

8. EQUIVALENT ISOTROPIC RADIATED POWER TEST

8.1. Test Procedure

Use the test method described in ANSI C63.10 Annex G :

- (1) Connected the EUT's antenna port to the Spectrum Analyzer by suitable attenuator ,set the Spectrum Analyzer as below:

Span: Zero

RBW:100KHz

VBW:100KHz

Read out the duty cycle(X) of the transmitter and record as X

- (2) The channel power measure function of spectrum Analyzer was used to measure out average output power of transmitter.

- (3) Calculated e.i.r.p according to the formula: Read + Cable loss + Atten loss + Antenna Gain + $10\log(1/x)$

- (4) Repeated test at the lowest, the middle, and the highest frequency of the stated frequency range.

8.2. Test Results

U-NII-1 Band:

EUT: WiFi module		
M/N: U9W43		
Test date: 2021-12-09	Pressure: 101.1 ±1.0 kpa	Humidity: 52.1 ±3.0%
Tested by: Winter	Test site: RF site	Temperature: 22.9 ±0.6 °C

SISO:

Test Mode	Frequency (MHz)	EIRP (dBm)	
		ANT A	ANT B
11a	5180	14.85	14.79
	5200	15.01	15.11
	5240	15.23	15.37
11n HT20	5180	14.92	14.69
	5200	14.97	14.99
	5240	14.77	15.15
11n HT40	5190	14.32	14.07
	5230	14.5	14.49
11ac VHT20	5180	14.92	14.62
	5200	14.96	14.99
	5240	14.99	14.95
11ac VHT40	5190	14.08	14.16
	5230	14.54	14.79
11ac VHT80	5210	14.02	14.63
Conclusion: PASS			

MIMO:

Test Mode	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	EIRP (dBm)
11n HT20	5180	15.36	4.35	19.71
	5200	16.67	4.35	21.02
	5240	16.34	4.35	20.69
11n HT40	5190	15.71	4.35	20.06
	5230	15.79	4.35	20.14
11ac VHT20	5180	16.21	4.35	20.56
	5200	16.38	4.35	20.73
	5240	16.31	4.35	20.66
11ac VHT40	5190	15.06	4.35	19.41
	5230	16.31	4.35	20.66
11ac VHT80	5210	15.30	4.35	19.65

Note: Directional Gain= $10 \log[(10^{1.42/20} + 10^{1.25/20})^2 / 2]$ dBi= 4.35dBi.

9. SPECTRAL DENSITY TEST

9.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.07,21	1 Year
2.	Attenuator	Agilent	8491B	MY39269201	Oct.09,21	1 Year
3.	RF Cable	HUBER+SUHNER	SUCOFLEX-106	505238/6	Apr.07,21	1 Year

9.2. Limit

Band 5150-5250 MHz:

The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

Band 5725-5850 MHz:

The power spectral density shall not exceed 30 dBm in any 500 KHz band.

9.3. Test Procedure

For the Band 5.15-5.25GHz:

The transmitter output was connected to a spectrum analyzer. Power density was measured by spectrum analyzer with 1MHz RBW and 3MHz VBW; Detector: RMS mode.

For the band 5.725-5.85 GHz:

The transmitter output was connected to a spectrum analyzer. Power density was measured by spectrum analyzer with 1MHz RBW and 3MHz VBW, RMS Detector.

So use the test method described in KDB789033 clause E

- 1) Set the RBW=100kHz and VBW ≥ 3 RBW
- 2) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is $\leq$ RBW/2, so that narrowband signals are not lost between frequency bins.)
- 3) Sweep time = auto
- 4) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- 5) Use the "peak search" function of spectrum analyzer find the max value, then add $10\log(500\text{kHz}/\text{RBW})$ to the measured result.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

9.4.Test Results

U-NII-1 Band:

EUT: WiFi module		
M/N: U9W43		
Test date: 2021-12-22	Pressure: 103.1 ±1.0 kpa	Humidity: 51.5 ±3.0%
Tested by: Winter	Test site: RF site	Temperature: 22.5 ±0.6 °C

SISO:

Test Mode	Frequency (MHz)	Power density (dBm/MHz)		Limit (dBm/MHz)
		ANT A	ANT B	
11a	5180	2.519	2.746	11
	5200	1.588	2.657	
	5240	3.268	3.210	
11n HT20	5180	2.265	2.395	11
	5200	2.569	2.421	
	5240	2.661	2.955	
11n HT40	5190	-0.899	-0.881	11
	5230	-0.607	-0.583	
11ac VHT20	5180	2.361	2.470	11
	5200	2.333	2.693	
	5240	3.007	2.851	
11ac VHT40	5190	-0.951	-0.760	11
	5230	-0.841	-0.604	
11ac VHT80	5210	-4.290	-4.127	11
Conclusion: PASS				

MIMO:

Test Mode	Frequency (MHz)	Power density (dBm/MHz)			Limit (dBm/MHz)
		ANT A	ANT B	Total	
11n HT20	5180	1.792	1.630	4.722	11
	5200	2.150	1.925	5.049	
	5240	2.137	2.446	5.305	
11n HT40	5190	-1.550	-1.525	1.473	11
	5230	-1.248	-1.047	1.864	
11ac VHT20	5180	2.233	1.845	5.054	11
	5200	2.143	1.997	5.081	
	5240	2.352	2.607	5.492	
11ac VHT40	5190	-1.956	-1.564	1.255	11
	5230	-1.301	-1.044	1.840	
11ac VHT80	5210	-4.896	-4.257	-1.554	11
Conclusion: PASS					

Note: 1. Directional Gain= $10 \log[(10^{1.42/20} + 10^{1.25/20})^2 / 2]$ dBi= 4.35dBi < 6dBi.
2. The transmit signals are correlated.

U-NII-3 Band:

EUT: WiFi module		
M/N: U9W43		
Test date: 2021-12-23	Pressure: 103.1 ±1.0 kpa	Humidity: 51.5 ±3.0%
Tested by: Winter	Test site: RF site	Temperature: 22.5 ±0.6 °C

SISO:

Test Mode	Frequency (MHz)	Power density (dBm/500KHz)		Limit (dBm/500KHz)
		ANT A	ANT B	
11a	5745	0.759	1.833	30
	5785	0.960	2.038	
	5825	1.018	2.152	
11n HT20	5745	-0.575	2.034	30
	5785	0.496	2.061	
	5825	0.371	1.820	
11n HT40	5755	-3.168	-1.933	30
	5795	-3.198	-2.114	
11ac VHT20	5745	0.551	1.775	30
	5785	0.606	1.757	
	5825	0.693	1.601	
11ac VHT40	5755	-3.129	-1.803	30
	5795	-3.250	-1.882	
11ac VHT80	5775	-6.635	-5.175	30
Conclusion: PASS				

MIMO:

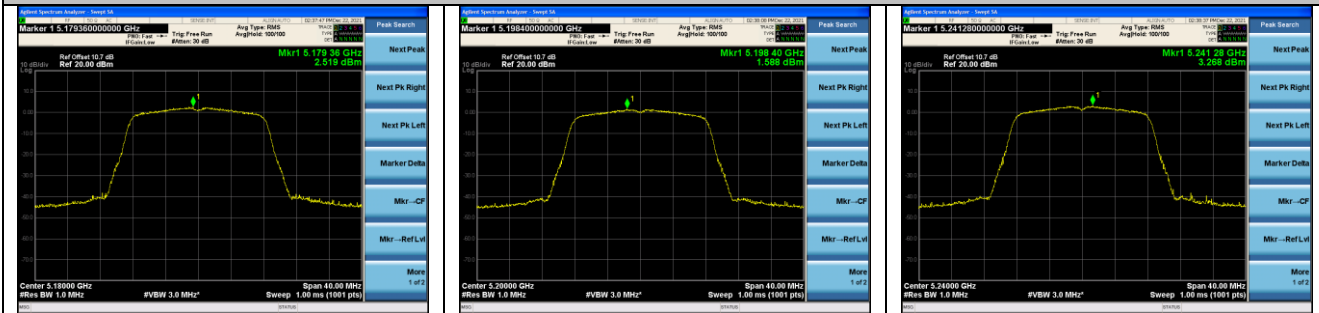
Test Mode	Frequency (MHz)	Power density (dBm/500KHz)			Limit (dBm/MHz)
		ANT A	ANT B	Total	
11n HT20	5745	-0.257	0.386	3.09	30
	5785	-0.263	1.409	3.66	
	5825	-0.071	0.857	3.43	
11n HT40	5755	-3.834	-2.875	-0.32	30
	5795	-3.662	-3.052	-0.34	
11ac VHT20	5745	0.091	1.230	3.71	30
	5785	0.145	1.442	3.85	
	5825	-0.278	1.304	3.59	
11ac VHT40	5755	-3.927	-2.903	-0.37	30
	5795	-3.746	-2.209	0.10	
11ac VHT80	5775	-7.110	-5.507	-3.22	30
Conclusion: PASS					

- Note: 1. Directional Gain= $10 \log[(10^{0.98/20} + 10^{-0.28/20})^2/2]$ dBi= 3.38dBi < 6dBi.
2. The total result = Reading + $10 \log(500\text{kHz}/100\text{kHz})$
3. The transmit signals are correlated.

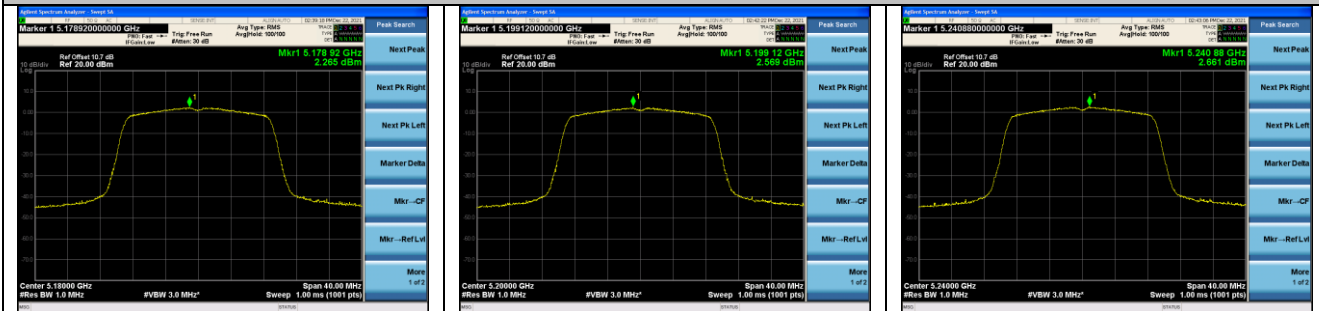
U-NII-1 Band (SISO)

ANT A

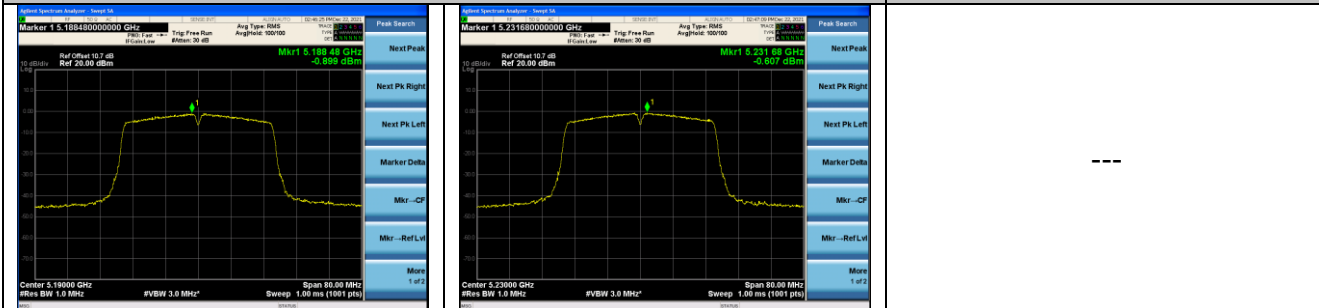
IEEE 802.11a



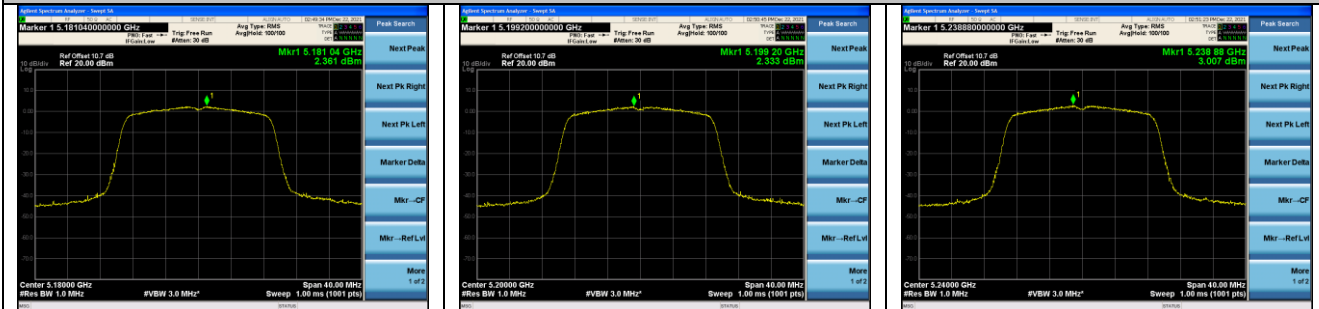
IEEE 802.11n HT20



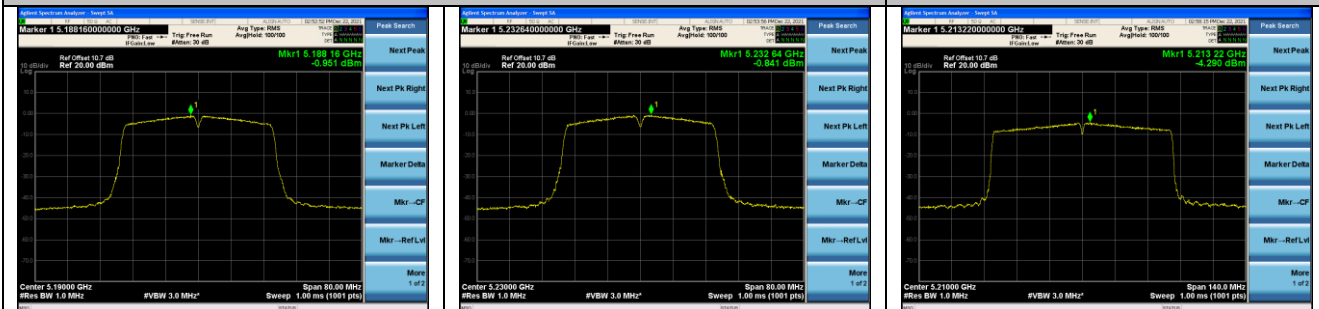
IEEE 802.11n HT40



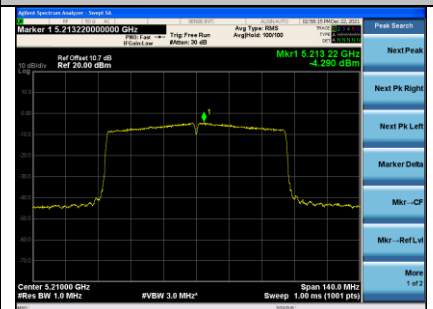
IEEE 802.11ac VHT20



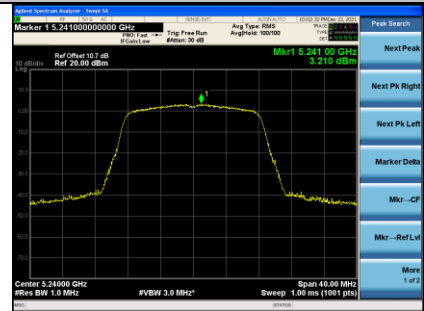
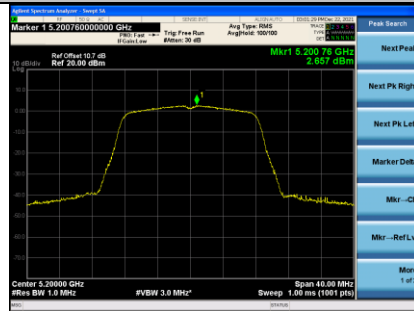
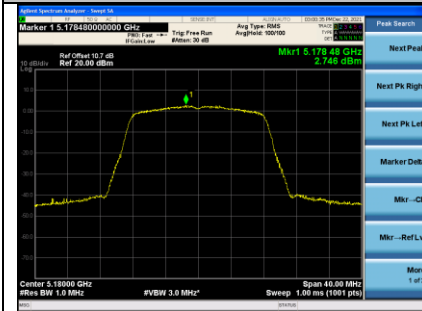
IEEE 802.11ac VHT40



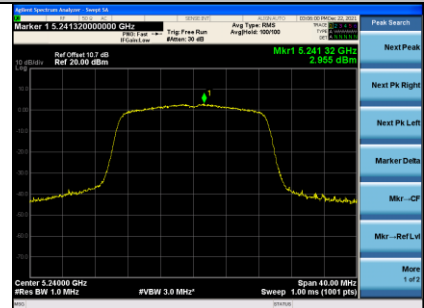
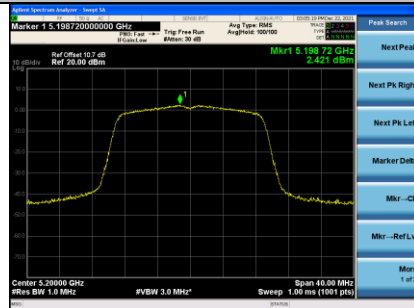
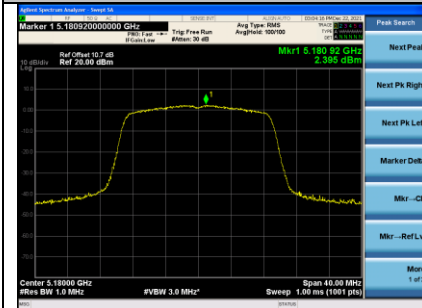
IEEE 802.11ac VHT80



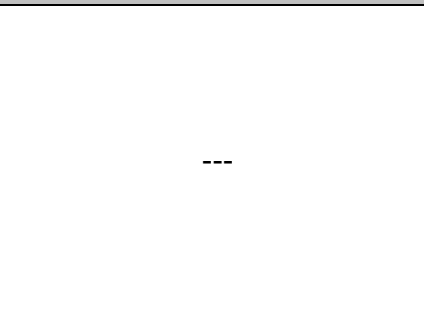
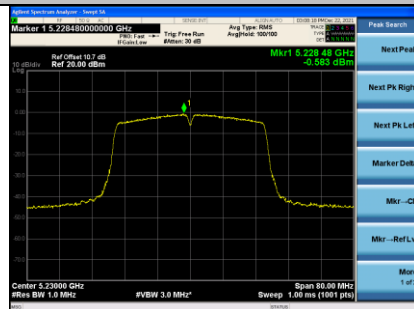
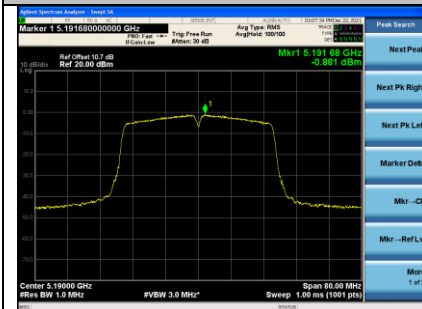
ANT B IEEE 802.11a



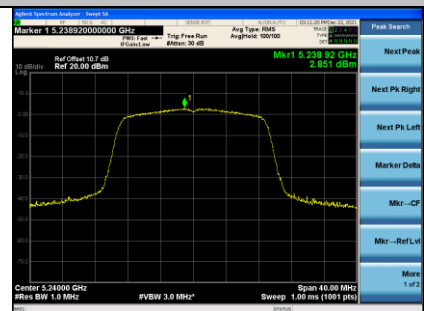
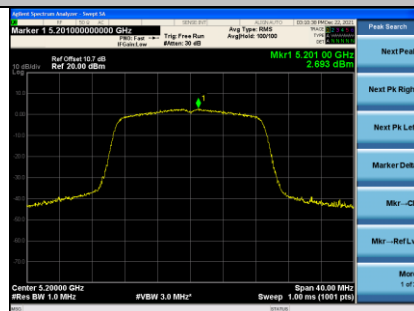
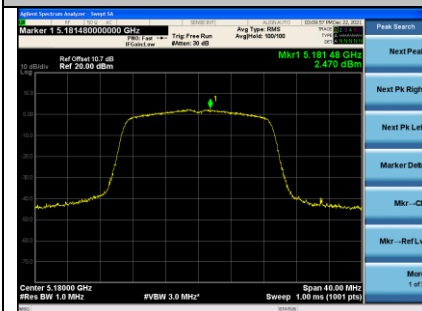
IEEE 802.11n HT20



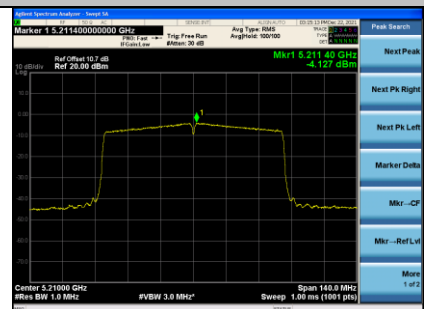
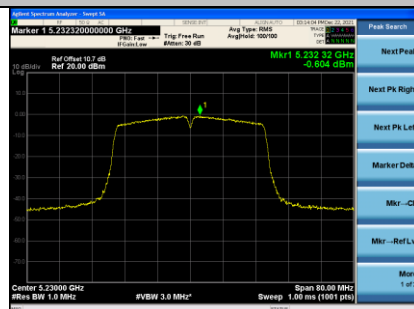
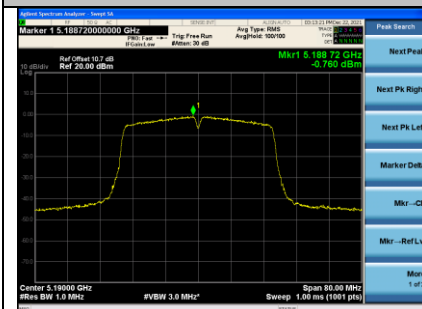
IEEE 802.11n HT40



IEEE 802.11ac VHT20



IEEE 802.11ac VHT40

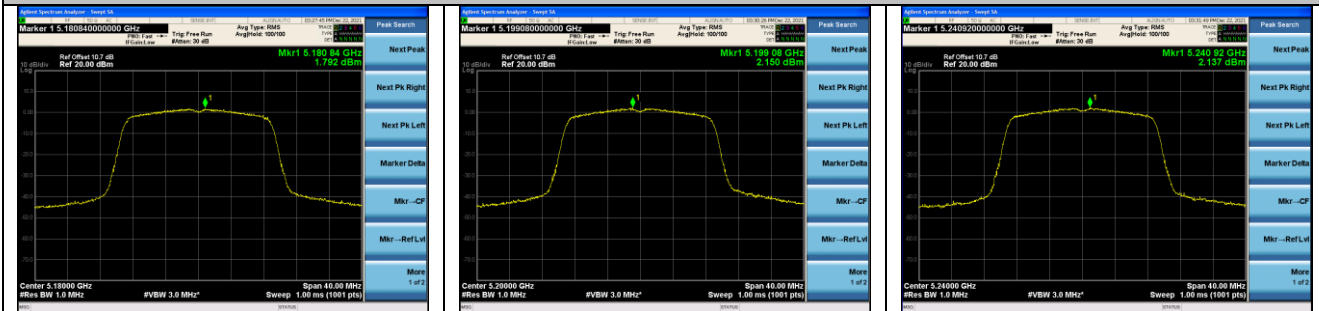


IEEE 802.11ac VHT80

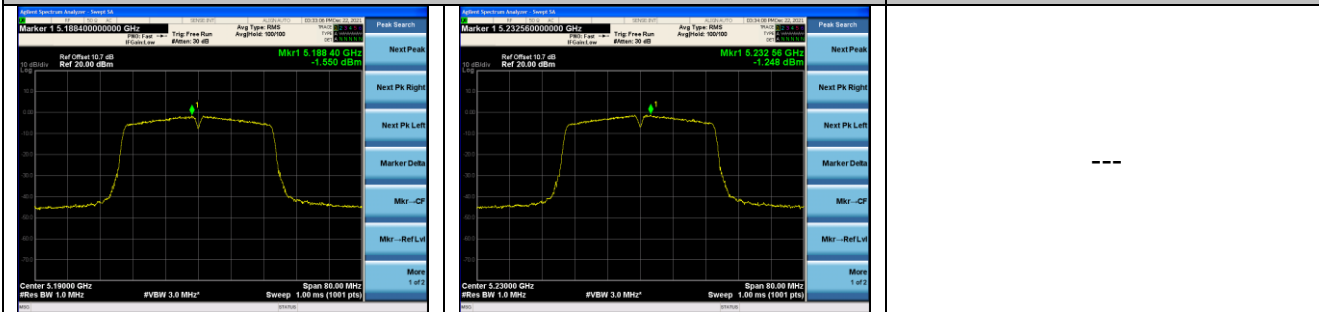
U-NII-1 Band (MIMO)

ANT A

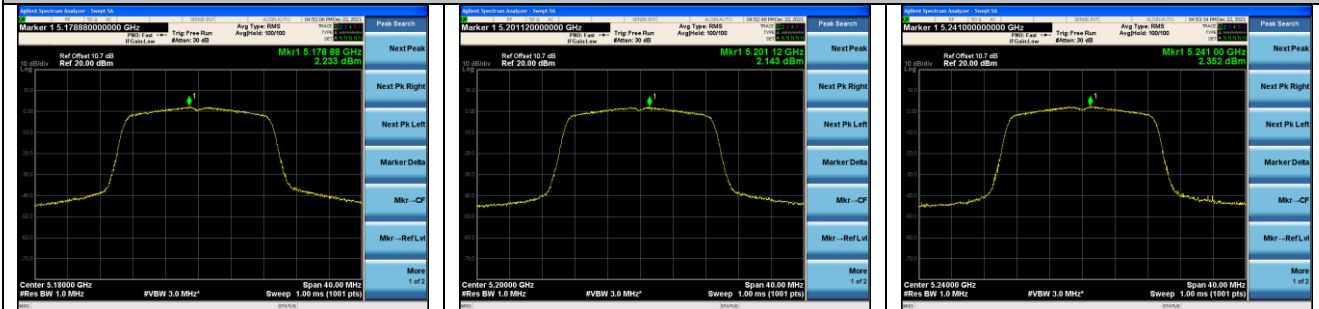
IEEE 802.11n HT20



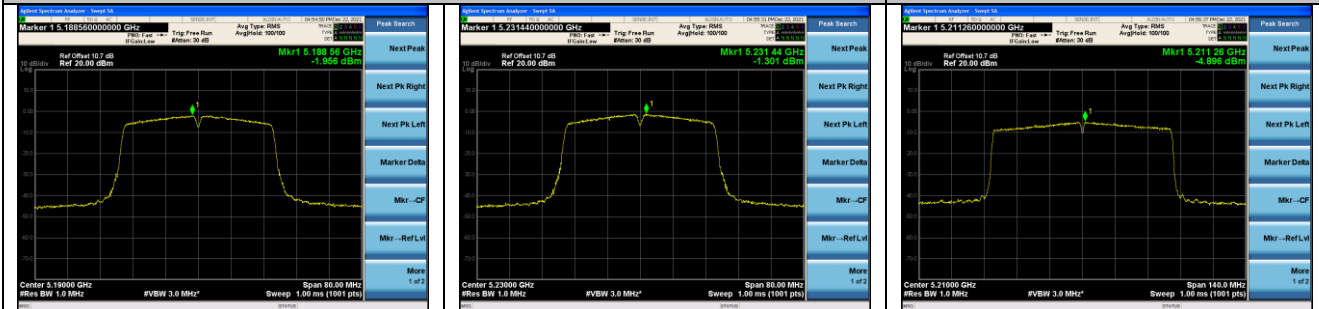
IEEE 802.11n HT40



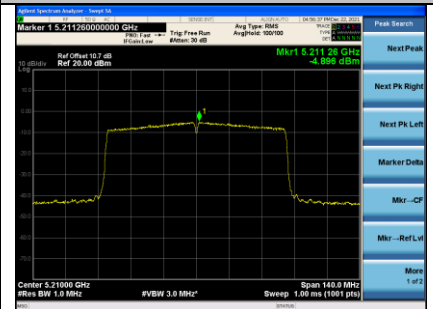
IEEE 802.11ac VHT20



IEEE 802.11ac VHT40



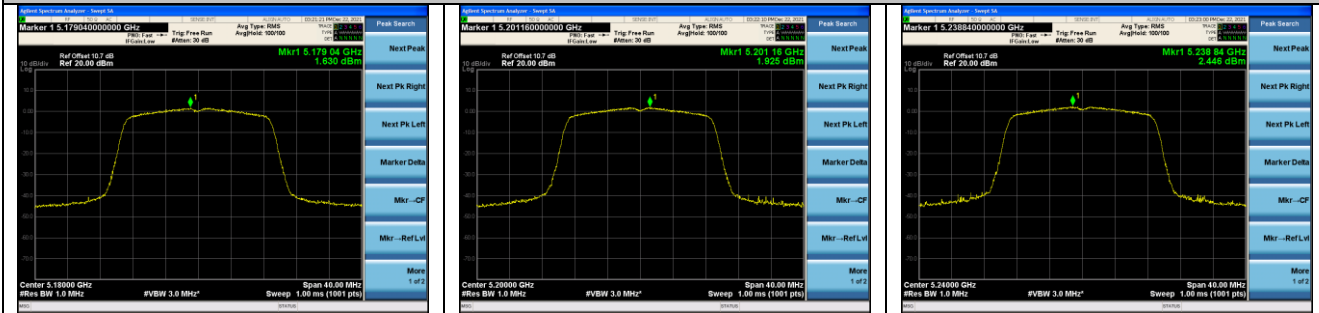
IEEE 802.11ac VHT80



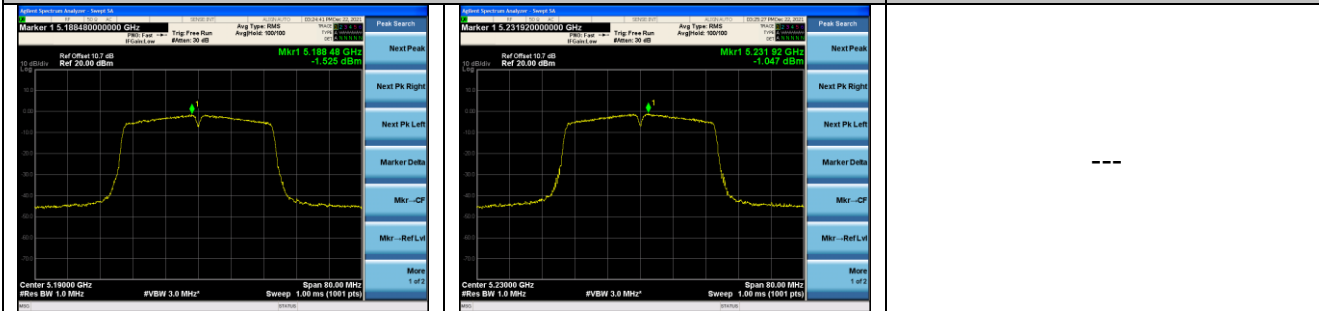
U-NII-1 Band (MIMO)

ANT B

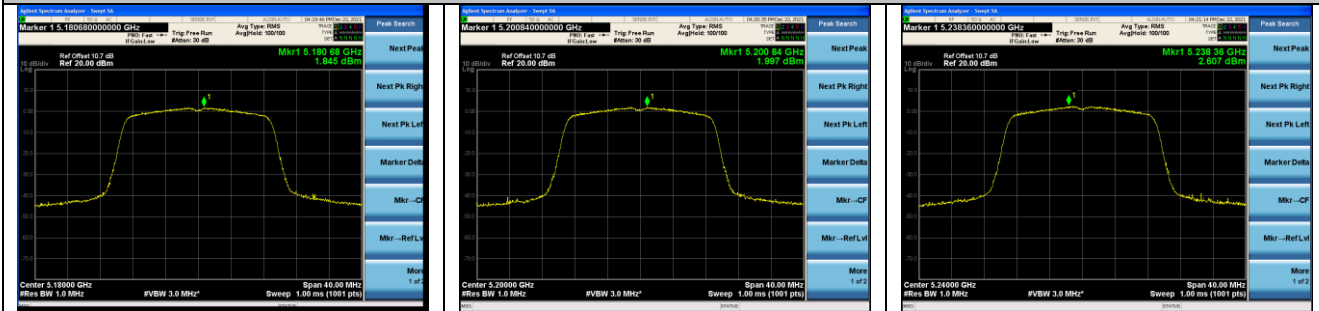
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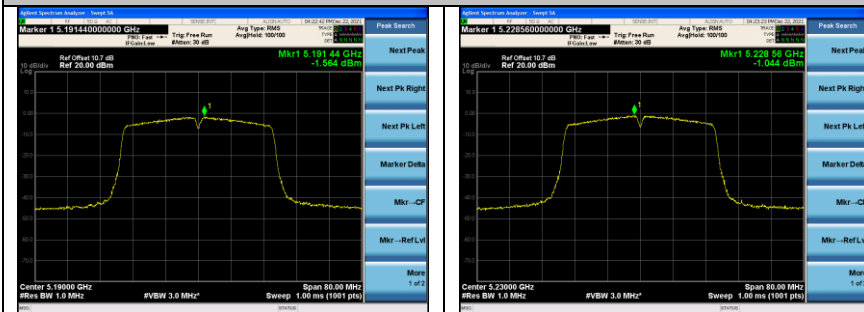
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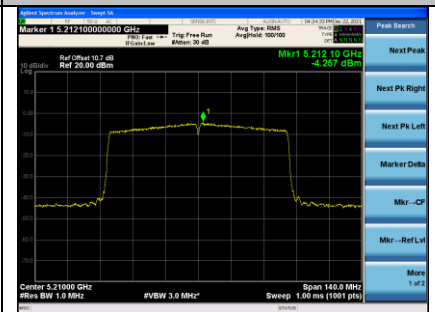
IEEE 802.11ac VHT20



IEEE 802.11ac VHT40



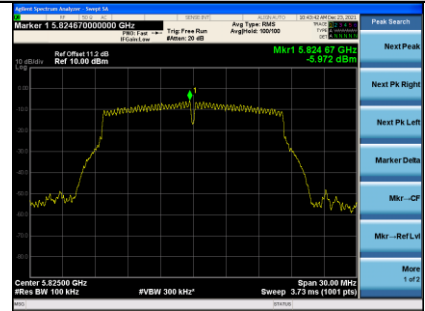
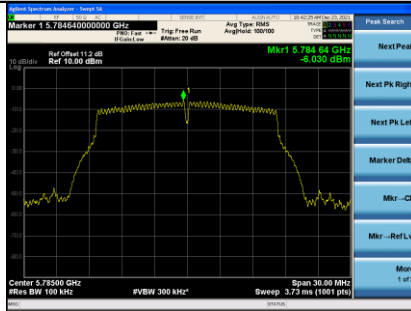
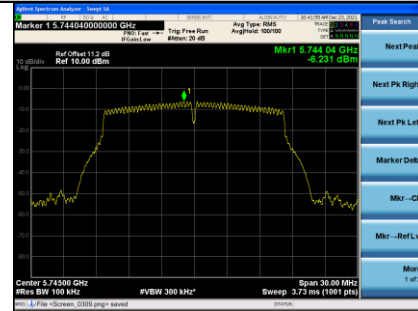
IEEE 802.11ac VHT80



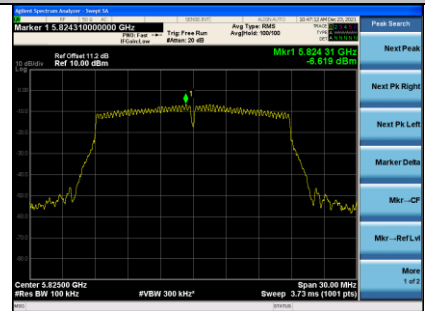
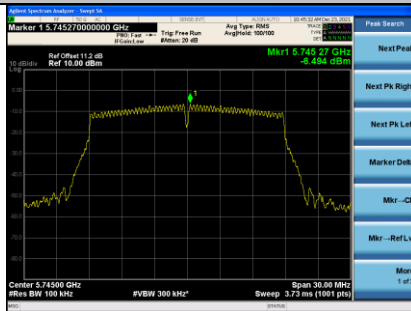
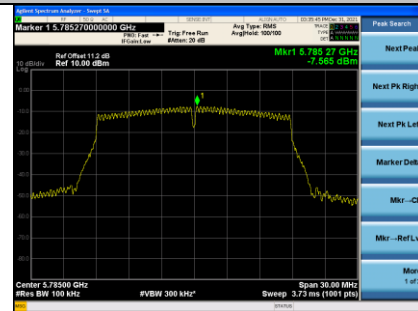
U-NII-3 Band (SISO)

ANT A

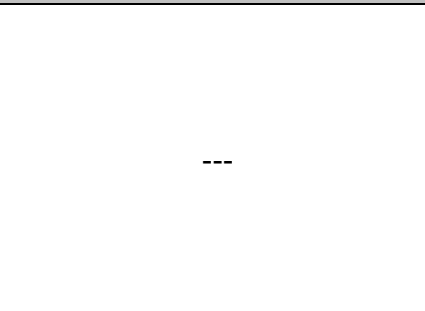
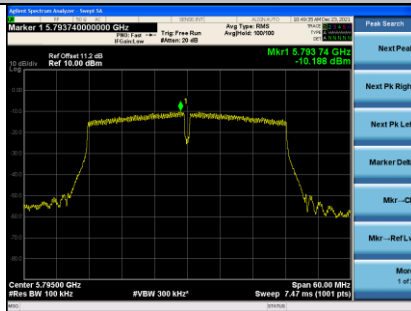
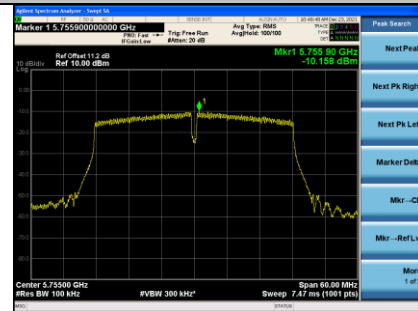
IEEE 802.11a



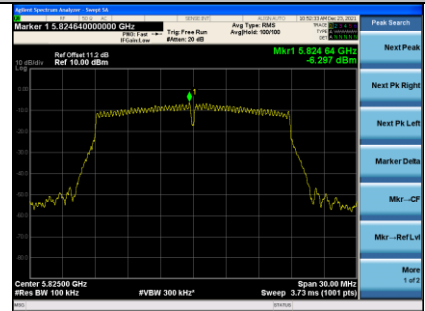
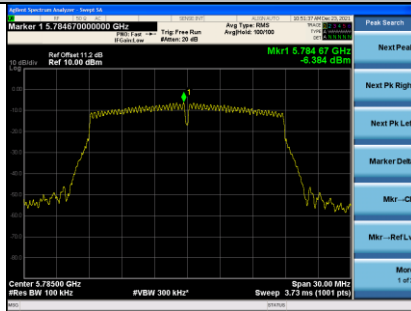
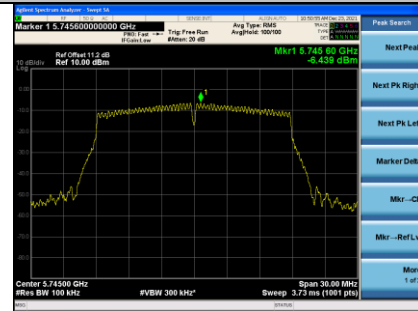
IEEE 802.11n HT20



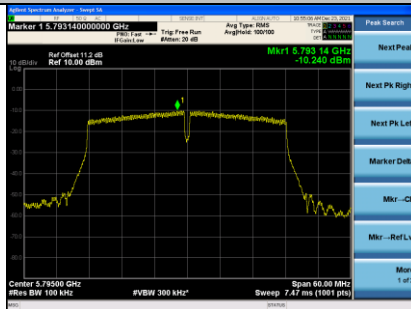
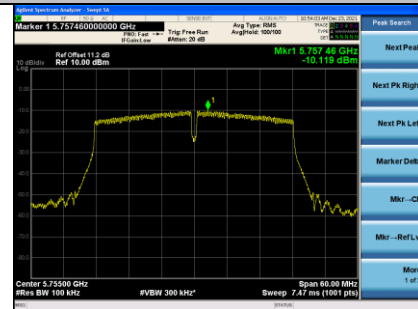
IEEE 802.11n HT40



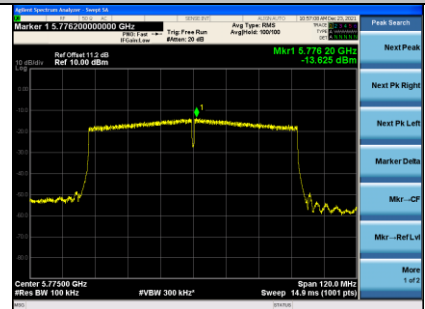
IEEE 802.11ac VHT20



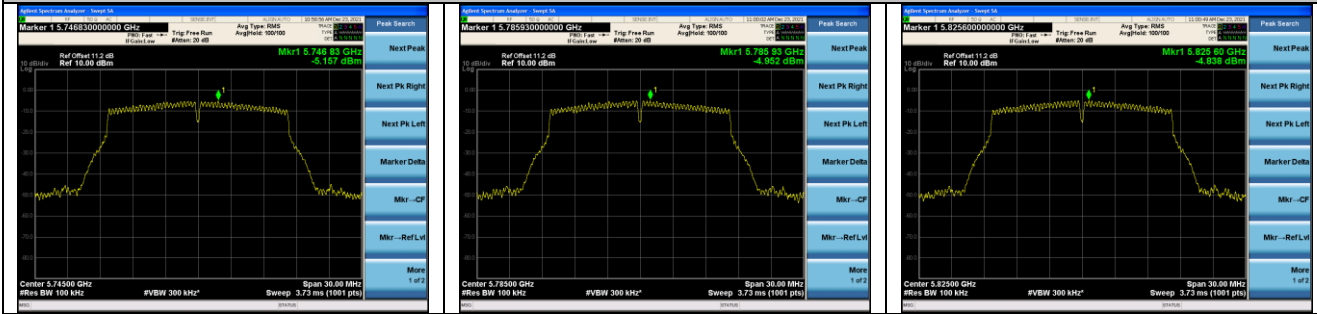
IEEE 802.11ac VHT40



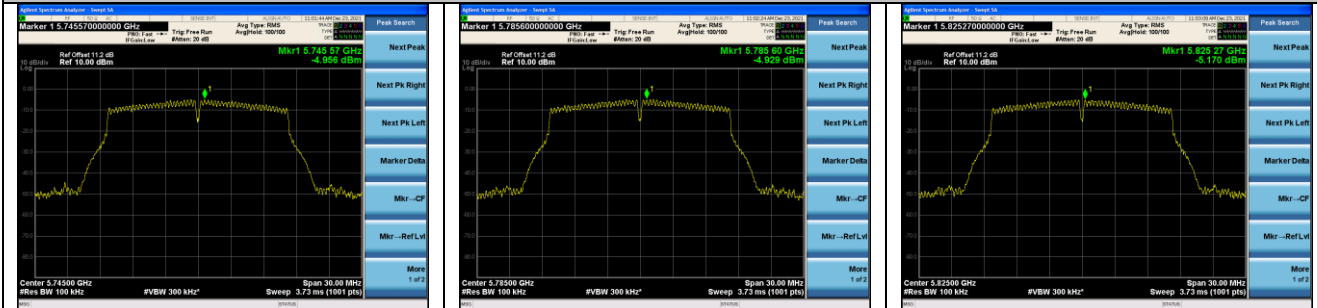
IEEE 802.11ac VHT80



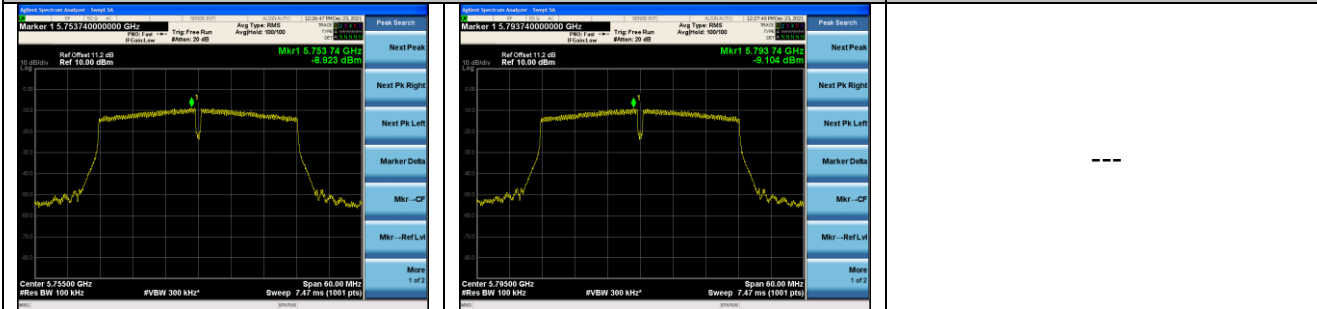
ANT B IEEE 802.11a



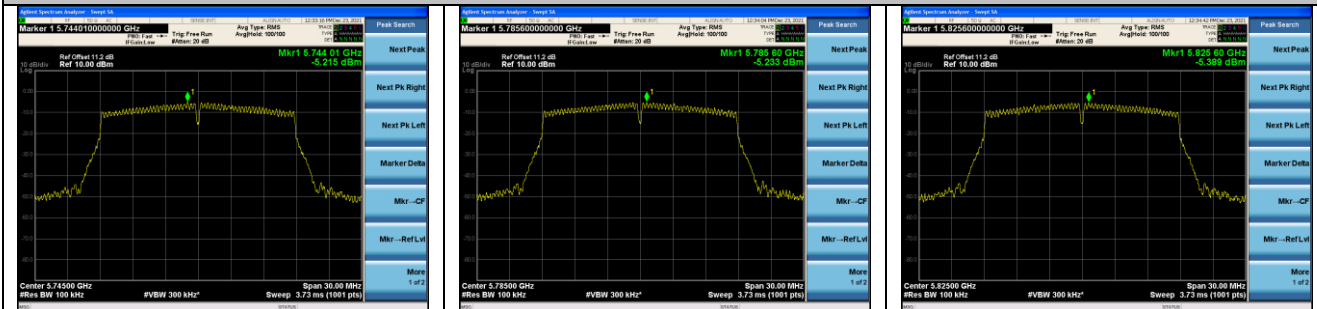
IEEE 802.11n HT20



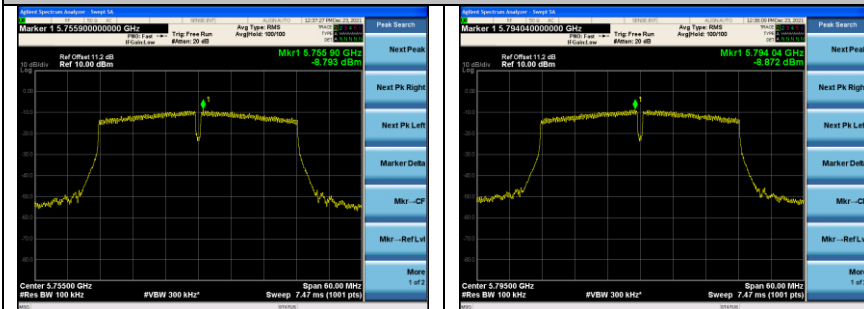
IEEE 802.11n HT40



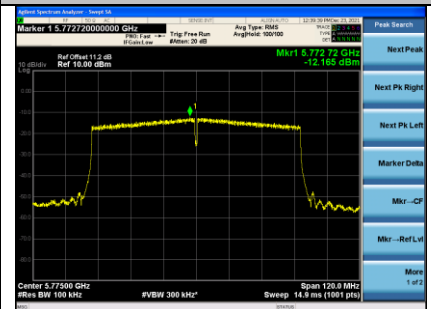
IEEE 802.11ac VHT20



IEEE 802.11ac VHT40



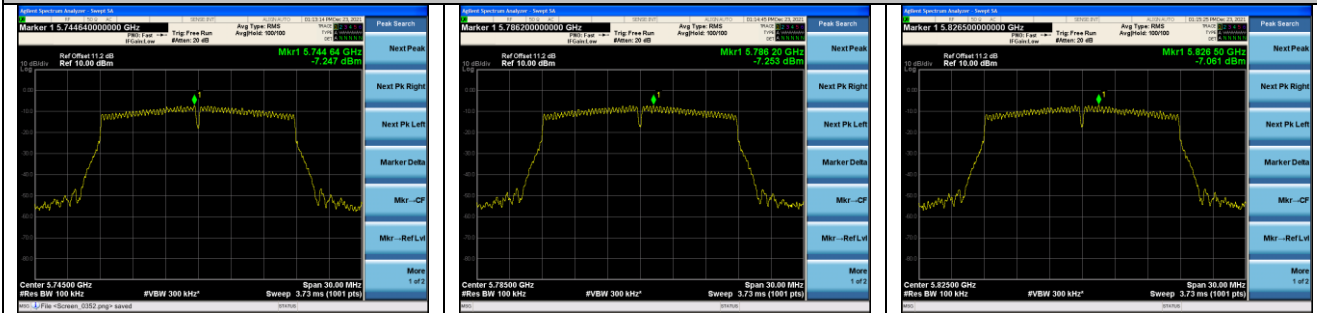
IEEE 802.11ac VHT80



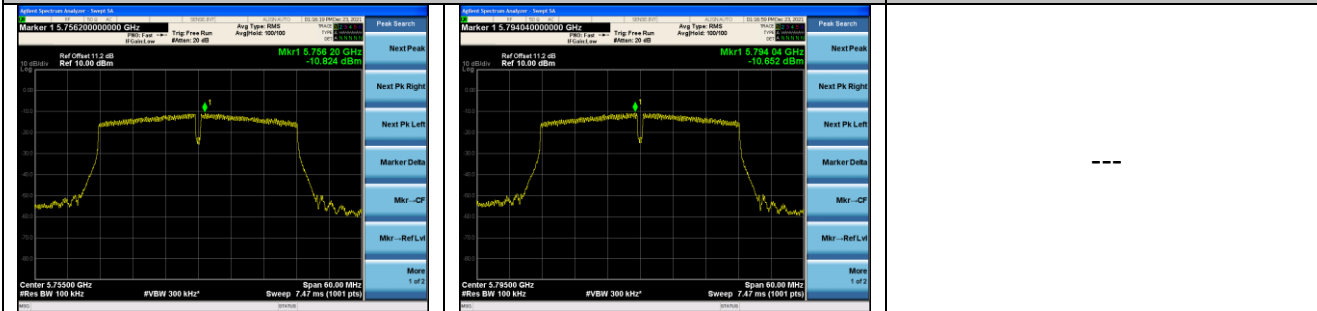
U-NII-3 Band (MIMO)

ANT A

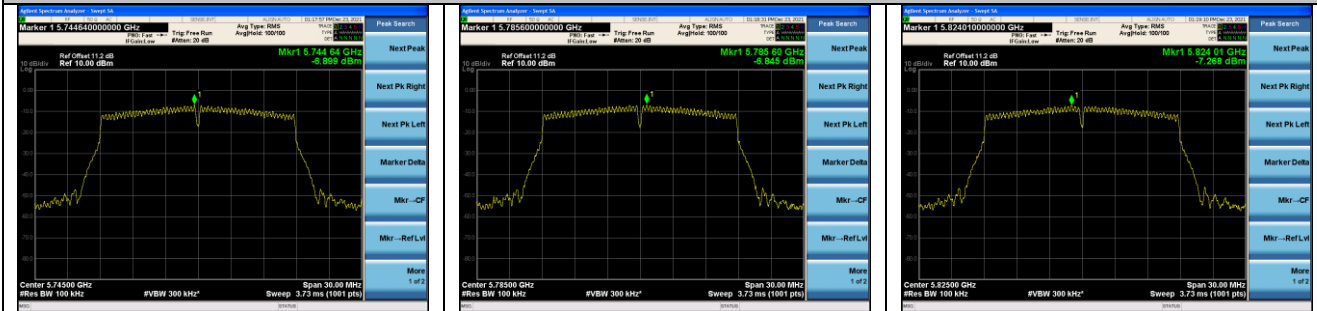
IEEE 802.11n HT20



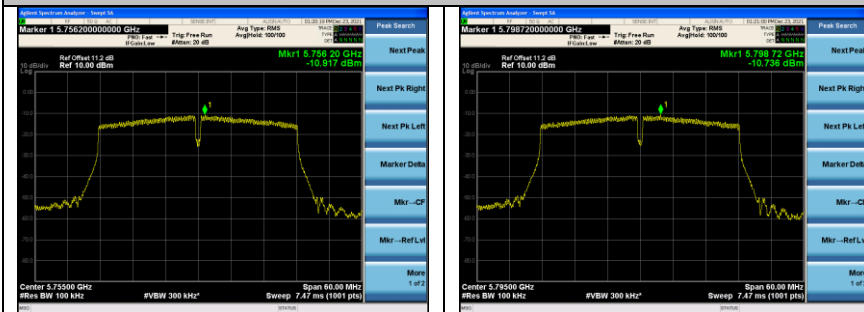
IEEE 802.11n HT40



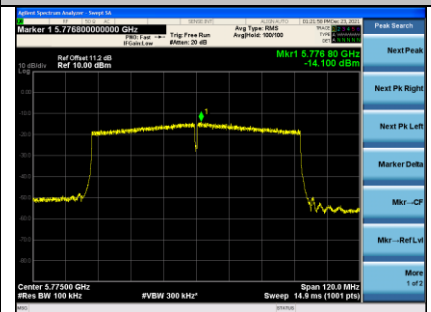
IEEE 802.11ac VHT20



IEEE 802.11ac VHT40



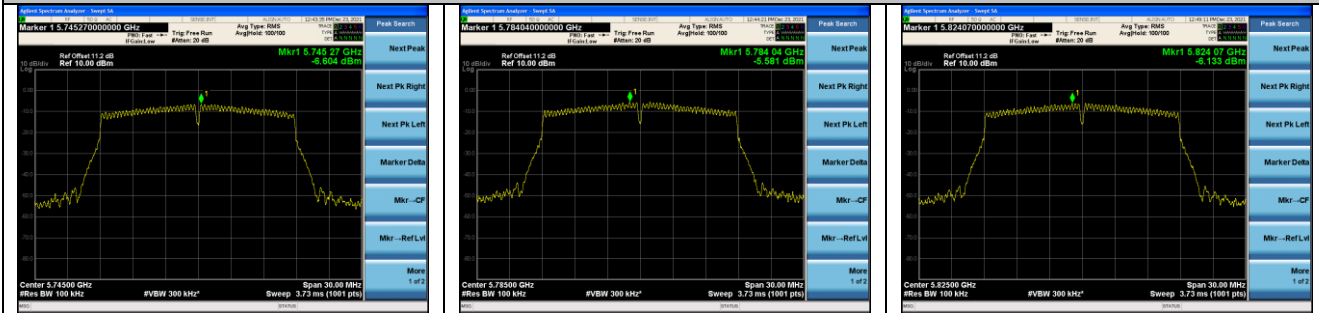
IEEE 802.11ac VHT80



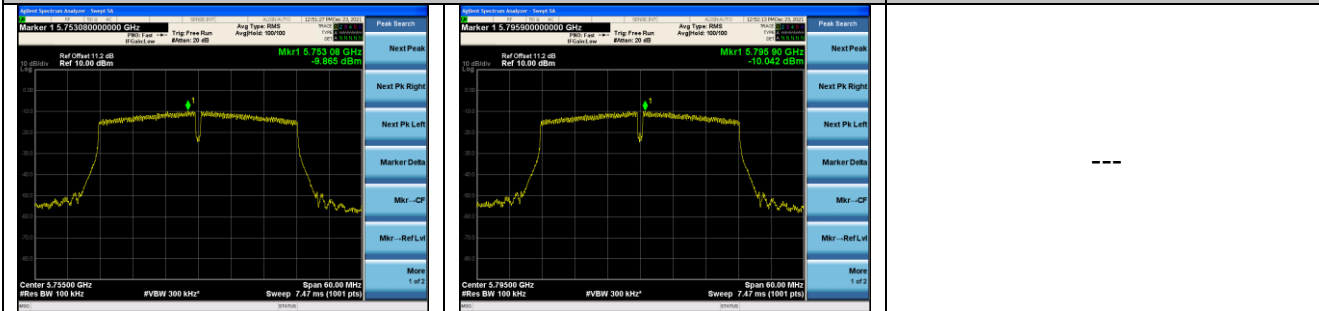
U-NII-3 Band (MIMO)

ANT B

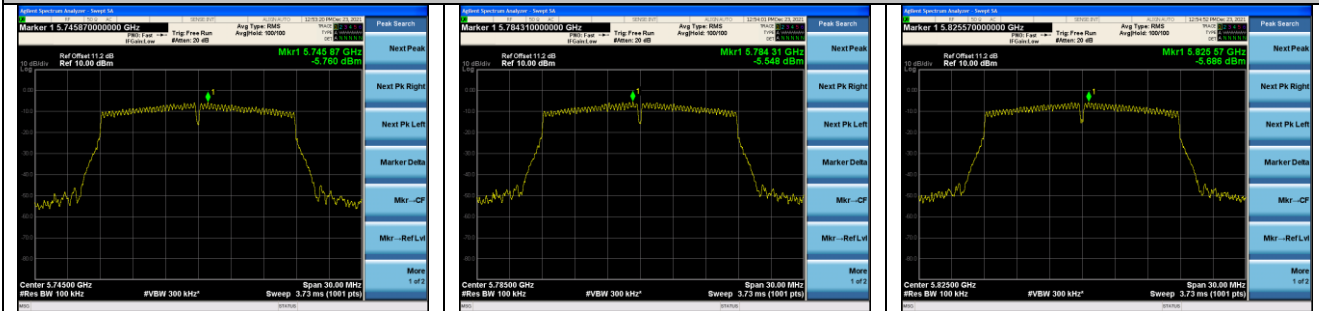
IEEE 802.11n HT20



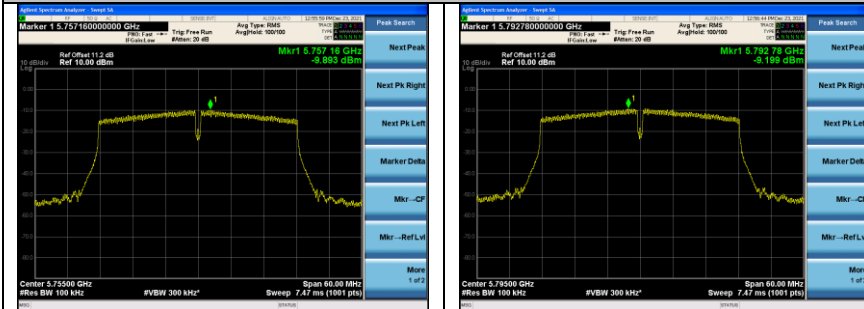
IEEE 802.11n HT40



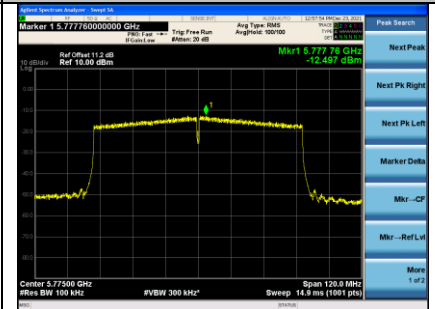
IEEE 802.11ac VHT20



IEEE 802.11ac VHT40



IEEE 802.11ac VHT80



10.FREQUENCY STABILITY MEASUREMENT

10.1.Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
4.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.07,21	1 Year
5.	Attenuator	Agilent	8491B	MY39269201	Oct.09,21	1 Year
6.	RF Cable	HUBER+SUHNER	SUCOFLEX-106	505238/6	Apr.07,21	1 Year

10.2.Limit

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

10.3.Test Procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
EUT have transmitted absence of modulation signal and fixed channelise. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings. fc is declaring of channel frequency. Then the frequency error formula is $(f_c - f)/f \times 10^{-6}$ ppm. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.
2. Extreme temperature is 0 ℃~60 ℃.

10.4. Test Result

EUT: WiFi module		
M/N: U9W43		
Test date: 2021-12-30	Pressure: 104.1 ±1.0 kpa	Humidity: 51.1 ±3.0%
Tested by: Winter	Test site: RF site	Temperature: 22.4 ±0.6 °C

Frequency Stability vs. Voltage:

Test Voltage	Temperature	CH	Max. Reading (MHz)	Target Frequency (MHz)	Result (ppm)
DC 5V	20°C	CH36	5179.9770	5180	-4.4402
		CH38	5209.9615	5190	-5.4913
		CH40	5199.9660	5200	-6.5385
		CH42	5209.9615	5210	-7.3896
		CH46	5229.9605	5230	-7.5526
		CH48	5239.9610	5240	-7.4427
		CH149	5744.9740	5745	-4.5257
		CH151	5754.9730	5755	-4.6916
		CH155	5774.9740	5775	-4.5022
		CH157	5784.9590	5785	-7.0873
		CH159	5794.9615	5795	-6.6437
		CH165	5824.9630	5825	-6.3519
DC 4.5V	20°C	CH36	5179.9855	5180	-2.7992
		CH38	5189.9775	5190	-4.3353
		CH40	5199.9895	5200	-2.0192
		CH42	5209.9875	5210	-2.3992
		CH46	5229.9795	5230	-3.9197
		CH48	5239.9745	5240	-4.8664
		CH149	5744.9840	5745	-2.7850
		CH151	5754.9745	5755	-4.4309
		CH155	5774.9850	5775	-2.5974
		CH157	5784.9650	5785	-6.0501
		CH159	5794.9720	5795	-4.8318
		CH165	5824.9930	5825	-1.2017

DC 5.5V	20℃	CH36	5179.9855	5180	-2.7992
		CH38	5189.9615	5190	-7.4181
		CH40	5199.9970	5200	-0.5769
		CH42	5209.9870	5210	-2.4952
		CH46	5229.9850	5230	-2.8681
		CH48	5239.9885	5240	-2.1947
		CH149	5744.9805	5745	-3.3943
		CH151	5754.9840	5755	-2.7802
		CH155	5774.9905	5775	-1.6450
		CH157	5784.9750	5785	-4.3215
		CH159	5794.9750	5795	-4.3141
		CH165	5824.9970	5825	-0.5150

Frequency Stability vs. Temperature:

Test Voltage	Temperature	CH	Max. Reading (MHz)	Target Frequency (MHz)	Result (ppm)
DC 5V	0℃	CH36	5179.9780	5180	-4.2471
		CH38	5189.9590	5190	-7.8998
		CH40	5199.9980	5200	-0.3846
		CH42	5209.9685	5210	-6.0461
		CH46	5229.9795	5230	-3.9197
		CH48	5239.9960	5240	-0.7634
		CH149	5744.9680	5745	-5.5701
		CH151	5754.9795	5755	-3.5621
		CH155	5774.9770	5775	-3.9827
		CH157	5784.9680	5785	-5.5315
		CH159	5794.9780	5795	-3.7964
		CH165	5824.9850	5825	-2.5751
DC 5V	10℃	CH36	5179.9675	5180	-6.2741
		CH38	5189.9955	5190	-0.8671
		CH40	5199.9865	5200	-2.5962
		CH42	5209.9780	5210	-4.2226
		CH46	5229.9950	5230	-0.956
		CH48	5239.9485	5240	-9.8282
		CH149	5744.9875	5745	-2.1758
		CH151	5754.9865	5755	-2.3458
		CH155	5774.9870	5775	-2.2511
		CH157	5784.9860	5785	-2.4201
		CH159	5794.9670	5795	-5.6946
		CH165	5824.9865	5825	-2.3176

DC 5V	20℃	CH36	5179.9850	5180	-2.8958
		CH38	5189.9845	5190	-2.9865
		CH40	5199.9780	5200	-4.2308
		CH42	5209.9815	5210	-3.5509
		CH46	5229.9715	5230	-5.4493
		CH48	5239.9650	5240	-6.6794
		CH149	5744.9650	5745	-6.0923
		CH151	5754.9870	5755	-2.2589
		CH155	5774.9760	5775	-4.1558
		CH157	5784.9750	5785	-4.3215
		CH159	5794.9840	5795	-2.7610
		CH165	5824.9680	5825	-5.4936
DC 5V	30℃	CH36	5179.9880	5180	-2.3166
		CH38	5189.9540	5190	-8.8632
		CH40	5199.9925	5200	-1.4423
		CH42	5209.9740	5210	-4.9904
		CH46	5229.9965	5230	-0.6692
		CH48	5239.9785	5240	-4.1031
		CH149	5744.9820	5745	-3.1332
		CH151	5754.9835	5755	-2.8671
		CH155	5774.9685	5775	-5.4545
		CH157	5784.9930	5785	-1.2100
		CH159	5794.9820	5795	-3.1061
		CH165	5824.9685	5825	-5.4077
DC 5V	40℃	CH36	5179.9580	5180	-8.1081
		CH38	5189.9885	5190	-2.2158
		CH40	5199.9790	5200	-4.0385
		CH42	5209.9985	5210	-0.2879
		CH46	5229.9845	5230	-2.9637
		CH48	5239.9675	5240	-6.2023
		CH149	5744.9695	5745	-5.3090
		CH151	5754.9780	5755	-3.8228
		CH155	5774.9765	5775	-4.0693
		CH157	5784.9745	5785	-4.4080
		CH159	5794.9695	5795	-5.2632
		CH165	5824.9830	5825	-2.9185

DC 5V	50℃	CH36	5179.9810	5180	-3.668
		CH38	5189.9980	5190	-0.3854
		CH40	5199.9815	5200	-3.5577
		CH42	5209.9885	5210	-2.2073
		CH46	5229.9765	5230	-4.4933
		CH48	5239.9725	5240	-5.2481
		CH149	5744.9940	5745	-1.0444
		CH151	5754.9695	5755	-5.2997
		CH155	5774.9865	5775	-2.3377
		CH157	5784.9890	5785	-1.9015
		CH159	5794.9840	5795	-2.7610
		CH165	5824.9730	5825	-4.6352
DC 5V	60℃	CH36	5179.9745	5180	-4.9228
		CH38	5189.9785	5190	-4.1426
		CH40	5199.9860	5200	-2.6923
		CH42	5209.9875	5210	-2.3992
		CH46	5229.9785	5230	-4.1109
		CH48	5239.9740	5240	-4.9618
		CH149	5744.9715	5745	-4.9608
		CH151	5754.9835	5755	-2.8671
		CH155	5774.9420	5775	-3.0303
		CH157	5784.9935	5785	-1.1236
		CH159	5794.9195	5795	-5.2632
		CH165	5824.9840	5825	-2.7468

11. ANTENNA REQUIREMENT

11.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.407 (a), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

11.2. Antenna Connected Construction

The antennas used for this product are monopole antenna that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is **U-NII-1 Band:** ANT A: 1.42dBi & ANT B: 1.25dBi; **U-NII-3 Band:** ANT A: 0.98dBi & ANT B: -0.28dBi.

12. DEVIATION TO TEST SPECIFICATIONS

[NONE]

..... THE END