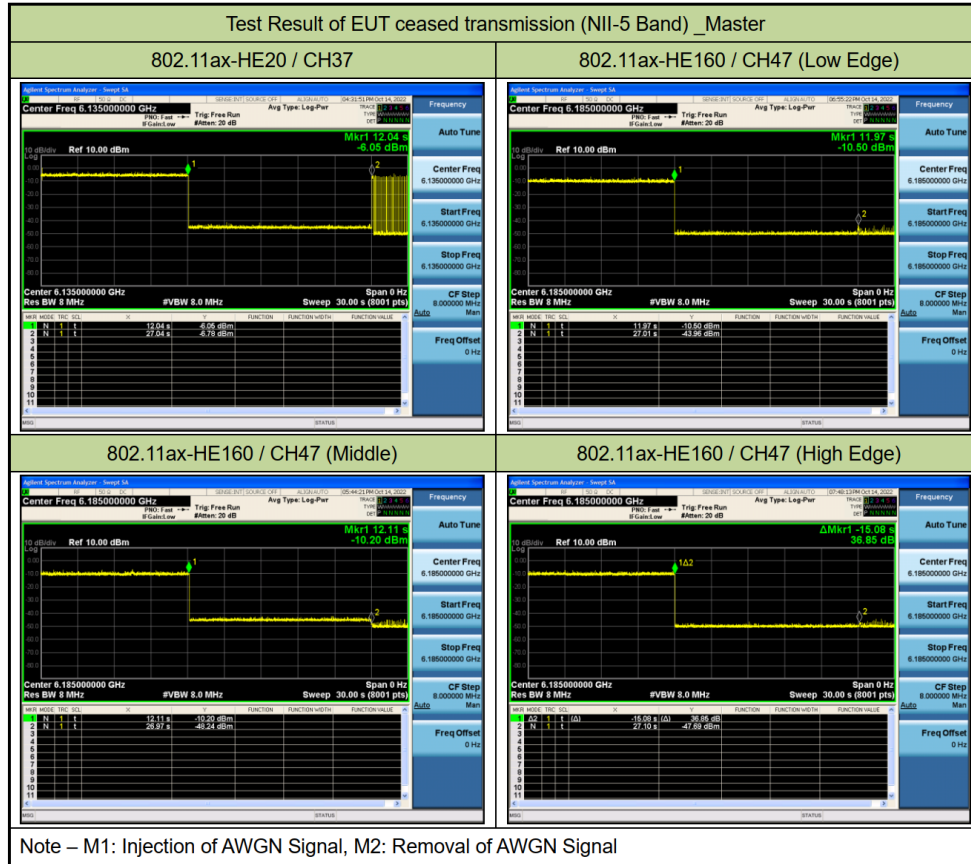
Test Site	SR5	Test Engineer	Peter
Test Mode	Master	Test Date	2022/10/17~2022/10/18

Test Channel	Bandwidth (MHz)	Freq. (MHz)	AWGN Freq. (MHz)	AWGN Power (dBm)	Ant. Gain (dBi)	Adjust Power (dBm)	Detection Limit (dBm)	Detected Number	Detection Probability (%)	Limit (%)	Test Result
Operation Band: U-NII 5											
37	20	6135	6135	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
47	160	6185	6110	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
47	160	6185	6185	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
47	160	6185	6260	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
Operation Band: U-NII 6											
101	20	6455	6455	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
103	80	6465	6430	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
103	80	6465	6465	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
103	80	6465	6500	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
Operation Band: U-NII 7											
133	20	6615	6615	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
143	160	6665	6620	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
143	160	6665	6695	-62.0	1.0	-63.0	≤ -62.0	10	100	90	Pass
143	160	6665	6770	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
Operation Band: U-NII 8											
197	20	6935	6935	-65.0	1.0	-66.0	≤ -62.0	10	100	90	Pass
207	160	6985	6940	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
207	160	6985	7015	-63.0	1.0	-64.0	≤ -62.0	10	100	90	Pass
207	160	6985	7090	-64.0	1.0	-65.0	≤ -62.0	10	100	90	Pass

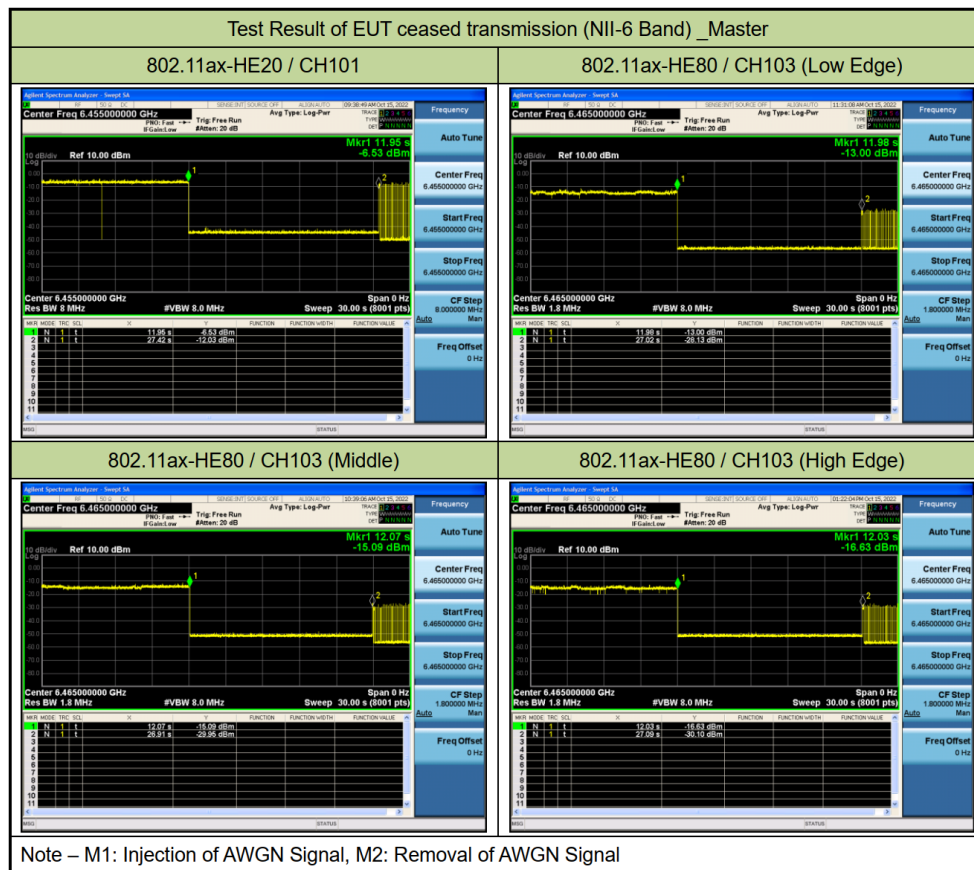
Note 1: Adjust Power (dBm) = AWGN Power (dBm) – Antenna Gain (dBi).

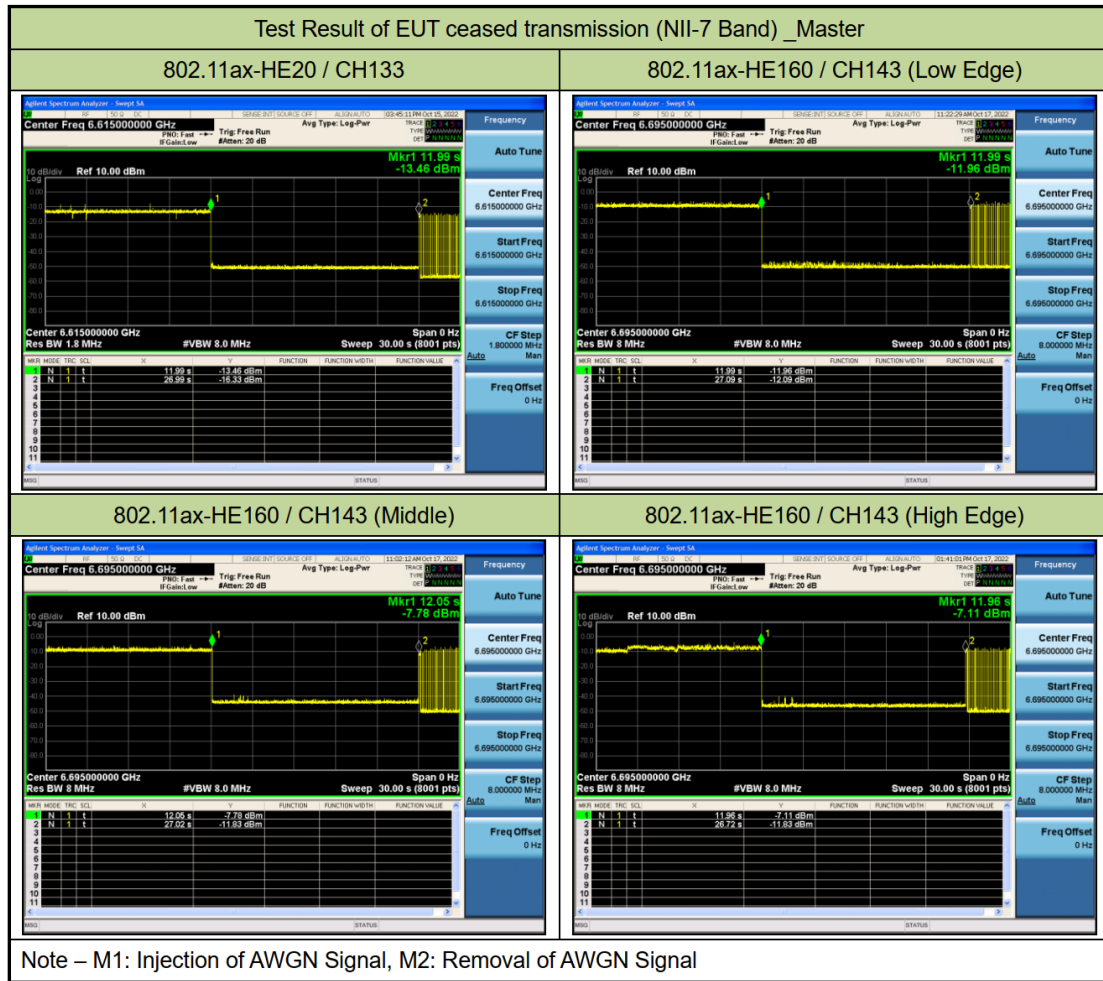
Note 2: Conducted measurements are used.

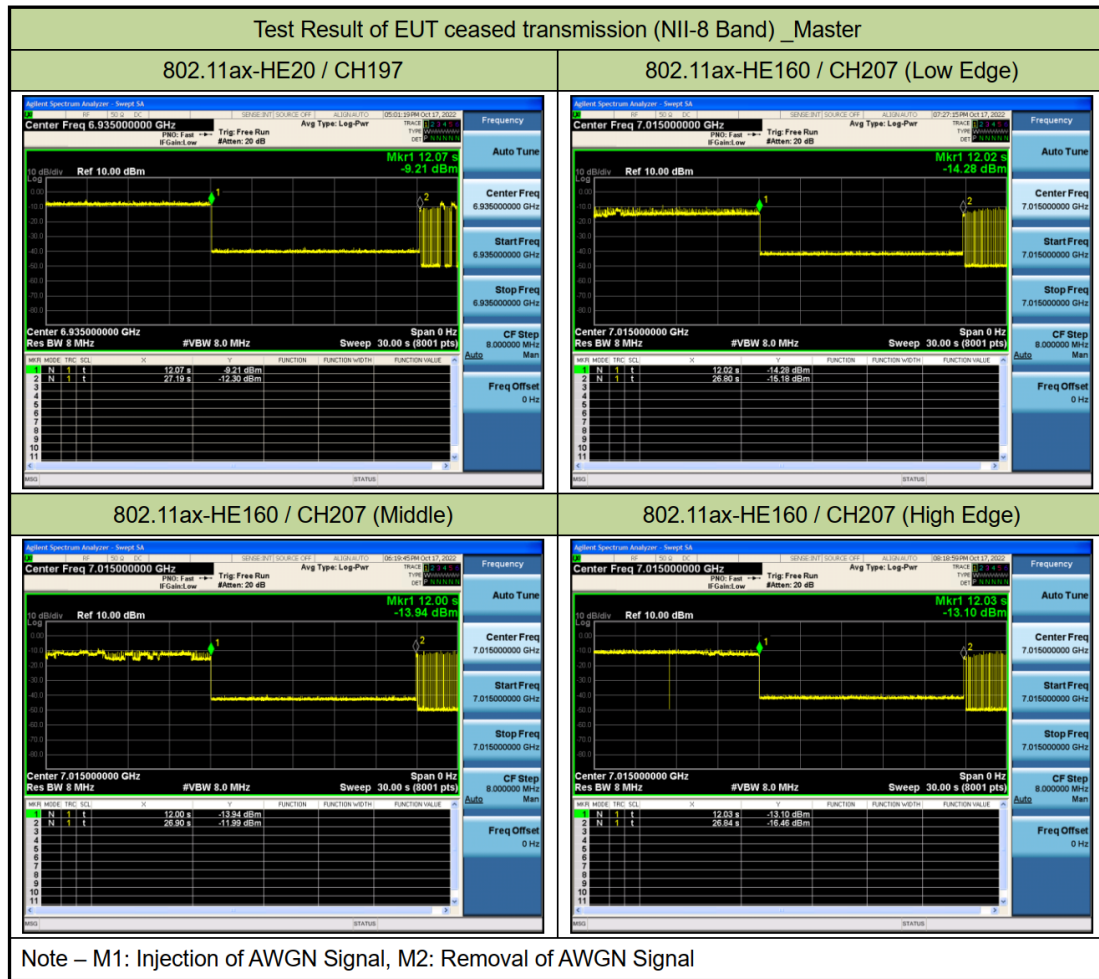
2.6 Include plots showing EUT has stopped transmitting after detection of AWGN signal.
The plots of UNII-5 On page 110 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6”



The plots of UNII-6 On page 111 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6”







2.7 Describe whether channel puncturing and/or bandwidth reduction mechanisms supported. The report needs to include a plot as an example for at least one of the AWGN signals used.

Not Support.

2.8 If radiated testing is used, show that spot-checks were done to identify which side of the EUT has the lowest sensitivity to the incumbent signal detection, and that side was indeed chosen for the test.

Conducted test is performed for this device.

3. Client Device Limitations

This device is not a client device.

4. Emission Mask

4.1 Power spectral density suppression complies with 47 CFR § 15.407(b)(6).

Please refer to section 6.5.5 (Page 70 ~ 97) of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part3 & Part4 & Part5 & Part 6” for the test result of power spectral density suppression.

4.2 If EUT supports OFDMA discuss testing of partial Resource Unit (RU) configurations. In any case the shape of the mask shall be based on full RU.

This device supports one configuration only in 802.11ax full RU mode.

Please refer to note 4 of Operation Description for this information (On Page 2)

This information is also noted on page 11 (section 2.5 remark 3) of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part1”

4.3 OOB limits only apply outside of the 5.925-7.125 GHz band. All in-band emissions need to meet the channel mask. In case a higher RBW for the in-Band Emissions Mask is used (i.e., a more conservative case) that should be noted.

Please refer to section 6.5.5 (Page 70 ~ 97) of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part3 & Part4 & Part5 & Part 6” for the test result of channel mask.

5. Filing

99% of the occupied bandwidth must be contained within all the U-NII sub bands authorized for that equipment class.

Please refer to section 6.2.5 (Page 21 ~ 28) of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part1” for the 99% OBW test result. The result satisfies this requirement.

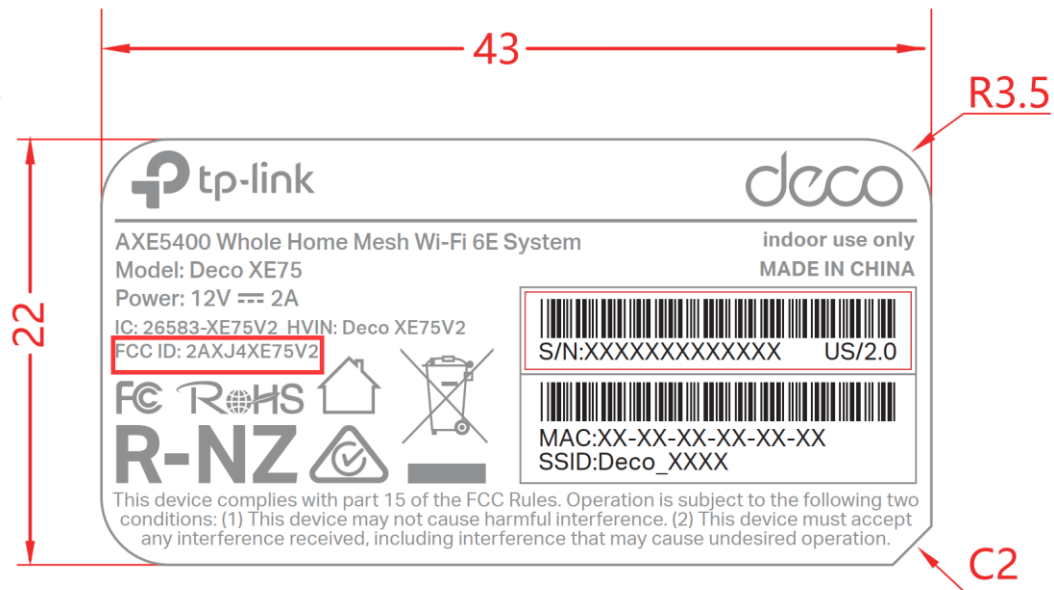
6. Hearing Aid Compatibility (HAC)

Not Applicable.

7. Labelling

7.1 Label showing indoor only for Subordinate and APs.

Please refer to the document “FCC ID Label”. The label showing “Indoor User only”.



7.2 E-labelling may be acceptable if proper justification is provided

Not Applicable.

8. Modular Certifications (when applicable)

Not Applicable.

9. RF Exposure

9.1 Demonstrate applicable classification (portable/mobile/fixed) in reference to worst-case scenario use cases

Please refer report “2206TW0121-U7-FCC RF Exposure Report” for RF Exposure information. Section 2.3 of the report states that this device is a mobile device.

9.2 Address $f > 6$ GHz RF exposure via most recent applicable KDB or TCB Workshop procedures.

Section 3.3 of “2206TW0121-U7-FCC RF Exposure Report” showed that the most recent KDB (KDB 447498 D04 v01) was used.

9.3 Address all applicable simultaneous transmission conditions using the compliance condition $TER \leq 1$.

Please refer to section 4.3 of “2206TW0121-U7-FCC RF Exposure Report” for this information. This device supports 2.4GHz WLAN, 5GHz WLAN and UN6GHz RLAN.

The 2.4GHz WLAN, 5GHz WLAN and 6GHz RLAN can transmit simultaneously.

The Max. Exposure Ratio = $0.6806 < 1$.

10. Security

Provide specific exhibit with device security description is required (complying with 47 CFR §

15.407(i))

Please refer to the document “Software Security Requirements Cover Letter” for security information.

11. Spurious Emissions

Show that measurements are made at the prescribed antenna heights, per KDB Publication 987594 D01, including measurements along all three axes, as per ANSI C63.10.

Spurious Emissions test items refer to section 6.8 and 6.9 of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6 & Part7”.

Please refer to section 6.8.5 (Page 117 ~ 292) and section 6.9.5 (Page 296 ~ 359) of “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part6” & “2209TW0106-U6-FCC Part 15.407-WiFi 6G_Part7”.

According to ANSI C63.10 - Section 6.3.1: “*Where EUTs are designed to be installed in one of two orientations (such as wireless access points that can be located horizontally on a table or mounted vertically to the wall), these devices shall be tested in both orientations*”.

This device is designed to be located horizontally on a table, so only this orientation was tested. Please refer to “EUT Test Setup Photos” for detailed information.