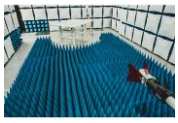
PCTEST
18855 Adams Court, Morgan Hill, CA 95037 USA
Tel. 410.290.6652 / Fax 410.290.6654
http://www.pctest.com



MEASUREMENT REPORT
FCC PART 15.407 / ISED RSS-247 UNII 802.11a/n/ac/ax(SU)

Applicant Name:
Apple Inc.
One Apple Park Way
Cupertino, CA 95014
United States

Date of Testing:
12/12/2020 - 03/2/2021
Test Site/Location:
PCTEST Lab. Morgan Hill, CA, USA
Test Report Serial No.:
1C2101020005-15-R1.BCG

FCC ID:	**BCGA2379**
IC:	**579C-A2379**
APPLICANT:	**Apple Inc.**

Application Type:	Certification
Model/HVIN:	A2379
EUT Type:	Tablet Device
Frequency Range:	5180 – 5825MHz
Modulation Type:	OFDM
FCC Classification:	Unlicensed National Information Infrastructure (UNII)
FCC Rule Part(s):	Part 15 Subpart E (15.407)
ISED Specification:	RSS-247 Issue 2
Test Procedure(s):	ANSI C63.10-2013, KDB 789033 D02 v02r01 KDB 662911 D01 v02r01

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 and KDB 789033 D02 v02r01. Test results reported herein relate only to the item(s) tested.

This revised Test Report (S/N: 1C2101020005-15-R1.BCG) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Randy Ortanez
President

ACCREDITED
CERT #2041.02

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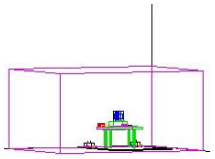
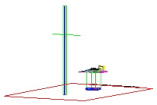


MEASUREMENT REPORT



UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO				CDD					
				Antenna 5b		Antenna 4b		Antenna 5b		Antenna 4b		Summed	
				Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
1	20	802.11a/n	5180 - 5240	89.125	19.50	89.125	19.50	49.431	16.94	50.119	17.00	98.401	19.93
2A		802.11a/n	5260 - 5320	89.125	19.50	89.125	19.50	49.091	16.91	49.091	16.91	97.499	19.89
2C		802.11a/n	5500 - 5720	89.125	19.50	89.125	19.50	50.119	17.00	48.978	16.90	99.083	19.96
3		802.11a/n	5745 - 5825	88.308	19.46	89.125	19.50	88.308	19.46	89.125	19.50	174.582	22.42
1	40	802.11n	5190 - 5230	87.096	19.40	88.308	19.46	89.125	19.50	89.125	19.50	178.238	22.51
2A		802.11n	5270 - 5310	89.125	19.50	89.125	19.50	88.512	19.47	89.125	19.50	177.828	22.50
2C		802.11n	5510 - 5710	88.716	19.48	89.125	19.50	89.125	19.50	88.308	19.46	177.011	22.48
3		802.11n	5755 - 5795	89.125	19.50	89.125	19.50	89.125	19.50	86.896	19.39	176.198	22.46
1	80	802.11ac	5210	17.378	12.40	17.783	12.50	15.596	11.93	15.740	11.97	31.333	14.96
2A		802.11ac	5290	30.479	14.84	31.117	14.93	27.733	14.43	28.184	14.50	55.976	17.48
2C		802.11ac	5530 - 5690	88.512	19.47	89.125	19.50	89.125	19.50	89.125	19.50	178.238	22.51
3		802.11ac	5775	77.268	18.88	75.683	18.79	68.077	18.33	69.183	18.40	137.404	21.38
1	20	802.11ax (SU)	5180 - 5240	88.308	19.46	87.498	19.42	50.119	17.00	49.204	16.92	99.312	19.97
2A		802.11ax (SU)	5260 - 5320	88.512	19.47	87.700	19.43	50.119	17.00	50.119	17.00	100.231	20.01
2C		802.11ax (SU)	5500 - 5720	88.716	19.48	89.125	19.50	50.119	17.00	50.119	17.00	100.231	20.01
3		802.11ax (SU)	5745 - 5825	88.105	19.45	87.700	19.43	89.125	19.50	89.125	19.50	177.419	22.49
1	40	802.11ax (SU)	5190 - 5230	85.704	19.33	89.125	19.50	89.125	19.50	88.920	19.49	178.238	22.51
2A		802.11ax (SU)	5270 - 5310	89.125	19.50	86.896	19.39	89.125	19.50	88.716	19.48	177.828	22.50
2C		802.11ax (SU)	5510 - 5710	89.125	19.50	89.125	19.50	87.297	19.41	89.125	19.50	176.604	22.47
3		802.11ax (SU)	5755 - 5795	88.920	19.49	89.125	19.50	89.125	19.50	89.125	19.50	178.238	22.51
1	80	802.11ax (SU)	5210	16.982	12.30	17.378	12.40	15.488	11.90	15.849	12.00	31.333	14.96
2A		802.11ax (SU)	5290	30.409	14.83	31.623	15.00	27.669	14.42	28.184	14.50	55.847	17.47
2C		802.11ax (SU)	5530 - 5690	88.105	19.45	89.125	19.50	88.105	19.45	89.125	19.50	177.419	22.49
3		802.11ax (SU)	5775	60.814	17.84	60.954	17.85	59.293	17.73	57.544	17.60	116.950	20.68

FCC EUT Overview (Low Data Rate)

UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO				CDD/SDM					
				Antenna 5b		Antenna 4b		Antenna 5b		Antenna 4b		Summed	
				Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
1	20	802.11a/n	5180 - 5240	26.607	14.25	26.424	14.22	18.281	12.62	18.408	12.65	36.644	15.64
2A		802.11a/n	5260 - 5320	89.125	19.50	89.125	19.50	49.091	16.91	49.091	16.91	97.499	19.89
2C		802.11a/n	5500 - 5720	89.125	19.50	89.125	19.50	50.119	17.00	48.978	16.90	99.083	19.96
3		802.11a/n	5745 - 5825	88.308	19.46	89.125	19.50	88.308	19.46	89.125	19.50	174.582	22.42
1	40	802.11n	5190 - 5230	50.234	17.01	51.642	17.13	37.411	15.73	35.810	15.54	73.282	18.65
2A		802.11n	5270 - 5310	89.125	19.50	89.125	19.50	88.512	19.47	89.125	19.50	177.828	22.50
2C		802.11n	5510 - 5710	88.716	19.48	89.125	19.50	89.125	19.50	88.105	19.45	177.011	22.48
3		802.11n	5755 - 5795	89.125	19.50	89.125	19.50	89.125	19.50	86.896	19.39	176.198	22.46
1	80	802.11ac	5210	17.298	12.38	17.100	12.33	15.849	12.00	15.560	11.92	31.405	14.97
2A		802.11ac	5290	30.479	14.84	31.117	14.93	27.733	14.43	28.184	14.50	55.976	17.48
2C		802.11ac	5530 - 5690	88.512	19.47	89.125	19.50	89.125	19.50	89.125	19.50	178.238	22.51
3		802.11ac	5775	77.268	18.88	75.683	18.79	68.077	18.33	69.183	18.40	137.404	21.38
1	20	802.11ax (SU)	5180 - 5240	26.363	14.21	26.182	14.18	18.664	12.71	18.750	12.73	36.983	15.68
2A		802.11ax (SU)	5260 - 5320	88.512	19.47	87.700	19.43	50.119	17.00	50.119	17.00	100.231	20.01
2C		802.11ax (SU)	5500 - 5720	88.716	19.48	89.125	19.50	49.545	16.95	50.119	17.00	99.541	19.98
3		802.11ax (SU)	5745 - 5825	88.105	19.45	87.700	19.43	89.125	19.50	88.105	19.45	177.419	22.49
1	40	802.11ax (SU)	5190 - 5230	51.404	17.11	52.723	17.22	37.497	15.74	36.058	15.57	73.621	18.67
2A		802.11ax (SU)	5270 - 5310	89.125	19.50	86.896	19.39	89.125	19.50	88.716	19.48	177.828	22.50
2C		802.11ax (SU)	5510 - 5710	89.125	19.50	89.125	19.50	87.297	19.41	89.125	19.50	176.604	22.47
3		802.11ax (SU)	5755 - 5795	88.920	19.49	89.125	19.50	89.125	19.50	89.125	19.50	178.238	22.51
1	80	802.11ax (SU)	5210	17.378	12.40	17.418	12.41	15.417	11.88	15.668	11.95	31.117	14.93
2A		802.11ax (SU)	5290	30.409	14.83	31.623	15.00	27.669	14.42	28.184	14.50	55.847	17.47
2C		802.11ax (SU)	5530 - 5690	88.105	19.45	89.125	19.50	88.105	19.45	89.125	19.50	177.419	22.49
3		802.11ax (SU)	5775	60.814	17.84	60.954	17.85	59.293	17.73	57.544	17.60	116.950	20.68

ISED EUT Overview (Low Data Rate)

UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO				CDD					
				Antenna 5b		Antenna 4b		Antenna 5b		Antenna 4b		Summed	
				Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
1	20	802.11a/n	5180 - 5240	89.125	19.50	89.125	19.50	50.119	17.00	50.119	17.00	100.000	20.00
2A		802.11a/n	5260 - 5320	89.125	19.50	89.125	19.50	49.431	16.94	50.119	17.00	99.541	19.98
2C		802.11a/n	5500 - 5720	89.125	19.50	89.125	19.50	50.119	17.00	50.119	17.00	100.000	20.00
3		802.11a/n	5745 - 5825	89.125	19.50	89.125	19.50	89.125	19.50	89.125	19.50	176.198	22.46
1	40	802.11n	5190 - 5230	88.716	19.48	89.125	19.50	89.125	19.50	87.498	19.42	176.604	22.47
2A		802.11n	5270 - 5310	89.125	19.50	88.308	19.46	89.125	19.50	88.512	19.47	177.828	22.50
2C		802.11n	5510 - 5710	89.125	19.50	88.512	19.47	89.125	19.50	89.125	19.50	175.388	22.44
3		802.11n	5755 - 5795	89.125	19.50	89.125	19.50	89.125	19.50	88.512	19.47	177.828	22.50
1	80	802.11ac	5210	17.179	12.35	17.783	12.50	10.666	10.28	11.169	10.48	21.827	13.39
2A		802.11ac	5290	25.119	14.00	24.660	13.92	22.387	13.50	22.336	13.49	44.771	16.51
2C		802.11ac	5530 - 5690	87.297	19.41	88.308	19.46	83.753	19.23	85.704	19.33	169.434	22.29
3		802.11ac	5775	70.795	18.50	69.183	18.40	63.096	18.00	61.944	17.92	125.026	20.97
1	20	802.11ax (SU)	5180 - 5240	89.125	19.50	87.902	19.44	49.545	16.95	50.119	17.00	99.770	19.99
2A		802.11ax (SU)	5260 - 5320	88.105	19.45	88.716	19.48	50.119	17.00	50.003	16.99	99.312	19.97
2C		802.11ax (SU)	5500 - 5720	89.125	19.50	89.125	19.50	50.119	17.00	50.119	17.00	100.231	20.01
3		802.11ax (SU)	5745 - 5825	89.125	19.50	87.902	19.44	88.105	19.45	89.125	19.50	175.388	22.44
1	40	802.11ax (SU)	5190 - 5230	86.497	19.37	88.716	19.48	87.498	19.42	89.125	19.50	176.604	22.47
2A		802.11ax (SU)	5270 - 5310	87.700	19.43	88.920	19.49	87.096	19.40	88.105	19.45	175.388	22.44
2C		802.11ax (SU)	5510 - 5710	87.700	19.43	87.498	19.42	88.512	19.47	89.125	19.50	176.604	22.47
3		802.11ax (SU)	5755 - 5795	87.498	19.42	89.125	19.50	89.125	19.50	88.920	19.49	178.238	22.51
1	80	802.11ax (SU)	5210	15.311	11.85	15.849	12.00	11.220	10.50	11.220	10.50	22.439	13.51
2A		802.11ax (SU)	5290	25.119	14.00	25.119	14.00	21.979	13.42	21.577	13.34	43.551	16.39
2C		802.11ax (SU)	5530 - 5690	89.125	19.50	88.308	19.46	86.497	19.37	87.700	19.43	174.181	22.41
3		802.11ax (SU)	5775	55.463	17.44	55.208	17.42	50.119	17.00	49.317	16.93	99.541	19.98

FCC EUT Overview (Mid Data Rate)

UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO				CDD/SDM					
				Antenna 5b		Antenna 4b		Antenna 5b		Antenna 4b		Summed	
				Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
1	20	802.11a/n	5180 - 5240	26.607	14.25	26.632	14.25	18.408	12.65	18.793	12.74	36.983	15.68
2A		802.11a/n	5260 - 5320	89.125	19.50	89.125	19.50	49.431	16.94	50.119	17.00	99.541	19.98
2C		802.11a/n	5500 - 5720	89.125	19.50	89.125	19.50	50.119	17.00	50.119	17.00	100.000	20.00
3		802.11a/n	5745 - 5825	89.125	19.50	89.125	19.50	89.125	19.50	89.125	19.50	176.198	22.46
1	40	802.11n	5190 - 5230	50.933	17.07	51.286	17.10	36.475	15.62	36.813	15.66	73.282	18.65
2A		802.11n	5270 - 5310	89.125	19.50	88.308	19.46	89.125	19.50	88.512	19.47	177.828	22.50
2C		802.11n	5510 - 5710	89.125	19.50	88.512	19.47	86.696	19.38	83.560	19.22	170.216	22.31
3		802.11n	5755 - 5795	89.125	19.50	89.125	19.50	89.125	19.50	88.512	19.47	177.828	22.50
1	80	802.11ac	5210	17.179	12.35	16.866	12.27	11.220	10.50	10.990	10.41	22.233	13.47
2A		802.11ac	5290	25.119	14.00	24.660	13.92	22.387	13.50	22.336	13.49	44.771	16.51
2C		802.11ac	5530 - 5690	87.297	19.41	88.308	19.46	83.753	19.23	85.704	19.33	169.434	22.29
3		802.11ac	5775	70.795	18.50	69.183	18.40	63.096	18.00	61.944	17.92	125.026	20.97
1	20	802.11ax (SU)	5180 - 5240	26.607	14.25	26.242	14.19	18.365	12.64	18.707	12.72	36.813	15.66
2A		802.11ax (SU)	5260 - 5320	88.105	19.45	88.716	19.48	50.119	17.00	50.003	16.99	99.312	19.97
2C		802.11ax (SU)	5500 - 5720	89.125	19.50	89.125	19.50	50.119	17.00	50.119	17.00	100.231	20.01
3		802.11ax (SU)	5745 - 5825	89.125	19.50	87.902	19.44	88.105	19.45	89.125	19.50	175.388	22.44
1	40	802.11ax (SU)	5190 - 5230	51.642	17.13	52.000	17.16	35.156	15.46	36.224	15.59	71.450	18.54
2A		802.11ax (SU)	5270 - 5310	87.700	19.43	88.920	19.49	87.096	19.40	88.105	19.45	175.388	22.44
2C		802.11ax (SU)	5510 - 5710	87.700	19.43	87.498	19.42	87.498	19.42	89.125	19.50	176.604	22.47
3		802.11ax (SU)	5755 - 5795	87.498	19.42	89.125	19.50	89.125	19.50	88.920	19.49	178.238	22.51
1	80	802.11ax (SU)	5210	14.997	11.76	15.066	11.78	10.889	10.37	11.066	10.44	21.979	13.42
2A		802.11ax (SU)	5290	25.119	14.00	25.119	14.00	21.979	13.42	21.577	13.34	43.551	16.39
2C		802.11ax (SU)	5530 - 5690	89.125	19.50	88.308	19.46	86.497	19.37	87.700	19.43	174.181	22.41
3		802.11ax (SU)	5775	55.463	17.44	55.208	17.42	50.119	17.00	49.317	16.93	99.541	19.98

ISED EUT Overview (Mid Data Rate)

UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO				CDD					
				Antenna 5b		Antenna 4b		Antenna 5b		Antenna 4b		Summed	
				Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
1	20	802.11a/n	5180 - 5240	89.125	19.50	87.498	19.42	48.865	16.89	49.888	16.98	98.628	19.94
2A		802.11a/n	5260 - 5320	87.498	19.42	89.125	19.50	49.888	16.98	50.119	17.00	99.312	19.97
2C		802.11a/n	5500 - 5720	89.125	19.50	89.125	19.50	50.119	17.00	50.119	17.00	100.231	20.01
3		802.11a/n	5745 - 5825	89.125	19.50	89.125	19.50	89.125	19.50	89.125	19.50	178.238	22.51
1	40	802.11n	5190 - 5230	87.902	19.44	88.105	19.45	87.498	19.42	89.125	19.50	176.604	22.47
2A		802.11n	5270 - 5310	88.512	19.47	87.096	19.40	87.096	19.40	88.105	19.45	175.388	22.44
2C		802.11n	5510 - 5710	87.297	19.41	88.716	19.48	88.512	19.47	89.125	19.50	176.604	22.47
3		802.11n	5755 - 5795	89.125	19.50	86.497	19.37	89.125	19.50	88.920	19.49	178.238	22.51
1	80	802.11ac	5210	13.740	11.38	13.709	11.37	10.765	10.32	11.015	10.42	21.777	13.38
2A		802.11ac	5290	22.387	13.50	21.677	13.36	17.783	12.50	17.660	12.47	35.481	15.50
2C		802.11ac	5530 - 5690	87.902	19.44	87.096	19.40	89.125	19.50	88.105	19.45	177.419	22.49
3		802.11ac	5775	48.641	16.87	49.431	16.94	39.355	15.95	39.811	16.00	79.250	18.99
1	20	802.11ax (SU)	5180 - 5240	89.125	19.50	89.125	19.50	49.431	16.94	49.888	16.98	99.312	19.97
2A		802.11ax (SU)	5260 - 5320	89.125	19.50	88.105	19.45	50.119	17.00	49.888	16.98	100.000	20.00
2C		802.11ax (SU)	5500 - 5720	89.125	19.50	89.125	19.50	49.774	16.97	50.119	17.00	99.770	19.99
3		802.11ax (SU)	5745 - 5825	89.125	19.50	89.125	19.50	89.125	19.50	89.125	19.50	178.238	22.51
1	40	802.11ax (SU)	5190 - 5230	88.308	19.46	88.308	19.46	78.886	18.97	78.705	18.96	157.761	21.98
2A		802.11ax (SU)	5270 - 5310	88.512	19.47	89.125	19.50	89.125	19.50	87.498	19.42	176.604	22.47
2C		802.11ax (SU)	5510 - 5710	88.512	19.47	87.902	19.44	87.297	19.41	89.125	19.50	176.604	22.47
3		802.11ax (SU)	5755 - 5795	89.125	19.50	88.920	19.49	89.125	19.50	89.125	19.50	178.238	22.51
1	80	802.11ax (SU)	5210	14.125	11.50	14.125	11.50	10.765	10.32	11.015	10.42	21.777	13.38
2A		802.11ax (SU)	5290	21.827	13.39	22.131	13.45	17.783	12.50	17.660	12.47	35.481	15.50
2C		802.11ax (SU)	5530 - 5690	89.125	19.50	86.099	19.35	89.125	19.50	88.105	19.45	177.419	22.49
3		802.11ax (SU)	5775	50.119	17.00	48.753	16.88	39.355	15.95	39.811	16.00	79.250	18.99

FCC EUT Overview (High Data Rate)

UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO				CDD/SDM					
				Antenna 5b		Antenna 4b		Antenna 5b		Antenna 4b		Summed	
				Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
1	20	802.11a/n	5180 - 5240	26.607	14.25	26.607	14.25	18.535	12.68	18.535	12.68	37.068	15.69
2A		802.11a/n	5260 - 5320	87.498	19.42	89.125	19.50	49.888	16.98	50.119	17.00	99.312	19.97
2C		802.11a/n	5500 - 5720	89.125	19.50	89.125	19.50	50.119	17.00	50.119	17.00	100.231	20.01
3		802.11a/n	5745 - 5825	89.125	19.50	89.125	19.50	89.125	19.50	89.125	19.50	178.238	22.51
1	40	802.11n	5190 - 5230	52.240	17.18	51.880	17.15	37.154	15.70	35.563	15.51	72.778	18.62
2A		802.11n	5270 - 5310	88.512	19.47	87.096	19.40	87.096	19.40	88.105	19.45	175.388	22.44
2C		802.11n	5510 - 5710	87.297	19.41	88.716	19.48	87.498	19.42	89.125	19.50	176.604	22.47
3		802.11n	5755 - 5795	89.125	19.50	86.497	19.37	89.125	19.50	88.920	19.49	178.238	22.51
1	80	802.11ac	5210	13.521	11.31	13.521	11.31	10.839	10.35	11.066	10.44	21.928	13.41
2A		802.11ac	5290	22.387	13.50	21.677	13.36	17.783	12.50	17.660	12.47	35.481	15.50
2C		802.11ac	5530 - 5690	87.902	19.44	87.096	19.40	89.125	19.50	88.105	19.45	177.419	22.49
3		802.11ac	5775	48.641	16.87	49.431	16.94	39.355	15.95	39.811	16.00	79.250	18.99
1	20	802.11ax (SU)	5180 - 5240	26.122	14.17	26.182	14.18	18.197	12.60	18.707	12.72	36.898	15.67
2A		802.11ax (SU)	5260 - 5320	89.125	19.50	88.105	19.45	50.119	17.00	49.888	16.98	100.000	20.00
2C		802.11ax (SU)	5500 - 5720	89.125	19.50	89.125	19.50	49.774	16.97	50.119	17.00	99.770	19.99
3		802.11ax (SU)	5745 - 5825	89.125	19.50	89.125	19.50	89.125	19.50	89.125	19.50	178.238	22.51
1	40	802.11ax (SU)	5190 - 5230	52.119	17.17	52.845	17.23	35.481	15.50	36.224	15.59	71.779	18.56
2A		802.11ax (SU)	5270 - 5310	88.512	19.47	89.125	19.50	89.125	19.50	87.498	19.42	176.604	22.47
2C		802.11ax (SU)	5510 - 5710	85.901	19.34	87.902	19.44	87.297	19.41	89.125	19.50	176.604	22.47
3		802.11ax (SU)	5755 - 5795	89.125	19.50	88.920	19.49	89.125	19.50	89.125	19.50	178.238	22.51
1	80	802.11ax (SU)	5210	13.868	11.42	14.060	11.48	11.015	10.42	11.220	10.50	22.233	13.47
2A		802.11ax (SU)	5290	21.827	13.39	22.131	13.45	17.783	12.50	17.660	12.47	35.481	15.50
2C		802.11ax (SU)	5530 - 5690	89.125	19.50	86.099	19.35	89.125	19.50	88.105	19.45	177.419	22.49
3		802.11ax (SU)	5775	50.119	17.00	48.753	16.88	39.355	15.95	39.811	16.00	79.250	18.99

ISED EUT Overview (High Data Rate)

1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST facility located at 18855 Adams Court, Morgan Hill, CA 95037. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014 and KDB 414788 D01 v01r01.

1.3 Test Facility / Accreditations

Measurements were performed at PCTEST located in Morgan Hill, CA 95037, U.S.A.

- PCTEST is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).

- PCTEST facility is a registered (22831) test laboratory with the site description on file with ISED.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Tablet Device FCC ID: BCGA2379** and **IC: 579C-A2379**. The test data contained in this report pertains only to the emissions due to the EUT's UNII 802.11a/n/ac/ax(SU) transmitter.

Test Device Serial No.: H4MTX492NT, NN63X069PP, JR9GHQH6LP, KRF23LVQ2T

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (FR1/FR2), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, Bluetooth (1x, EDR, LE1M, LE2M, HDR4, HDR8), WPT

This device supports BT Beamforming

Band 1		Band 2A		Band 2C		Band 3	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
36	5180	52	5260	100	5500	149	5745
:	:	:	:	:	:	:	:
42	5210	56	5280	116	5580	157	5785
:	:	:	:	:	:	:	:
48	5240	64	5320	144	5720	165	5825

Table 2-1. 802.11a / 802.11n / 802.11ac / 802.11ax (20MHz) Frequency / Channel Operations

Band 1		Band 2A		Band 2C		Band 3	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
38	5190	54	5270	102	5510	151	5755
:	:	:	:	:	:	:	:
46	5230	62	5310	110	5550	159	5795
				:	:		
				142	5710		

Table 2-2. 802.11n / 802.11ac / 802.11ax (40MHz BW) Frequency / Channel Operations

Band 1		Band 2A		Band 2C		Band 3	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
42	5210	58	5290	106	5530	155	5775
				:	:		
				138	5690		

Table 2-3. 802.11ac / 802.11ax (80MHz BW) Frequency / Channel Operations

Notes:

1. 5GHz NII operation is possible in 20MHz, and 40MHz, and 80MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak per the guidance of Section B)2)b) KDB 789033 D02 v02r01 and ANSI C63.10-2013. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Measured Duty Cycles				
802.11 Mode/Band		Duty Cycle [%]		
		Antenna 5b	Antenna 4b	CDD
5GHz	a (Low Rate)	99.0	98.7	98.6
	a (Mid Rate)	96.8	96.8	96.8
	a (High Rate)	94.6	94.5	94.5
	n (HT20) (Low Rate)	99.0	98.9	98.0
	n (HT20) (Mid Rate)	96.0	96.1	93.0
	n (HT20) (High Rate)	93.2	93.6	88.3
	ax(SU) (HT20 Low Rate)	98.9	98.5	98.0
	ax(SU) (HT20 Mid Rate)	94.9	95.1	95.1
	ax(SU) (HT20 High Rate)	88.8	88.1	87.8
	n (HT40 Low Rate)	97.6	98.1	96.1
	n (HT40 Mid Rate)	92.4	92.1	88.4
	n (HT40 High Rate)	88.3	87.6	82.9
	ax(SU) (HT40 Low Rate)	97.4	97.0	97.7
	ax(SU) (HT40 Mid Rate)	91.7	92.2	92.2
	ax(SU) (HT40 High Rate)	83.5	83.9	83.6
	ac (HT80 Low Rate)	99.3	95.5	92.2
	ac (HT80 Mid Rate)	86.2	86.9	81.8
	ac (HT80 High Rate)	82.6	81.8	78.0
	ax(SU) (HT80 Low Rate)	94.1	94.9	94.5
	ax(SU) (HT80 Mid Rate)	86.7	87.0	87.4
	ax(SU) (HT80 High Rate)	79.4	79.7	79.1

Table 2-4. Measured Duty Cycles

2. The device employs MIMO technology. Below are the possible configurations.

WiFi Configurations		SISO		CDD		SDM		STBC	
		Antenna 5b	Antenna 4b	Antenna 5b	Antenna 4b	Antenna 5b	Antenna 4b	Antenna 5b	Antenna 4b
5GHz	11a	✓	✓	✓	✓	×	×	×	×
	11n (20MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax(SU) (20MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11n (40MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax(SU) (40MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ac (80MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax(SU) (80MHz)	✓	✓	✓	✓	✓	✓	✓	✓

Table 2-5. Frequency / Channel Operations

✓= Support ; × = NOT Support
SISO = Single Input Single Output
SDM = Spatial Diversity Multiplexing – MIMO function
CDD = Cyclic Delay Diversity - 2Tx Function
STBC = Space-Time Block Coding – 2Tx Function

Data Rate(s) Tested: 6, 9, 12, 18, 24, 36, 48, 54Mbps (802.11a)

6.5/7.2, 13/14.4, 19.5/21.7, 26/28.9, 39/43.3, 52/57.8, 58.5/65, 65/72.2 (n – 20MHz)

13.5/15, 27/30, 40.5/45, 54/60, 81/90, 108/120, 121.5/135, 135/150 (n – 40MHz BW)

29.3/32.5, 58.5/65, 87.8/97.5, 117/130, 175.5/195, 234/260, 263.3/292.5, 292.5/325, 351/390, 390/433.3 (ac – 80MHz BW)
13/14.4, 26.28.9, 39/43.3, 52/57.8, 78/86.7, 104/115.6, 117/130, 130/144.4MBps (MIMO n/ac – 20MHz)
156/173Mbps (MIMO ac – 20MHz)
27/30, 54/60, 81/90, 108/120, 162/180, 216/240, 243,270, 270/300Mbps (MIMO n/ac – 40MHz) 324/360, 360/400Mbps (MIMO ac – 40MHz)
58.5/65, 117/130, 175.5/195, 234/260, 351/390, 468/520, 526.5/585, 585/650, 702/780, 780/866.7Mbps (MIMO ac – 80MHz)
8/8.6, 16/17.2, 24/25.8, 33/34.4, 49/51.6, 65/68.8, 73/77.4, 81/86.0, 98/103.2, 108/114.7, 122/129.0, 135/143.4 (ax – 20MHz)
16/17.2, 33/34.4, 49/51.6, 65/68.8, 98/103.2, 130/137.6, 146/154.9, 163/172.1, 195/206.5, 217/229.4, 244/258.1, 271/286.8 (ax – 40MHz BW)
34/36.0, 68/72.1, 102/108.1, 136/144.1, 204/216.2, 272/288.2, 306/324.4, 340/360.3, 408/432.4, 453/480.4, 510/540.4, 567/600.5 (ax – 80MHz BW)

3. This device supports simultaneous transmission operations, which allows for multiple transmitters to transmit simultaneously on the same antenna. The table below shows all configurations possible.

Antenna	Simultaneous Tx Config	WLAN	Bluetooth	GSM / WCDMA	LTE / Sub 6 LTE NR			UNII
		802.11 b/g/n/ax	BDR, EDR, HDR4/8, LE1M/2M	Mid Band	Mid Band	High Band	Ultra High Band	802.11 a/n/ac/ax
2a	Config 1	✓	×	×	×	×	✓	×
2a	Config 2	×	✓	×	×	×	✓	×
4a	Config 3	✓	×	×	×	×	✓	×
4a	Config 4	×	✓	×	×	×	✓	×
4b	Config 5	×	×	✓	×	×	×	✓
4b	Config 6	×	×	×	✓	×	×	✓
4b	Config 7	×	×	×	×	✓	×	✓

Table 2-6. Simultaneous Transmission Configurations

✓ = Support; × = Not Support

2.3 Antenna Description

Following antenna gains provided by manufacturer were used for the testing.

Frequency [GHz]	Antenna Gain (dBi)	
	Antenna 5b	Antenna 4b
5.150 – 5.250	4.7	0.6
5.250 – 5.350	4.9	-0.6
5.470 – 5.725	5.1	-1.4
5725 – 5.850	5.1	0.4

Table 2-7. Highest Antenna Gain

2.4 Test Support Equipment

1	Apple MacBook Pro	Model:	A2141	S/N:	C02DV7VKMD6T
	w/AC/DC Adapter	Model:	A2166	S/N:	N/A
2	Apple USB-C Cable	Model:	Chimp	S/N:	420A57
3	USB-C Cable	Model:	A146	S/N:	N/A
	w/ AC Adapter	Model:	A2305	S/N:	N/A
4	Apple Pencil	Model:	N/A	S/N:	GQXYGSXBJKM9
5	DC Power Supply	Model:	KPS3010D	S/N:	N/A

Table 2-8. Test Support Equipment List

2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013 and KDB 789033 D02 v02r01. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, and 7.2, 7.3, 7.4, and 7.5 for antenna port conducted emissions test setups.

There are two vendors of the WiFi/Bluetooth radio modules, variant 1 and variant 2. Both radio modules have the same mechanical outline, same on-board antenna matching circuit, identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances. The worst case configuration was found between the two variants. The EUT was also investigated with and without charger.

For emissions from 1GHz – 18GHz, low, mid, and high channels were tested with highest power and worst case configuration. The emissions below 1GHz and above 18GHz were tested with the highest transmitting power and the worst case channel.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

For AC line conducted and radiated test below 1GHz, following configuration were investigated and EUT powered by AC/DC was the worst case.

- EUT powered by AC/DC adaptor via USB-C cable with wire charger
- EUT powered by host PC via USB-C cable with wire charger

802.11n HT20/40, 11ax(SU) HE20/40/80 and acVHT80 2TX CDD/SDM mode test data provided in this report covers 802.11n HT20/40, 11ax(SU) HE20/40/80 and 802.11acVHT80 2TX STBC mode

802.11ac VHT20 and VHT40 mode are different from 802.11n HT20 and HT40 only in control messages and have the same power settings.

The data rates have been classified into three different groups; low data rate, middle data rate, and high data rate. All three groups of data rate have been investigated and only the worst case data rate per group is reported. The worst case data rate for each group per mode are as follows:

- 802.11a:
  - Low Data Rate: 6Mbps
  - Mid Data Rate: 18Mbps
  - High Data Rate: 36Mbps
- 802.11n HT20/40:
  - Low Data Rate: MCS0/MCS8 (SISO/CDD)
  - Mid Data Rate: MCS3/MCS11 (SISO/CDD)
  - High Data Rate: MCS5/MCS13 (SISO/CDD)
- 802.11ac VHT80:
  - Low Data Rate: MCS0
  - Mid Data Rate: MCS3
  - High Data Rate: MCS5
- 802.11ax(SU) HE20/HE40/HE80:
  - Low Data Rate: MCS0
  - Mid Data Rate: MCS3
  - High Data Rate: MCS11

2.6 Software and Firmware

The test was conducted with firmware version 18E20700y installed on the EUT.

2.7 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 789033 D02 v02r01 were used in the measurement of the EUT**.**

Deviation from measurement procedure……..…….....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 7m x 3.66m x 2.7m shielded enclosure. The shielded enclosure is manufactured by AP Americas. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-6. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50µH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is EPCOS 2X60A Power Line Filter (100dB Attenuation, 14kHz-18GHz) and the two EPCOs 2X48A filters (100dB Minimum Insertion Loss, 14kHz - 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.8. Automated test software was used to perform the AC line conducted emissions testing. Automated measurement software utilized is Rohde & Schwarz EMC32, Version 10.50.40.

3.3 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

Per KDB 414788, radiated emission test sites other than open-field test sites (e.g., shielded anechoic chambers), may be employed for emission measurements below 30MHz if characterized so that the measurements correspond to those obtained at an open-field test site. To determine test site equivalency, a reference sample transmitting at 149kHz was measured on an open field test site (asphalt with no ground plane) and then measured in the 3m semi-anechoic chamber. A calibrated 60cm loop antenna was used while the reference device was rotated through the X, Y and Z axis in order to capture the worst case level. A maximum deviation of 2.77dB at 149kHz was measured when comparing the 3 meter semi-anechoic chamber to the open field site.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33 depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

3.4 Environmental Conditions

The temperature is controlled within range of 15ºC to 35ºC. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

4.0 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 antennas of the EUT are **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The EUT complies with the requirement of §15.203.

5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.23-2012. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.65
Line Conducted Disturbance	2.71
Radiated Disturbance (<30MHz)	4.06
Radiated Disturbance (30MHz - 1GHz)	4.30
Radiated Disturbance (1 - 18GHz)	4.78
Radiated Disturbance (>18GHz)	4.79

6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	3/4/2020	Annual	3/4/2021	MY49430244
Anritsu	ML2496A	Power Meter	4/9/2020	Annual	4/9/2021	2002005
Anritsu	MA2411B	Pulse Power Sensor	3/10/2020	Annual	3/10/2021	1911105
Anritsu	MA2411B	Pulse Power Sensor	3/10/2020	Annual	3/10/2021	1911106
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	8/11/2020	Annual	8/11/2021	T058701-01
COM-POWER	LIN-120A	LISN	3/4/2020	Annual	3/4/2021	241297
ETS-Lindgren	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	3/4/2020	Annual	3/4/2021	102325
ETS-Lindgren	3142E	BiConiLog Antenna (30MHz - 6GHz)	9/15/2020	Annual	9/15/2021	208204
ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	4/21/2020	Annual	4/21/2021	205956
Rohde & Schwarz	ESW26	EMI Test Receiver	6/1/2020	Annual	6/1/2021	101299
Rohde & Schwarz	ESW44	EMI Test Receiver	8/7/2020	Annual	8/7/2021	101668
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	4/3/2020	Annual	4/3/2021	100052
Rohde & Schwarz	TC-TA18	Cross Polarized Vivaldi Antenna (400MHz-18GHz)	10/2/2020	Annual	10/2/2021	101063
Rohde & Schwarz	HFH2-Z2	Loop Antenna	3/12/2020	Annual	3/12/2021	100546
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	12/3/2020	Annual	12/3/2021	101648
Rohde & Schwarz	ENV216	Two-Line V-Network (LISN)	12/7/2020	Annual	12/7/2021	101364

Table 6-1. Test Equipment List

Note:

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

7.0 TEST RESULTS

7.1 Summary

Company Name: Apple Inc.
FCC ID: BCGA2379
IC: 579C-A2379
FCC Classification: Unlicensed National Information Infrastructure (UNII)

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.407	RSS-Gen [6.7]	26dB Bandwidth	N/A	CONDUCTED	N/A	Section 7.2
15.407(e)	RSS-Gen [6.7]	6dB Bandwidth	>500kHz(5725-5850MHz)		PASS	Section 7.3
2.1049	RSS-Gen [6.7]	Occupied Bandwidth	N/A		PASS	Section 7.2, Section 7.3
15.407 (a.1.iv), (a.2), (a.3)	RSS-247 [6.2]	Maximum Conducted Output Power	Maximum conducted powers must meet the limits detailed in 15.407 (a) (RSS-247 [6.2])		PASS	Section 7.4
15.407 (a.1.iv), (a.2), (a.3)	RSS-247 [6.2]	Maximum Power Spectral Density	Maximum power spectral density must meet the limits detailed in 15.407 (a) (RSS-247 [6.2])		PASS	Section 7.5
15.407(h)	RSS-247 [6.3]	Dynamic Frequency Selection	See DFS Test Report	RADIATED	PASS	See DFS Test Report (1C2101020005-14)
15.407(b.1), (2), (3), (4)	RSS-247 [6.2]	Undesirable Emissions	Undesirable emissions must meet the limits detailed in 15.407(b) (RSS-247 [6.2])		PASS	Section 7.6
15.205, 15.407(b.1), (4), (5), (6)	RSS-Gen [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-Gen [8.9])		PASS	Section 7.6, 7.7
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 (RSS-Gen [8.8]) limits	LINE CONDUCTED	PASS	Section 7.8

Table 7-1. Summary of Test Results

Notes:

1) All channels, modes, and modulations/data rates were investigated among all UNII bands. The test results shown in the following sections represent the worst case emissions.
2) 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.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "UNII Automation," Version 5.2.
5) For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Chamber Automation," Version 1.3.1.

7.2 26dB & 99% Bandwidth Measurement – 802.11a/n/ac/ax(SU)

§2.1049; §15.407; RSS-Gen [6.7]

Test Overview and Limit

The bandwidth at 26dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in ANSI C63.10-2013 and KDB 789033 D02 v02r01, and at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26dB bandwidth.

The 26dB bandwidth is used to determine the conducted power limits.

Test Procedure Used

ANSI C63.10-2013 – Section 12.4
KDB 789033 D02 v02r01 – Section C

Test Settings

1. The signal analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 26. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth
3. VBW $\geq$ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

1. All antenna configurations and data rates were investigated and only the worst case are reported.
2. The data rates have been classified into three different groups; Low Data Rate, middle rate, and High Data Rate. All three data rate groups of data rate have been investigated and only the worst case data rate per group is reported.
3. Low, mid, and high channels were tested and tabular data has been reported. Only mid channels bandwidths plots have been reported.

Antenna 5b 26dB & 99% Bandwidth Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	99% Occupied BW [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	n (20MHz)	6.5/7.2 (MCS0)	17.96	21.75
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	17.79	21.19
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	17.79	21.10
	5180	36	ax-SU (20MHz)	8/8.6 (MCS0)	19.08	22.50
	5200	40	ax-SU (20MHz)	8/8.6 (MCS0)	19.09	21.45
	5240	48	ax-SU (20MHz)	8/8.6 (MCS0)	19.08	21.33
	5190	38	n (40MHz)	13.5/15 (MCS0)	36.52	42.74
	5230	46	n (40MHz)	13.5/15 (MCS0)	36.37	41.61
	5190	38	ax-SU (40MHz)	16/17.2 (MCS0)	38.02	42.10
	5230	46	ax-SU (40MHz)	16/17.2 (MCS0)	38.18	41.53
	5210	42	ac (80MHz)	29.3/32.5 (MCS0)	75.47	82.95
	5210	42	ax-SU (80MHz)	34/36.0 (MCS0)	77.34	82.78
Band 2A	5260	52	n (20MHz)	6.5/7.2 (MCS0)	17.78	21.18
	5280	56	n (20MHz)	6.5/7.2 (MCS0)	17.76	21.25
	5320	64	n (20MHz)	6.5/7.2 (MCS0)	17.91	22.06
	5260	52	ax-SU (20MHz)	8/8.6 (MCS0)	19.08	21.34
	5280	56	ax-SU (20MHz)	8/8.6 (MCS0)	19.42	37.57
	5320	64	ax-SU (20MHz)	8/8.6 (MCS0)	19.14	23.69
	5270	54	n (40MHz)	13.5/15 (MCS0)	36.42	41.55
	5310	62	n (40MHz)	13.5/15 (MCS0)	36.51	43.48
	5270	54	ax-SU (40MHz)	16/17.2 (MCS0)	38.11	41.63
	5310	62	ax-SU (40MHz)	16/17.2 (MCS0)	38.06	42.71
	5290	58	ac (80MHz)	29.3/32.5 (MCS0)	75.55	83.38
	5290	58	ax-SU (80MHz)	34/36.0 (MCS0)	77.21	82.69
Band 2C	5500	100	n (20MHz)	6.5/7.2 (MCS0)	17.92	22.03
	5580	116	n (20MHz)	6.5/7.2 (MCS0)	17.79	21.19
	5720	144	n (20MHz)	6.5/7.2 (MCS0)	17.81	21.06
	5500	100	ax-SU (20MHz)	8/8.6 (MCS0)	19.13	24.26
	5580	116	ax-SU (20MHz)	8/8.6 (MCS0)	19.07	21.41
	5720	144	ax-SU (20MHz)	8/8.6 (MCS0)	19.06	21.97
	5510	102	n (40MHz)	13.5/15 (MCS0)	36.62	43.64
	5550	110	n (40MHz)	13.5/15 (MCS0)	36.38	41.50
	5710	142	n (40MHz)	13.5/15 (MCS0)	36.27	41.07
	5510	102	ax-SU (40MHz)	16/17.2 (MCS0)	38.06	45.15
	5550	110	ax-SU (40MHz)	16/17.2 (MCS0)	38.04	41.59
	5710	142	ax-SU (40MHz)	16/17.2 (MCS0)	38.09	41.31
	5530	106	ac (80MHz)	29.3/32.5 (MCS0)	75.51	85.64
	5690	138	ac (80MHz)	29.3/32.5 (MCS0)	75.44	81.23
	5530	106	ax-SU (80MHz)	34/36.0 (MCS0)	77.33	87.55
	5690	138	ax-SU (80MHz)	34/36.0 (MCS0)	77.26	81.90

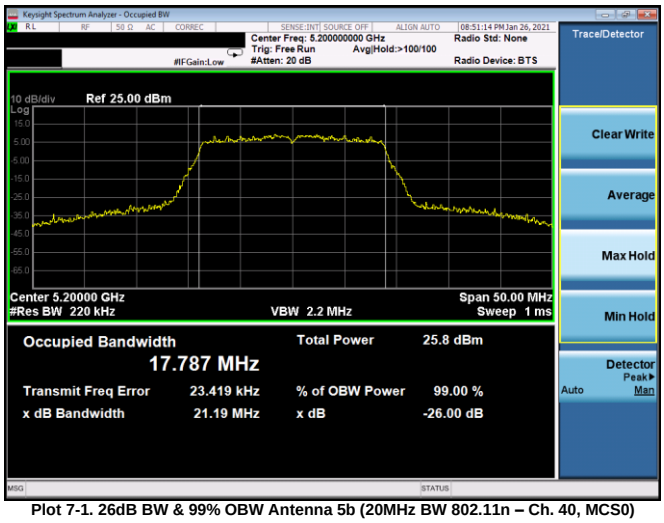
Table 7-2. Conducted Bandwidth Measurements Antenna 5b (Low Data Rate)

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	99% Occupied BW [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	n (20MHz)	26/28.9 (MCS3)	17.73	20.98
	5200	40	n (20MHz)	26/28.9 (MCS3)	17.73	21.00
	5240	48	n (20MHz)	26/28.9 (MCS3)	17.74	20.89
	5180	36	ax-SU (20MHz)	33/34.4 (MCS3)	19.04	22.56
	5200	40	ax-SU (20MHz)	33/34.4 (MCS3)	19.03	21.23
	5240	48	ax-SU (20MHz)	33/34.4 (MCS3)	19.03	21.16
	5190	38	n (40MHz)	54/60 (MCS3)	36.37	41.48
	5230	46	n (40MHz)	54/60 (MCS3)	36.31	40.95
	5190	38	ax-SU (40MHz)	65/68.8 (MCS3)	37.96	46.83
	5230	46	ax-SU (40MHz)	65/68.8 (MCS3)	37.95	41.79
	5210	42	ac (80MHz)	117/130 (MCS3)	75.51	83.28
	5210	42	ax-SU (80MHz)	567/600.5 (MCS3)	77.18	81.55
Band 2A	5260	52	n (20MHz)	26/28.9 (MCS3)	17.71	20.76
	5280	56	n (20MHz)	26/28.9 (MCS3)	17.72	20.82
	5320	64	n (20MHz)	26/28.9 (MCS3)	17.78	21.32
	5260	52	ax-SU (20MHz)	33/34.4 (MCS3)	19.13	26.94
	5280	56	ax-SU (20MHz)	33/34.4 (MCS3)	19.13	23.00
	5320	64	ax-SU (20MHz)	33/34.4 (MCS3)	19.09	25.26
	5270	54	n (40MHz)	54/60 (MCS3)	36.26	41.16
	5310	62	n (40MHz)	54/60 (MCS3)	36.34	40.92
	5270	54	ax-SU (40MHz)	65/68.8 (MCS3)	37.98	41.34
	5310	62	ax-SU (40MHz)	65/68.8 (MCS3)	37.95	52.82
	5290	58	ac (80MHz)	117/130 (MCS3)	75.40	80.95
	5290	58	ax-SU (80MHz)	567/600.5 (MCS3)	77.24	81.74
Band 2C	5500	100	n (20MHz)	26/28.9 (MCS3)	17.73	20.98
	5580	116	n (20MHz)	26/28.9 (MCS3)	17.71	20.82
	5720	144	n (20MHz)	26/28.9 (MCS3)	17.70	20.92
	5500	100	ax-SU (20MHz)	33/34.4 (MCS3)	19.07	21.15
	5580	116	ax-SU (20MHz)	33/34.4 (MCS3)	19.01	20.84
	5720	144	ax-SU (20MHz)	33/34.4 (MCS3)	19.03	21.12
	5510	102	n (40MHz)	54/60 (MCS3)	36.37	41.24
	5550	110	n (40MHz)	54/60 (MCS3)	36.33	40.88
	5710	142	n (40MHz)	54/60 (MCS3)	36.29	40.55
	5510	102	ax-SU (40MHz)	65/68.8 (MCS3)	37.98	52.79
	5550	110	ax-SU (40MHz)	65/68.8 (MCS3)	37.97	41.35
	5710	142	ax-SU (40MHz)	65/68.8 (MCS3)	37.91	41.23
	5530	106	ac (80MHz)	117/130 (MCS3)	75.40	80.57
	5690	138	ac (80MHz)	117/130 (MCS3)	75.50	81.40
	5530	106	ax-SU (80MHz)	567/600.5 (MCS3)	77.20	81.40
	5690	138	ax-SU (80MHz)	567/600.5 (MCS3)	77.25	81.76

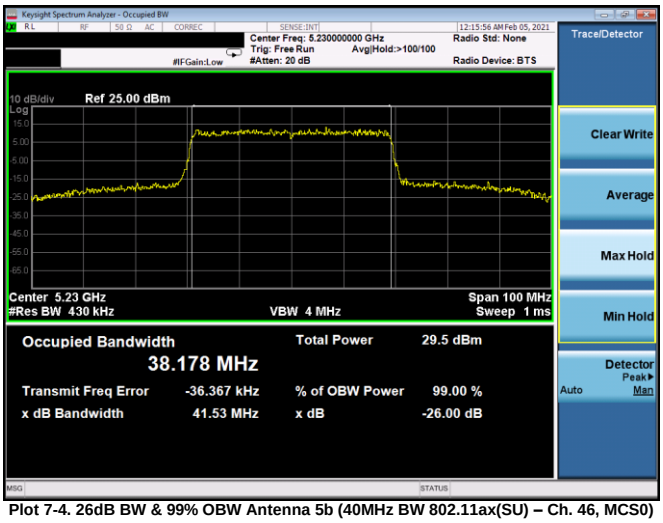
Table 7-3. Conducted Bandwidth Measurements Antenna 5b (Mid Data Rate)

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	99% Occupied BW [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	n (20MHz)	52/57.8 (MCS5)	17.79	21.06
	5200	40	n (20MHz)	52/57.8 (MCS5)	17.88	21.34
	5240	48	n (20MHz)	52/57.8 (MCS5)	17.95	21.76
	5180	36	ax-SU (20MHz)	135/143.4 (MCS11)	19.05	21.29
	5200	40	ax-SU (20MHz)	135/143.4 (MCS11)	19.10	24.52
	5240	48	ax-SU (20MHz)	135/143.4 (MCS11)	19.17	24.43
	5190	38	n (40MHz)	108/120 (MCS5)	36.50	41.23
	5230	46	n (40MHz)	108/120 (MCS5)	36.60	43.73
	5190	38	ax-SU (40MHz)	271/286.8 (MCS11)	37.91	41.41
	5230	46	ax-SU (40MHz)	271/286.8 (MCS11)	38.10	57.22
	5210	42	ac (80MHz)	292.5/325 (MCS5)	75.78	81.60
	5210	42	ax-SU (80MHz)	567/600.5 (MCS11)	77.07	81.29
Band 2A	5260	52	n (20MHz)	52/57.8 (MCS5)	17.88	22.15
	5280	56	n (20MHz)	52/57.8 (MCS5)	17.72	20.82
	5320	64	n (20MHz)	52/57.8 (MCS5)	17.83	21.03
	5260	52	ax-SU (20MHz)	135/143.4 (MCS11)	19.12	26.70
	5280	56	ax-SU (20MHz)	135/143.4 (MCS11)	19.14	21.74
	5320	64	ax-SU (20MHz)	135/143.4 (MCS11)	19.02	21.14
	5270	54	n (40MHz)	108/120 (MCS5)	36.62	45.69
	5310	62	n (40MHz)	108/120 (MCS5)	36.51	41.27
	5270	54	ax-SU (40MHz)	271/286.8 (MCS11)	38.07	51.81
	5310	62	ax-SU (40MHz)	271/286.8 (MCS11)	37.84	41.35
	5290	58	ac (80MHz)	292.5/325 (MCS5)	75.89	81.76
	5290	58	ax-SU (80MHz)	567/600.5 (MCS11)	77.09	81.79
Band 2C	5500	100	n (20MHz)	52/57.8 (MCS5)	17.80	20.86
	5580	116	n (20MHz)	52/57.8 (MCS5)	17.90	21.25
	5720	144	n (20MHz)	52/57.8 (MCS5)	17.82	21.13
	5500	100	ax-SU (20MHz)	135/143.4 (MCS11)	19.03	21.32
	5580	116	ax-SU (20MHz)	135/143.4 (MCS11)	19.03	21.00
	5720	144	ax-SU (20MHz)	135/143.4 (MCS11)	19.01	21.33
	5510	102	n (40MHz)	108/120 (MCS5)	36.47	41.37
	5550	110	n (40MHz)	108/120 (MCS5)	36.59	41.31
	5710	142	n (40MHz)	108/120 (MCS5)	36.58	41.93
	5510	102	ax-SU (40MHz)	271/286.8 (MCS11)	37.91	41.47
	5550	110	ax-SU (40MHz)	271/286.8 (MCS11)	37.99	47.97
	5710	142	ax-SU (40MHz)	271/286.8 (MCS11)	37.97	44.39
	5530	106	ac (80MHz)	292.5/325 (MCS5)	75.88	81.41
	5690	138	ac (80MHz)	292.5/325 (MCS5)	76.10	82.00
	5530	106	ax-SU (80MHz)	567/600.5 (MCS11)	77.14	81.42
	5690	138	ax-SU (80MHz)	567/600.5 (MCS11)	77.14	81.85

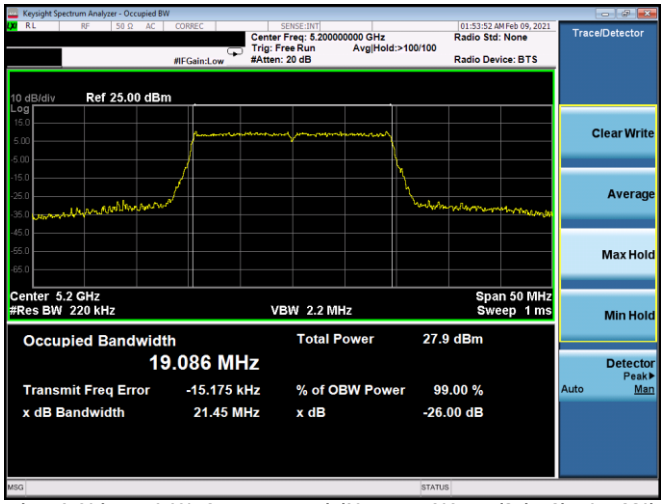
Table 7-4. Conducted Bandwidth Measurements Antenna 5b (High Data Rate)



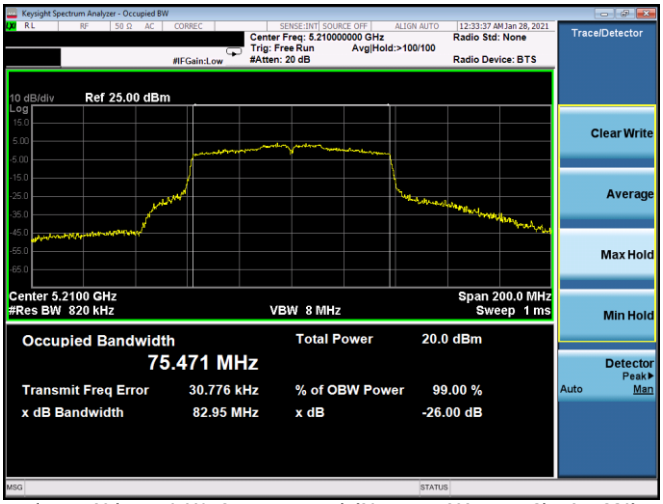
Plot 7-1. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11n – Ch. 40, MCS0)



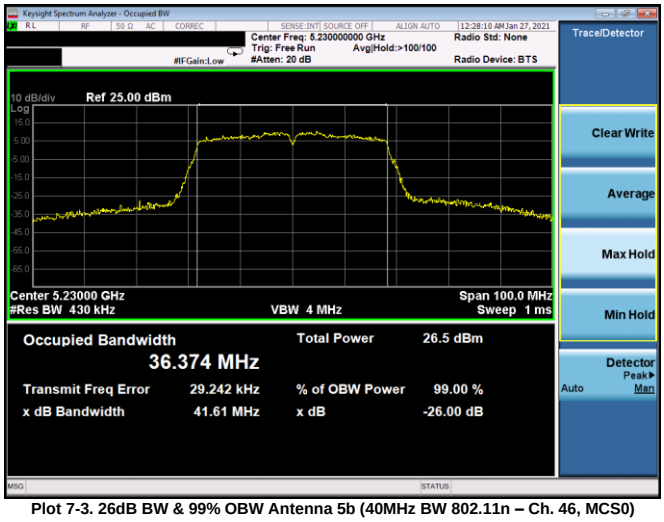
Plot 7-4. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11ax(SU) – Ch. 46, MCS0)



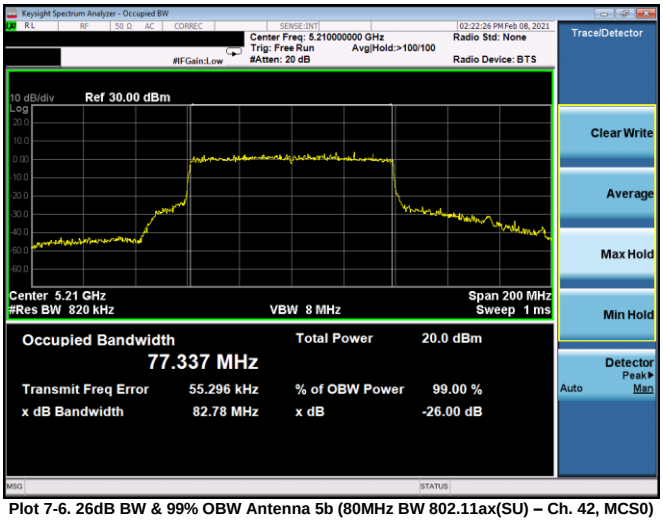
Plot 7-2. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11ax(SU) – Ch. 40, MCS0)



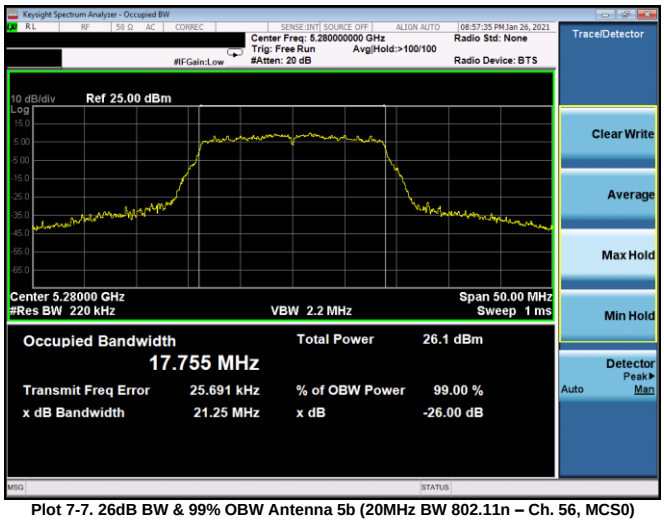
Plot 7-5. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ac – Ch. 42, MCS0)



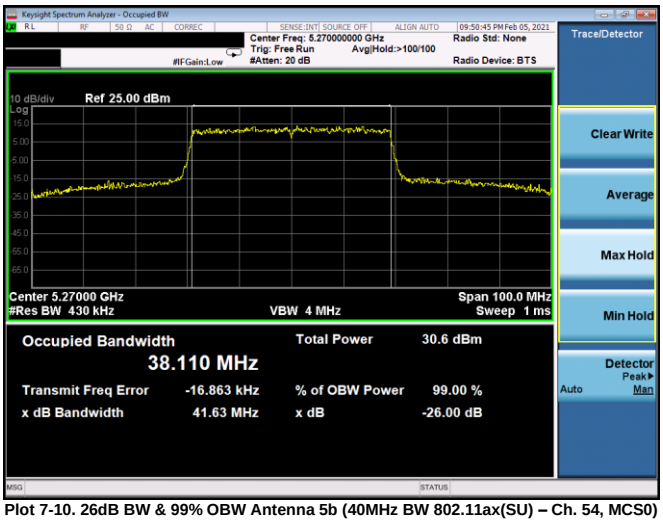
Plot 7-3. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11n – Ch. 46, MCS0)



Plot 7-6. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ax(SU) – Ch. 42, MCS0)

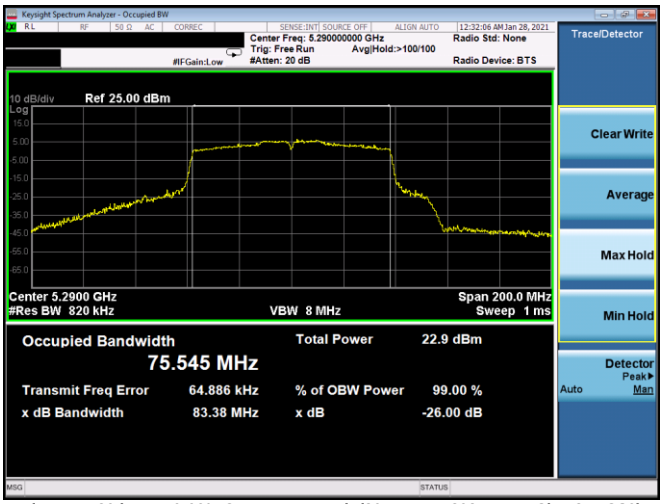


Plot 7-7. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11n – Ch. 56, MCS0)

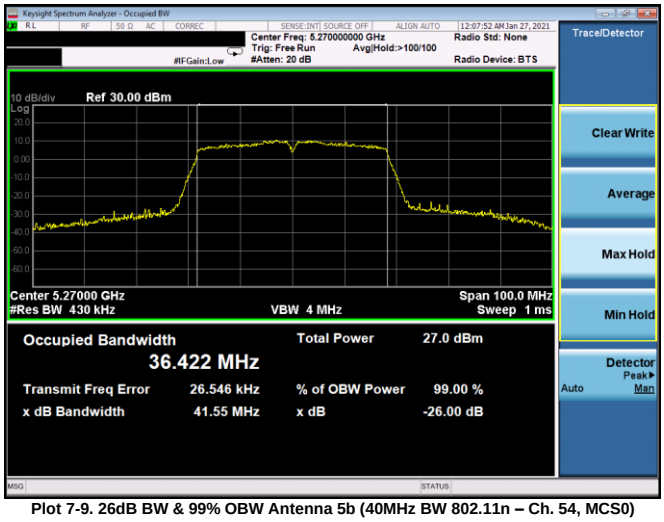


Plot 7-10. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11ax(SU) – Ch. 54, MCS0)

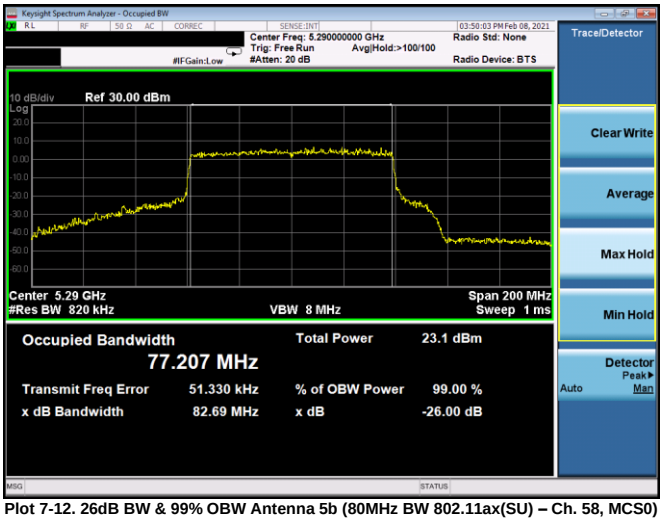
Plot 7-8. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11ax(SU) – Ch. 56, MCS0)



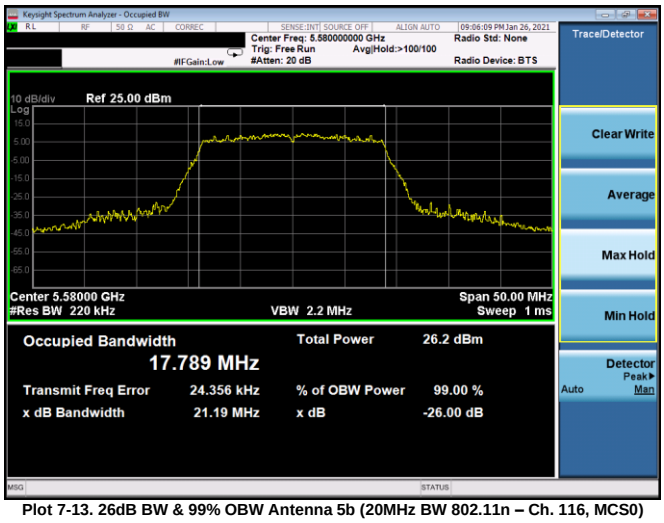
Plot 7-11. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ac – Ch. 58, MCS0)



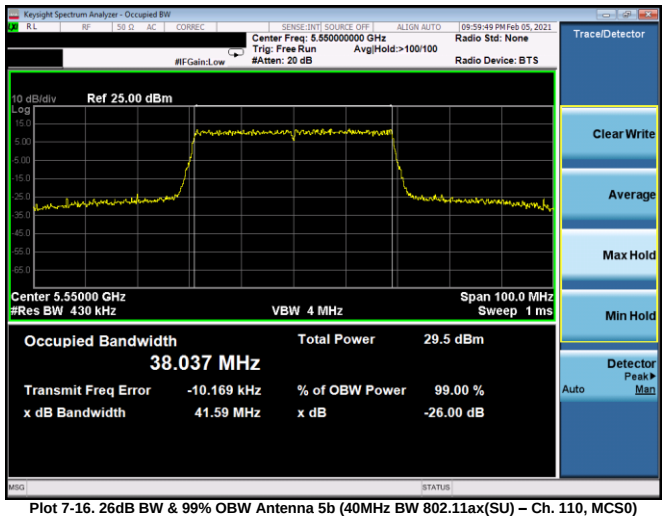
Plot 7-9. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11n – Ch. 54, MCS0)



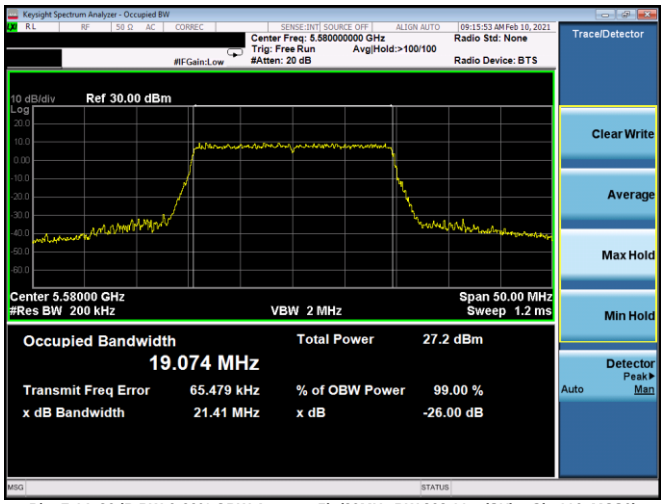
Plot 7-12. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ax(SU) – Ch. 58, MCS0)



Plot 7-13. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11n – Ch. 116, MCS0)

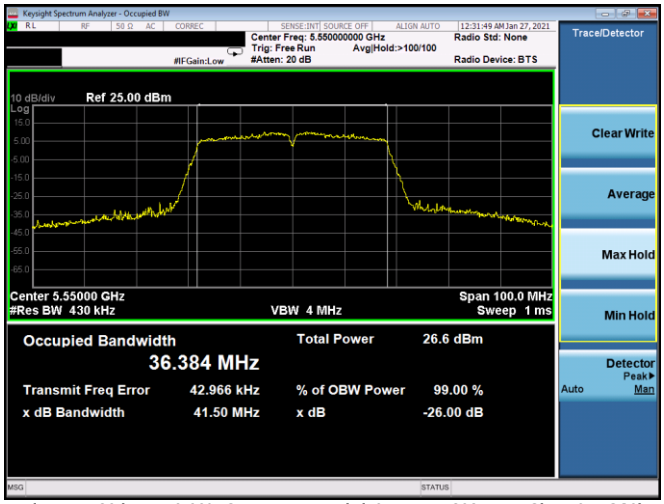


Plot 7-16. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11ax(SU) – Ch. 110, MCS0)

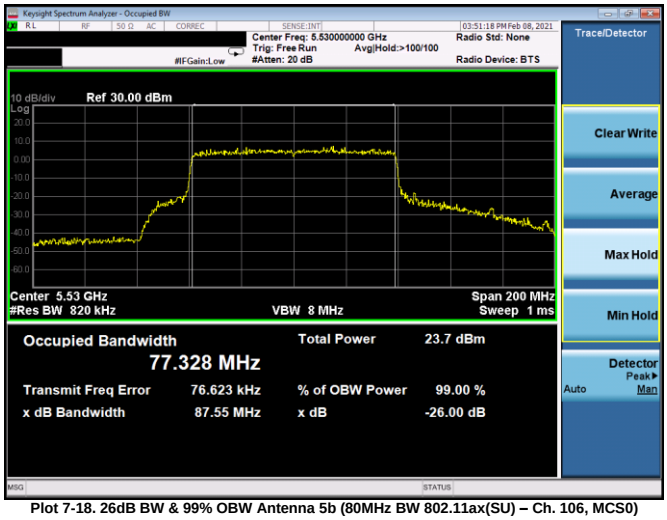


Plot 7-14. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11ax(SU) – Ch. 116, MCS0)

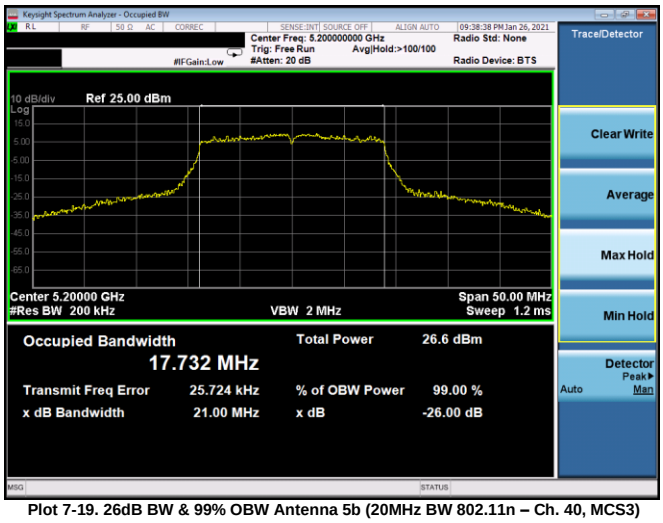
Plot 7-17. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ac – Ch. 106, MCS0)



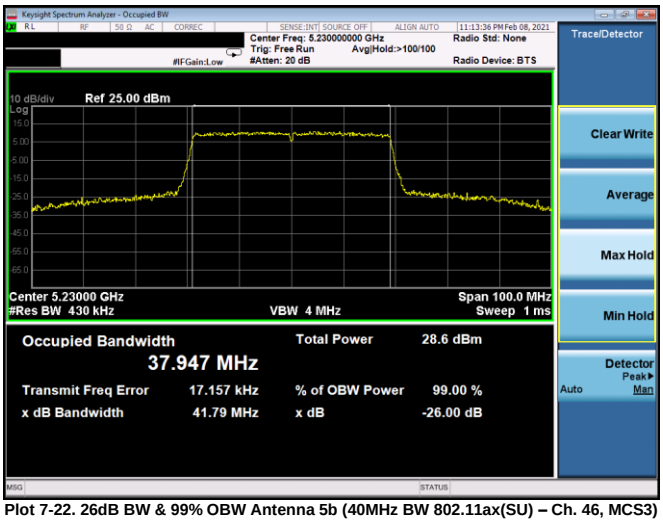
Plot 7-15. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11n – Ch. 110, MCS0)



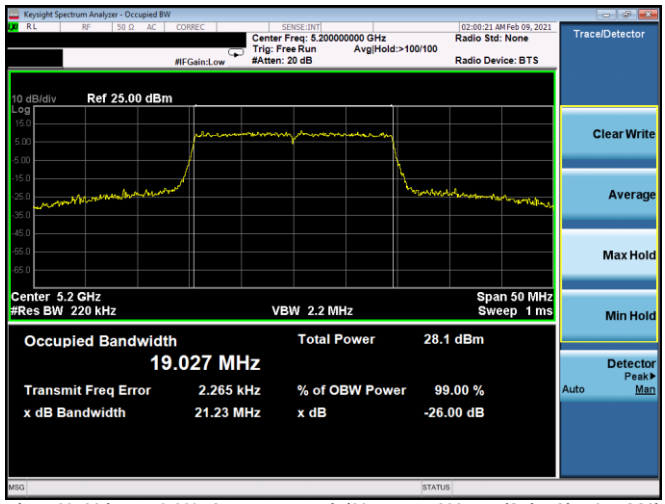
Plot 7-18. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ax(SU) – Ch. 106, MCS0)



Plot 7-19. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11n – Ch. 40, MCS3)

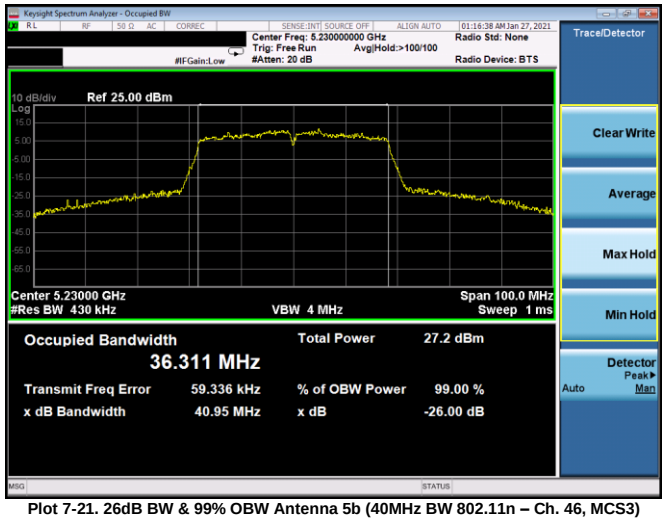


Plot 7-22. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11ax(SU) – Ch. 46, MCS3)

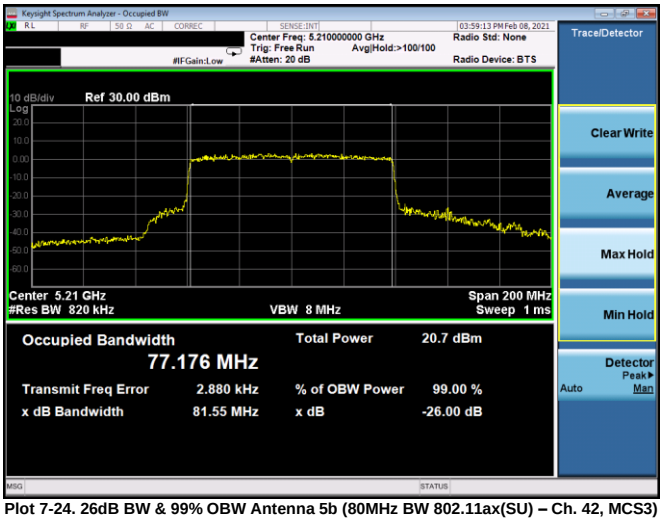


Plot 7-20. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11ax(SU) – Ch. 40, MCS3)

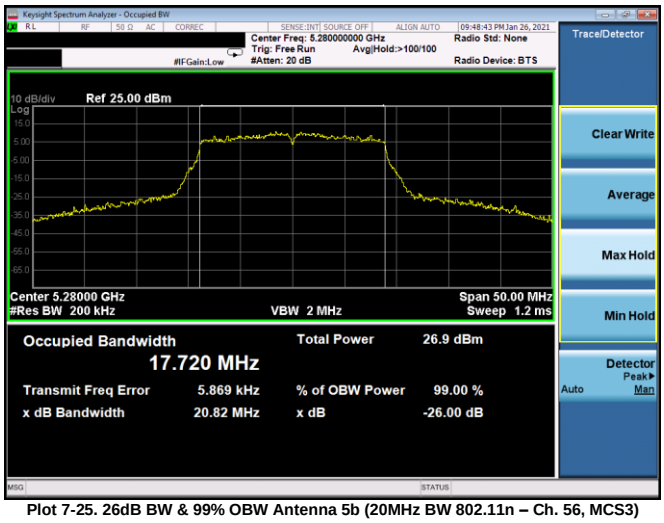
Plot 7-23. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ac – Ch. 42, MCS3)



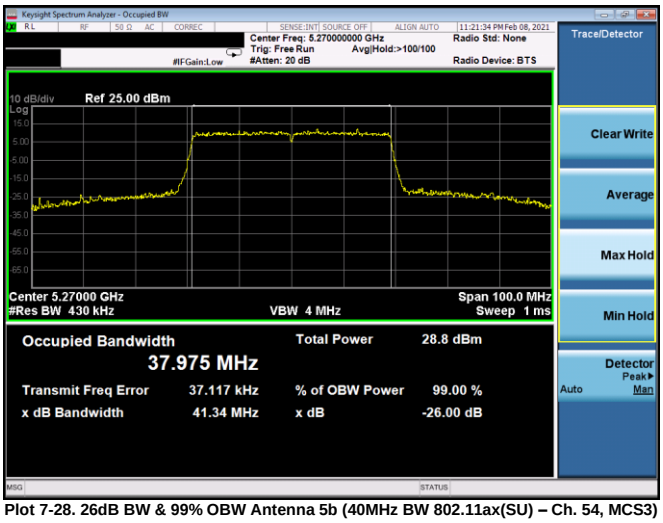
Plot 7-21. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11n – Ch. 46, MCS3)



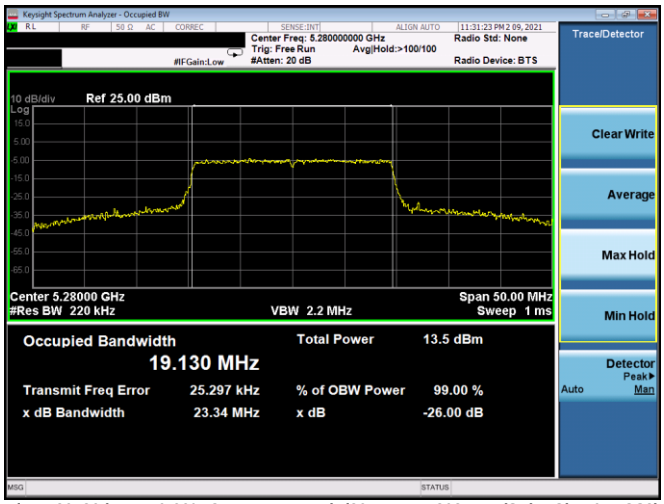
Plot 7-24. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ax(SU) – Ch. 42, MCS3)



Plot 7-25. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11n – Ch. 56, MCS3)

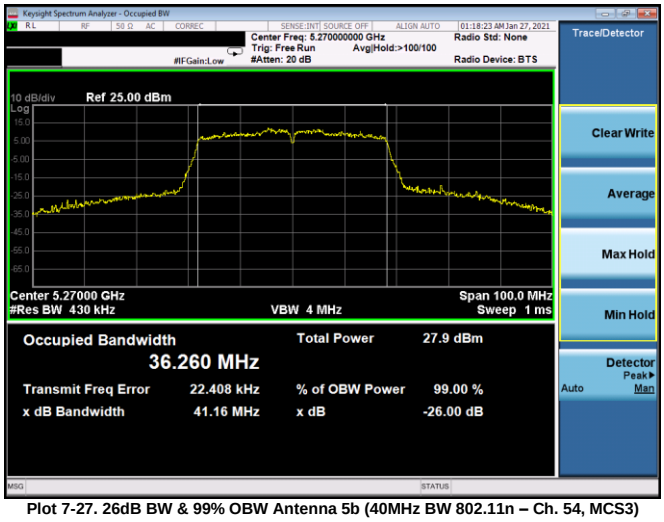


Plot 7-28. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11ax(SU) – Ch. 54, MCS3)

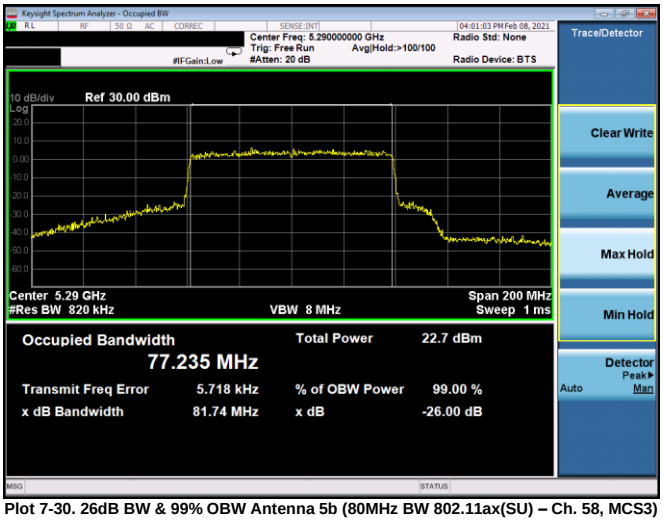


Plot 7-26. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11ax(SU) – Ch. 56, MCS3)

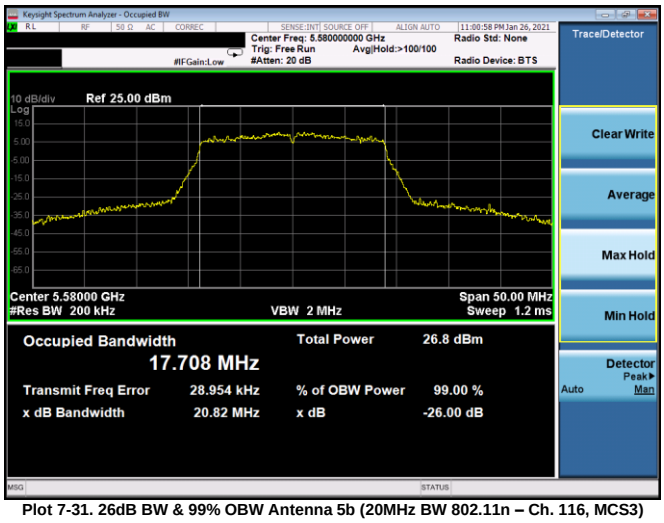
Plot 7-29. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ac – Ch. 58, MCS3)



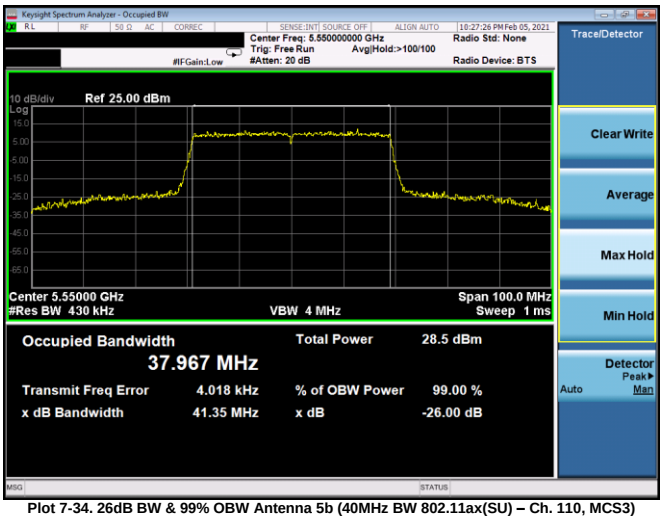
Plot 7-27. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11n – Ch. 54, MCS3)



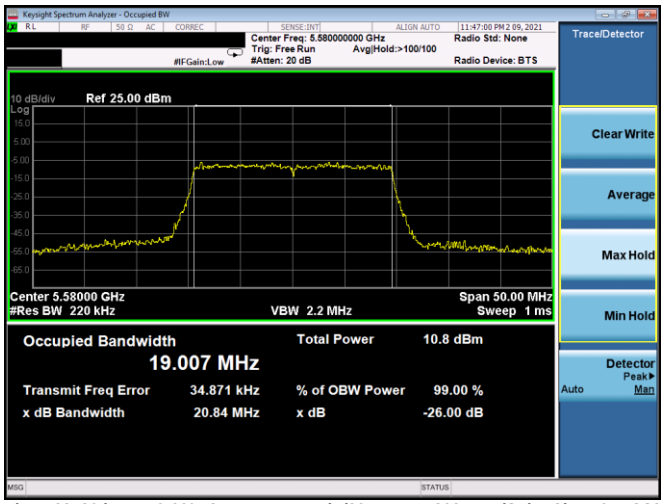
Plot 7-30. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ax(SU) – Ch. 58, MCS3)



Plot 7-31. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11n – Ch. 116, MCS3)

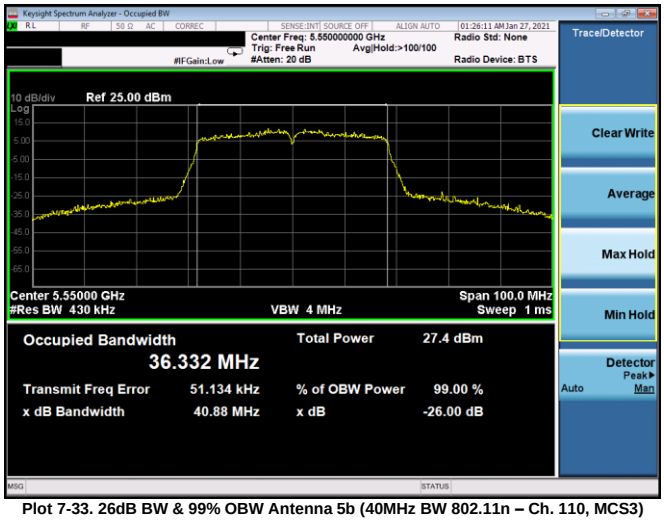


Plot 7-34. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11ax(SU) – Ch. 110, MCS3)

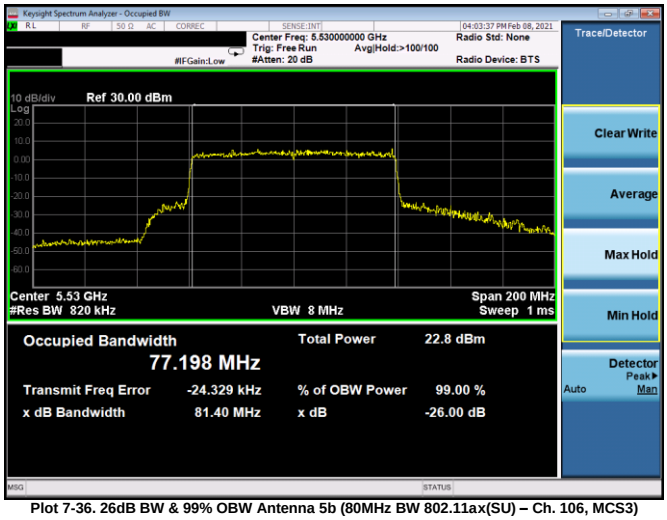


Plot 7-32. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11ax(SU) – Ch. 116, MCS3

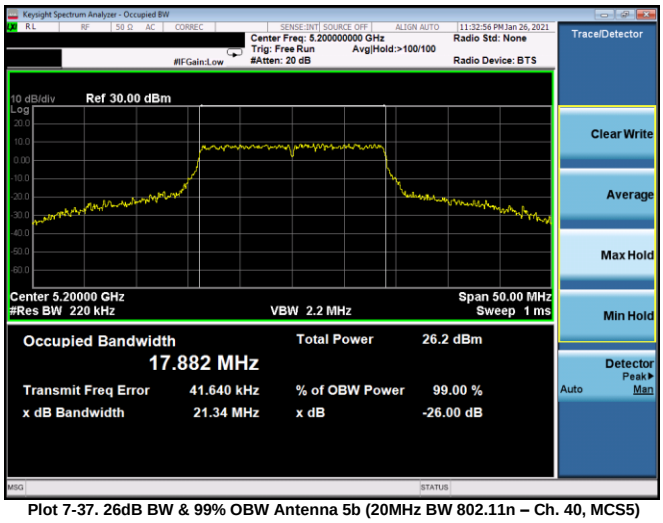
Plot 7-35. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ac – Ch. 106, MCS3)



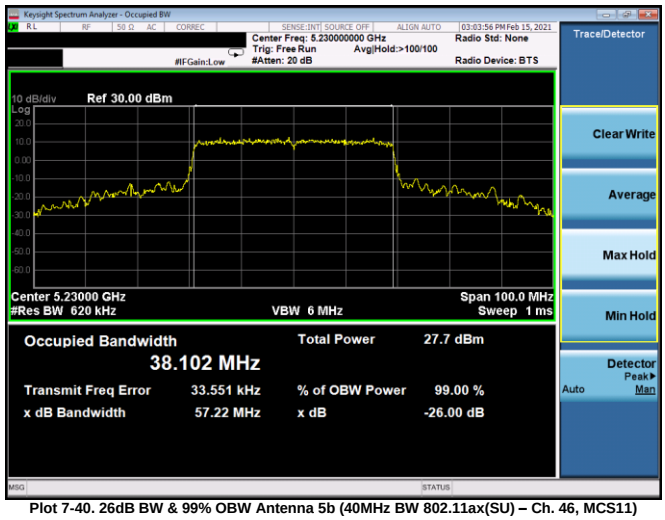
Plot 7-33. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11n – Ch. 110, MCS3)



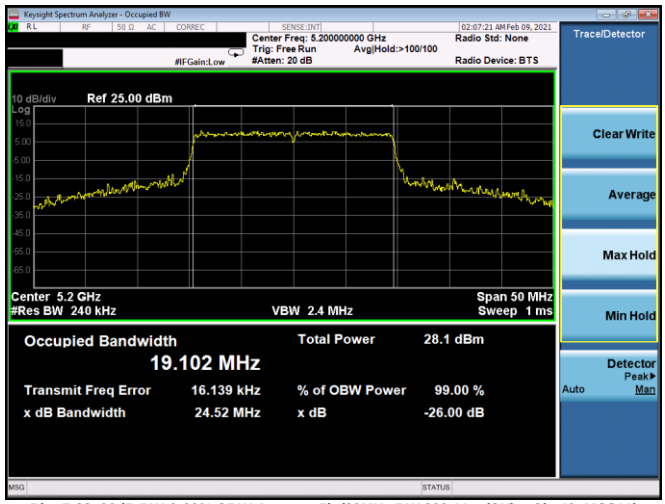
Plot 7-36. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ax(SU) – Ch. 106, MCS3)



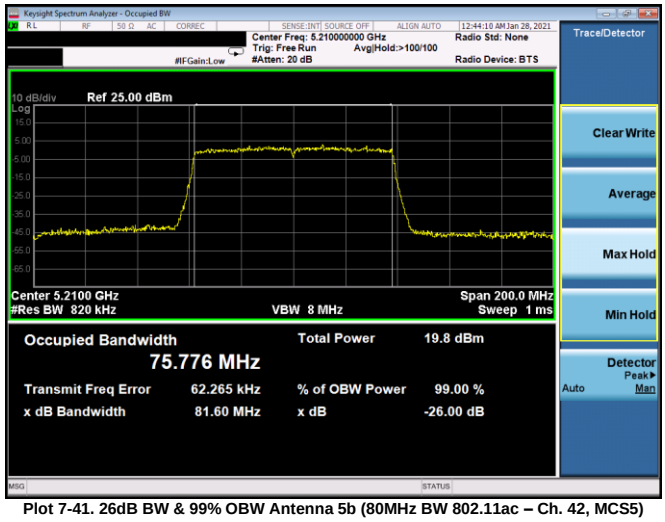
Plot 7-37. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11n – Ch. 40, MCS5)



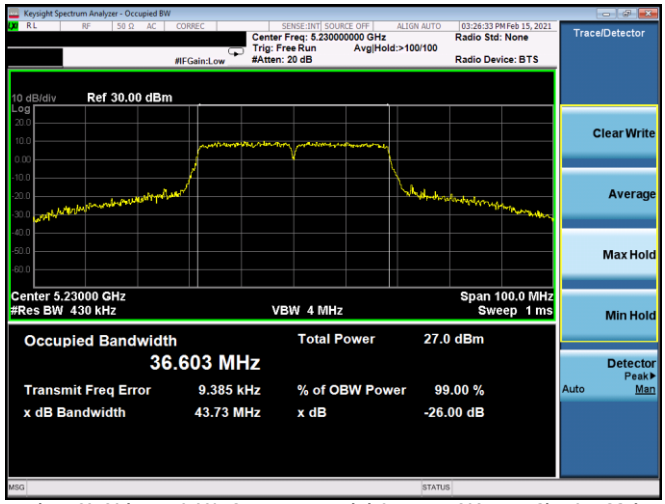
Plot 7-40. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11ax(SU) – Ch. 46, MCS11)



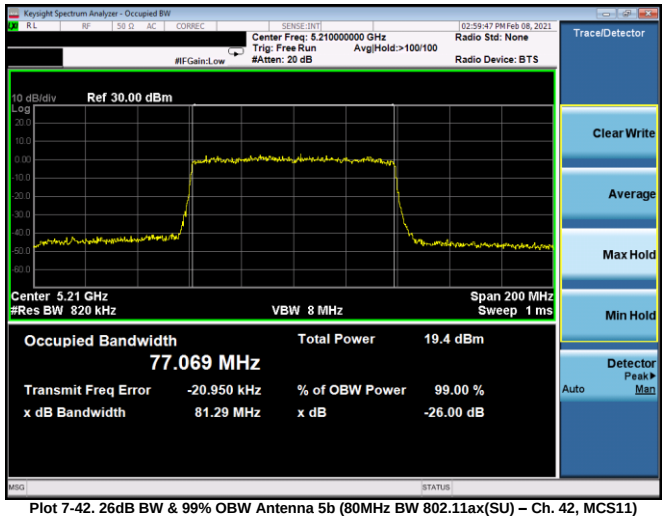
Plot 7-38. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11ax(SU) – Ch. 40, MCS11)



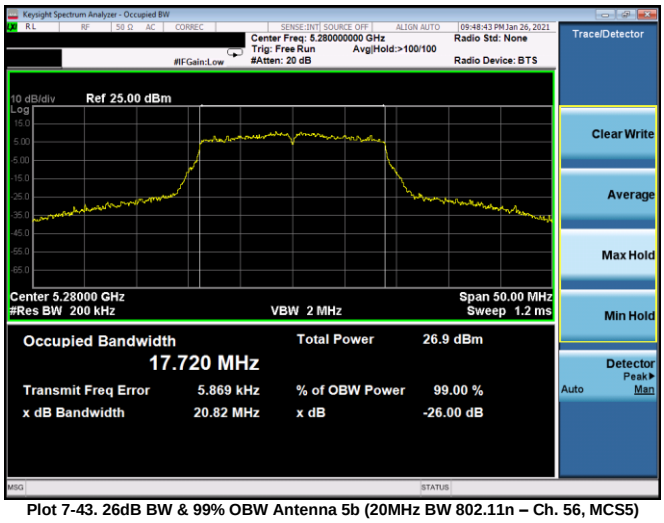
Plot 7-41. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ac – Ch. 42, MCS5)



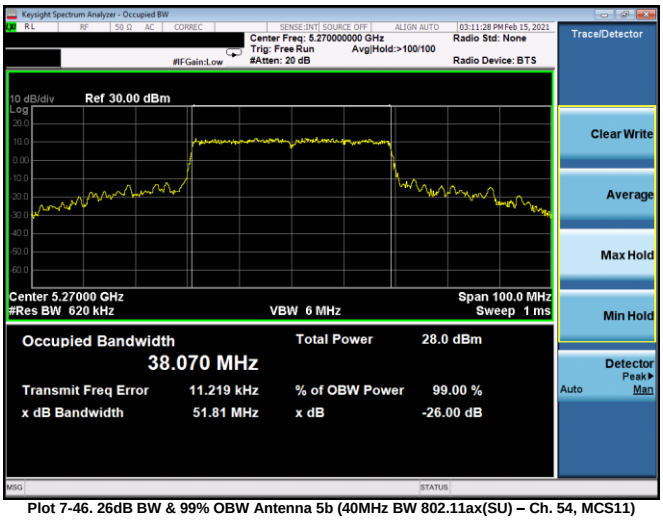
Plot 7-39. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11n – Ch. 46, MCS5)



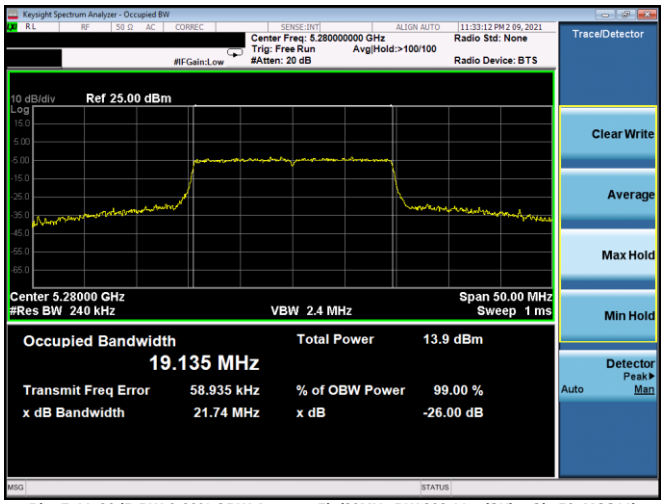
Plot 7-42. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ax(SU) – Ch. 42, MCS11)



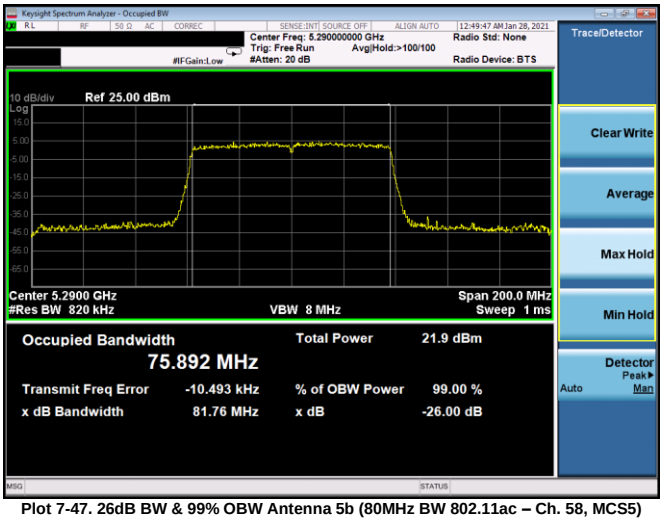
Plot 7-43. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11n – Ch. 56, MCS5)



Plot 7-46. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11ax(SU) – Ch. 54, MCS11)

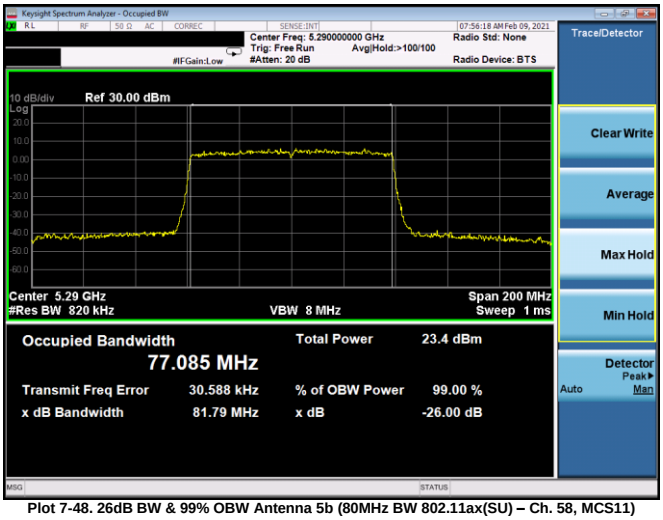


Plot 7-44. 26dB BW & 99% OBW Antenna 5b (20MHz BW 802.11ax(SU) – Ch. 56, MCS11)



Plot 7-47. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ac – Ch. 58, MCS5)

Plot 7-45. 26dB BW & 99% OBW Antenna 5b (40MHz BW 802.11n – Ch. 54, MCS5)



Plot 7-48. 26dB BW & 99% OBW Antenna 5b (80MHz BW 802.11ax(SU) – Ch. 58, MCS11)