



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:

08/02/2022 – 09/14/2022

Test Site/Location:

Element Washington DC LLC, Morgan Hill, CA, USA

Test Report Serial No.:

1C2205090023-16.BCG

FCC ID:	BCGA2757
IC:	579C-A2757
APPLICANT:	Apple Inc.

Application Type:

Certification

Model/HVIN:

A2757 (A2777)

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.

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.



RJ Ortiz

Executive Vice President



FCC ID: BCGA2757 IC: 579C-A2757	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N: 1C2205090023-16.BCG	Test Dates: 08/02/2022 – 09/14/2022	EUT Type: Tablet Device	Page 1 of 534

V 10.5 12/15/2021

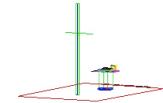
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UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO								CDD/SDM Primary								CDD/SDM Diversity															
				Antenna 3c				Antenna 3a				Antenna 1b				Antenna 3c				Antenna 3a				Summed				Antenna 3c							
				Max. Power (mW)	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	99.770	19.99	100.000	20.00	99.312	19.97	49.545	16.95	49.888	16.98	99.083	19.96	49.774	16.97	49.091	16.91	98.855	19.95	50.003	16.99	49.317	16.93	98.401	19.93	80.215	19.25	172.187	22.36				
		802.11a/n	5260 - 5320	99.541	19.98	99.541	19.98	97.499	19.89	49.545	16.95	49.431	16.94	98.401	19.93	50.003	16.99	49.317	16.93	98.401	19.93	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36						
		802.11a/n	5500 - 5720	99.541	19.98	99.541	19.98	97.317	19.88	49.317	16.93	50.003	16.99	98.176	19.92	49.659	16.96	49.888	16.98	98.855	19.95	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36						
		802.11a/n	5745 - 5825	108.893	20.37	111.944	20.49	111.173	20.46	110.154	20.42	108.643	20.36	218.273	23.39	111.944	20.49	20.49	111.944	20.49	111.944	20.49	111.686	20.48	221.820	23.46	111.686	20.48	221.820	23.46					
1	40	802.11a	5190 - 5230	86.497	19.37	87.902	19.44	87.498	19.42	87.297	19.41	84.723	19.28	172.187	22.36	86.497	19.37	87.700	19.43	174.181	22.41	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36						
2A		802.11a	5270 - 5310	86.896	19.39	87.902	19.44	85.507	19.32	88.105	19.45	86.920	19.49	177.011	22.48	87.902	19.44	84.140	19.25	172.187	22.36	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36						
2C		802.11a	5510 - 5710	86.099	19.35	88.512	19.47	86.099	19.35	88.716	19.48	88.308	19.46	177.011	22.48	87.096	19.40	86.696	19.38	171.791	22.35	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36						
3		802.11a/n	5755 - 5795	87.700	19.43	88.896	19.39	88.306	19.46	88.105	19.45	87.700	19.43	174.985	22.43	88.920	19.49	88.308	19.46	174.582	22.42	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36						
1	80	802.11ac	5210	32.434	15.11	33.497	15.25	31.769	15.02	24.210	13.84	24.434	13.88	48.641	16.87	121.061	20.83	59.556	17.75	59.841	17.77	119.399	20.77	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36				
2A		802.11ac	5290	17.179	12.35	17.539	12.44	12.48	15.417	18.76	18.89	19.57	50.954	17.85	60.117	17.79	121.061	20.83	59.556	17.75	59.841	17.77	119.399	20.77	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36			
2C		802.11ac	5350 - 5690	94.189	19.74	93.972	19.73	98.628	19.94	94.046	19.75	98.401	19.93	192.752	22.85	94.842	19.77	97.949	19.91	192.752	22.85	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36						
3		802.11ac	5775	57.775	18.03	53.333	18.02	53.333	17.27	55.976	17.48	109.396	20.39	55.081	17.41	54.828	17.39	109.901	20.41	55.081	17.41	109.901	20.41	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36				
1	20	802.11ax (SU)	5180 - 5240	86.865	19.95	99.312	20.00	97.105	19.77	47.424	16.76	49.091	16.91	96.608	19.85	49.204	16.92	49.317	16.93	97.949	19.91	50.003	16.99	49.317	16.93	98.401	19.93	80.215	19.25	172.187	22.36				
2A		802.11ax (SU)	5260 - 5320	86.865	19.95	99.312	20.00	97.105	19.77	47.424	16.76	49.091	16.91	96.608	19.85	49.204	16.92	49.317	16.93	97.949	19.91	50.003	16.99	49.317	16.93	98.401	19.93	80.215	19.25	172.187	22.36				
2C		802.11ax (SU)	5500 - 5720	99.770	19.99	99.770	19.99	98.688	19.98	49.431	16.94	98.175	19.92	49.317	16.93	49.659	16.96	49.888	16.98	49.888	16.98	98.855	19.95	50.003	16.99	49.317	16.93	98.401	19.93	80.215	19.25	172.187	22.36		
3		802.11ax (SU)	5745 - 5825	110.154	20.42	111.686	20.48	110.408	20.43	110.662	20.44	111.686	20.48	222.331	23.47	111.944	20.49	110.408	20.43	219.786	23.42	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36						
1	40	802.11ax (SU)	5190 - 5230	86.700	19.43	87.292	19.42	87.700	19.43	87.902	19.44	87.292	19.44	87.507	19.37	174.582	22.42	85.507	19.32	85.497	19.37	171.791	22.35	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36				
2A		802.11ax (SU)	5510 - 5710	87.700	19.43	87.096	19.44	85.507	19.32	88.105	19.45	86.920	19.49	177.011	22.48	87.902	19.44	84.140	19.25	172.187	22.36	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36						
2C		802.11ax (SU)	5755 - 5795	87.902	19.44	88.512	19.47	85.704	19.33	89.298	19.36	85.507	19.32	171.002	22.33	87.096	19.40	86.696	19.38	171.791	22.35	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36						
3		802.11ax (SU)	5775	57.775	18.03	17.539	12.44	12.48	15.417	18.76	18.89	19.57	60.954	17.85	10.117	17.26	121.060	20.83	59.556	17.75	59.841	17.77	119.399	20.77	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36			
1	80	802.11ac	5210	32.434	15.11	33.497	15.25	31.769	15.02	24.210	13.84	24.434	13.88	48.641	16.87	121.061	20.83	24.434	16.87	24.009	16.81	174.181	22.41	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36				
2A		802.11ac	5290	17.179	12.35	17.539	12.44	12.48	15.417	18.76	18.89	19.57	50.954	17.85	31.261	14.95	15.382	18.77	84.528	19.27	84.140	19.25	172.187	22.36	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36			
2C		802.11ac	5350 - 5690	94.189	19.74	93.972	19.73	98.628	19.94	94.046	19.94	98.401	19.93	192.752	22.85	94.842	19.91	97.949	19.91	192.752	22.85	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36						
3		802.11ac	5775	57.775	18.03	53.333	18.02	53.333	17.27	55.976	17.48	109.396	20.39	55.081	17.41	54.828	17.39	109.901	20.41	55.081	17.41	109.901	20.41	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36				
1	20	802.11ax (SU)	5180 - 5240	86.719	19.81	99.083	19.96	98.855	19.95	98.401	19.93	97.724	19.90	99.540	19.82	193.642	22.87	99.770	19.99	50.003	16.99	49.317	16.93	98.401	19.93	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36		
2A		802.11ax (SU)	5260 - 5320	100.000	20.00	99.628	19.94	98.175	19.92	48.084	18.62	50.003	16.99	98.175	19.92	49.204	16.92	49.888	16.98	97.724	19.90	50.003	16.99	49.317	16.93	98.401	19.93	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36
2C		802.11ax (SU)	5500 - 5720	100.000	20.00	99.770	19.99	97.700	19.99	48.084	18.62	50.003	16.99	98.175	19.92	49.317	16.93	49.659	16.96	98.855	19.95	50.003	16.99	49.317	16.93	98.401	19.93	80.215	19.25	172.187	22.36	80.215	19.25	172.187	22.36
3		802.11ax (SU)	5745 - 5825	108.893	20.37	111.944	20.49	110.154	20.42	108.643	20.36	218.273	23.39	111.944	20.49	20.49	111.944	20.49	111.944	20.49	111.686	20.48	221.820	23.46	80.215	19.25									

UNII Band	Channel Bandwidth (MHz)	Mode	Tx Frequency (MHz)	SISO						CDD/SDM Primary						CDD/SDM Diversity																	
				Antenna 3c			Antenna 3a			Antenna 1b			Antenna 3c			Antenna 3a			Summed			Antenna 3c			Antenna 1b			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)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)																
1	20	802.11a/n	5180 - 5240	39.446	15.96	39.537	15.97	39.719	15.99	24.717	13.93	24.774	13.94	49.656	16.96	25.119	14.00	25.003	13.98	49.659	16.96	25.003	13.98	49.659	16.96	25.003	13.98	49.659	16.96				
2A		802.11a/n	5260 - 5320	100.000	20.00	98.626	19.94	98.175	19.92	48.094	16.82	50.033	16.99	49.175	16.96	49.204	16.92	49.888	16.98	49.888	16.98	49.888	16.98	49.888	16.98	49.888	16.98	49.888	16.98				
2C		802.11a/n	5500 - 5720	100.000	20.00	99.770	19.99	99.770	19.99	50.119	17.00	50.003	16.99	100.000	20.00	49.659	16.96	50.003	16.99	49.659	16.96	50.003	16.99	49.659	16.96	50.003	16.99	49.659	16.96				
3		802.11a/n	5745 - 5825	112.202	20.50	111.944	20.49	111.173	20.46	112.202	20.50	223.367	23.49	111.429	20.47	111.686	20.48	219.280	23.41	111.686	20.48	219.280	23.41	111.686	20.48	219.280	23.41	111.686	20.48				
1	40	802.11a/n	5190 - 5240	69.502	18.42	70.307	18.47	69.343	18.41	44.259	16.46	43.451	16.38	87.700	19.43	44.668	16.50	44.055	16.44	88.716	19.48	44.055	16.44	88.716	19.48	44.055	16.44	88.716	19.48				
2A		802.11a/n	5220 - 5310	88.716	19.48	87.498	19.42	88.716	19.48	87.902	19.44	88.512	19.47	176.604	22.47	85.507	19.32	86.298	19.36	171.791	22.35	86.298	19.36	171.791	22.35	86.298	19.36	171.791	22.35				
2C		802.11a/n	5510 - 5710	67.700	19.43	88.512	19.47	88.716	19.48	88.716	19.48	87.297	19.41	124.451	20.35	86.497	19.37	87.096	19.40	173.780	22.40	86.497	19.37	87.096	19.40	86.497	19.37	87.096	19.40				
3		802.11a/n	5755 - 5795	67.902	19.44	87.096	19.40	88.105	19.45	87.096	19.40	122.982	22.38	86.298	19.36	88.512	19.47	174.181	22.41	86.298	19.36	174.181	22.41	86.298	19.36	174.181	22.41						
1	80	802.11aec	5210	29.717	14.73	28.708	14.58	28.907	14.61	21.380	13.30	21.277	13.37	43.152	16.35	21.727	13.37	43.251	16.36	21.478	13.32	43.251	16.36	21.478	13.32	43.251	16.36	21.478	13.32				
2A		802.11aec	5290	17.660	12.47	17.378	12.40	16.982	12.30	11.940	10.77	12.331	10.91	24.266	13.85	12.531	10.98	12.589	11.00	25.119	14.00	12.589	11.00	25.119	14.00	12.589	11.00	25.119	14.00				
2C		802.11aec	5530 - 5690	99.541	19.98	98.626	19.94	98.401	19.93	97.724	19.90	95.940	19.82	193.642	22.87	99.770	19.99	95.940	19.82	195.884	22.92	95.940	19.82	195.884	22.92	95.940	19.82	195.884	22.92				
3		802.11aec	5775	58.884	17.70	62.951	17.99	62.087	17.93	48.978	16.90	49.659	16.96	98.628	19.94	49.431	16.94	49.204	16.92	98.628	19.94	49.204	16.92	98.628	19.94	49.204	16.92	98.628	19.94				
1	20	802.11ax (SU)	5180 - 5240	39.264	15.94	39.811	16.00	39.811	16.00	24.774	13.94	25.003	13.98	49.774	16.97	99.541	19.98	50.003	16.99	49.888	16.98	99.541	19.98	49.888	16.98	99.541	19.98	49.888	16.98				
2A		802.11ax (SU)	5260 - 5320	99.541	19.98	99.312	19.97	100.000	20.00	50.119	17.00	49.774	16.97	99.541	19.98	50.119	17.00	49.888	16.98	99.541	19.98	50.119	17.00	49.888	16.98	99.541	19.98	49.888	16.98				
2C		802.11ax (SU)	5500 - 5720	88.665	18.38	70.630	18.49	69.663	18.43	43.351	16.37	43.752	16.41	87.096	19.40	43.152	16.35	43.251	16.36	86.497	19.37	43.251	16.36	86.497	19.37	43.251	16.36	86.497	19.37				
3		802.11ax (SU)	5745 - 5825	112.202	20.50	111.429	20.47	111.173	20.46	111.429	20.47	221.820	23.46	112.202	20.50	110.917	20.45	221.309	23.45	110.917	20.45	221.309	23.45	110.917	20.45	221.309	23.45	110.917	20.45				
1	40	802.11ax (SU)	5190 - 5240	66.696	19.38	88.303	19.46	88.920	19.49	88.716	19.48	87.700	19.43	176.604	22.47	86.896	19.39	85.310	19.31	172.187	22.36	85.310	19.31	172.187	22.36	85.310	19.31	172.187	22.36	85.310	19.31		
2A		802.11ax (SU)	5270 - 5310	87.498	19.42	88.920	19.49	87.297	19.41	86.696	19.38	87.700	19.43	174.582	22.42	86.099	19.35	88.512	19.47	174.582	22.42	86.099	19.35	174.582	22.42	86.099	19.35	174.582	22.42	86.099	19.35		
2C		802.11ax (SU)	5510 - 5710	88.620	19.49	88.896	19.39	88.716	19.48	87.096	19.40	85.704	19.33	12.298	19.40	86.497	19.37	88.308	19.46	175.198	22.43	88.308	19.46	175.198	22.43	88.308	19.46	175.198	22.43	88.308	19.46		
3		802.11ax (SU)	5755 - 5795	86.298	19.36	85.114	19.30	86.896	19.39	87.700	19.43	86.716	19.48	176.604	22.47	86.497	19.37	88.308	19.46	174.985	22.43	88.308	19.46	174.985	22.43	88.308	19.46	174.985	22.43	88.308	19.46		
1	80	802.11ax (SU)	5190 - 5240	87.175	14.44	27.303	14.33	27.104	14.30	20.184	13.05	20.184	13.05	40.365	16.80	221.309	23.45	111.173	19.45	20.46	10.944	20.38	220.293	23.43	111.173	19.45	20.46	10.944	20.38	220.293	23.43	111.173	19.45
2A		802.11ax (SU)	5270 - 5310	89.125	19.50	88.512	19.47	87.096	19.40	79.433	19.00	77.804	18.91	157.398	21.97	77.983	18.92	152.757	21.84	78.417	18.74	152.757	21.84	78.417	18.74	152.757	21.84	78.417	18.74				
2C		802.11ax (SU)	5510 - 5710	89.125	19.50	87.902	19.44	88.716	19.48	89.125	19.50	117.828	22.50	88.512	19.47	88.105	19.45	176.604	22.47	88.308	19.46	176.604	22.47	88.308	19.46	176.604	22.47	88.308	19.46				
3		802.11ax (SU)	5755 - 5795	88.512	19.47	85.704	19.33	86.896	19.39	87.498	19.42	85.114	19.30	172.584	22.37	87.700	19.43	95.051	19.87	95.855	19.95	95.855	19.95	95.855	19.95	95.855	19.95	95.855	19.95				
1	20	802.11ax (SU)	5190 - 5240	24.946	15.97	39.294	16.01	39.710	15.99	24.046	12.07	24.946	13.07	49.659	16.96	221.309	23.45	111.173	19.45	20.46	10.944	20.38	220.293	23.43	111.173	19.45	20.46	10.944	20.38	220.293	23.43	111.173	19.45
2A		802.11ax (SU)	5260 - 5320	99.541	19.89	97.049	19.91	99.083	19.96	40.091	16.01	50.119	17.00	99.312	19.97	49.317	16.93	50.119	17.00	99.541	19.98	49.888	16.98	49.888	16.98	49.888	16.98	49.888	16.98				
2C		802.11ax (SU)	5500 - 5720	96.383	19.84	99.628	19.94	98.628	19.94	50.119	17.00	99.541	19.98	50.003	16.99	50.119	17.00	99.770	19.99	50.119	17.00	99.770	19.99	50.119	17.00	99.770	19.99						
3		802.11ax (SU)	5745 - 5825	112.202	20.50	110.917	20.45	110.154	20.42	112.202	20.50	109.144	20.38	221.309	23.45	110.917	20.45	221.309	23.45	110.917	20.45	221.309	23.45	110.917	20.45	221.309	23.45	110.917	20.45				
1	40	802.11ax (SU)	5190 - 5240	18.44	14.44	27.303	14.33	27.104	14.30	20.184	13.05	20.184	13.05	40.365	16.80	220.740	23.45	104.361	16.47	20.730	13.08	40.730	16.10	104.361	16.47	20.730	13.08	104.361	16.47	20.730	13.08		
2A		802.11ax (SU)	5270 - 5310	18.42	14.42	17.668	14.21	15.704																									

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 Element Washington DC LLC Test Location

These measurement tests were conducted at the Element 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 Element Washington DC LLC located in Morgan Hill, CA 95037, U.S.A.

- Element Washington DC LLC 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.
- Element Washington DC LLC 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).
- Element Washington DC LLC facility is a registered (22831) test laboratory with the site description on file with ISED.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Tablet Device FCC ID: BCGA2757** and **IC: 579C-A2757**. 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.: W07L2L17MW, M419GH393R, C590R6TR4P, TPF4T67Q9F, C47217501601K7N4A

2.2 Device Capabilities

This device contains the following capabilities:

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

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

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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 3c	Antenna 3a	Antenna 1b	CDD (Primary)	CDD (Diversity)
5GHz	a (Low Rate)	98.8	98.6	98.8	98.4	98.2
	a (Mid Rate)	95.5	94.9	95.3	95.4	94.6
	a (High Rate)	91.8	93.0	90.3	88.1	89.0
	n (HT20) (Low Rate)	98.9	98.9	98.9	98.9	97.7
	n (HT20) (Mid Rate)	94.4	94.6	94.0	94.0	90.7
	n (HT20) (High Rate)	91.7	91.8	91.8	91.8	87.5
	ax(SU) (HT20 Low Rate)	98.5	98.4	98.3	98.3	98.3
	ax(SU) (HT20 Mid Rate)	92.7	92.2	92.5	92.5	93.2
	ax(SU) (HT20 High Rate)	86.5	86.9	85.8	85.8	85.9
	n (HT40 Low Rate)	97.7	97.7	95.9	95.9	96.1
	n (HT40 Mid Rate)	89.6	90.3	83.1	83.1	83.5
	n (HT40 High Rate)	86.0	85.7	78.8	78.8	81.6
	ax(SU) (HT40 Low Rate)	96.9	97.0	96.9	96.9	97.0
	ax(SU) (HT40 Mid Rate)	88.2	89.2	88.8	88.8	88.8
	ax(SU) (HT40 High Rate)	83.0	81.5	82.9	82.9	82.9
	ac (HT80 Low Rate)	95.2	95.6	92.0	92.0	91.3
	ac (HT80 Mid Rate)	82.3	83.1	78.3	78.3	76.4
	ac (HT80 High Rate)	77.8	77.2	74.7	74.7	73.8
	ax(SU) (HT80 Low Rate)	94.3	94.5	94.5	94.5	94.3
	ax(SU) (HT80 Mid Rate)	81.9	83.5	82.0	82.0	83.8
	ax(SU) (HT80 High Rate)	79.8	78.9	79.7	79.7	77.2

Table 2-4. Measured Duty Cycles

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

WiFi Configurations		SISO		CDD		SDM		STBC	
		Antenna 3c	Antenna 3a						
5GHz	11a	✓	✓	✓	✓	✗	✗	✗	✗
	11n (20MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax(SU) (20MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11n (40MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax(SU) (40MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ac (80MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ax(SU) (80MHz)	✓	✓	✓	✓	✓	✓	✓	✓

Table 2-5. WIFI Configurations

✓ = 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)

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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	WiFi 2.4GHz	Bluetooth	WiFi 5GHz	WCDMA / LTE / FR1 NR		
		802.11 b/g/n/ax	BDR, EDR, HDR4/8, LE1/2M	802.11 a/n/ac/ax	Mid Band	High Band	Ultra High Band
3c	Config 1	✗	✓	✓	✗	✗	✗
3c	Config 2	✓	✗	✗	✓	✗	✗
3c	Config 3	✓	✗	✗	✗	✓	✗
3c	Config 4	✗	✓	✓	✓	✗	✗
3c	Config 5	✗	✓	✓	✗	✓	✗
3a	Config 6	✗	✗	✓	✓	✗	✗
3a	Config 7	✗	✗	✓	✗	✓	✗
1b	Config 8	✓	✗	✗	✗	✗	✓
1b	Config 9	✗	✓	✗	✗	✗	✓

Table 2-6. Simultaneous Transmission Configurations

✓ = Support; ✗ = Not Support

Note:

All the above simultaneous transmission configurations have been tested and the worst-case configuration was found to be Config 3 and reported in WLAN OFDM and LTE Part 27b RF reports

Wi-Fi 2.4GHz and Bluetooth 2.4 GHz can transmit simultaneously on separate antennas. Specific 2.4 GHz Wi-Fi antenna that can only transmit simultaneously with 2.4 GHz Bluetooth antenna is listed in the SAR test report. For BT (2.4 GHz) in connected mode and Wi-Fi (2.4 GHz) – Wi-Fi max power will not exceed minimum of (13.5dBm, SAR max cap, Reg max cap) power. For BT (2.4 GHz) – BT will be using iPA only and Wi-Fi max power will not exceed minimum of (SAR max cap, Reg max cap) power.

2.3 Antenna Description

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

Frequency [GHz]	Antenna Gain (dBi)		
	Antenna 3c	Antenna 3a	Antenna 1b
5.150 – 5.250	2.8	0.4	-1.4
5.250 – 5.350	1.9	1.2	-1.9
5.470 – 5.725	3.6	2.2	-1.1
5.725 – 5.850	3.2	1.3	-1.0

Table 2-7. Highest Antenna Gain

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2.4 Test Support Equipment

Test Support Equipment List					
1	Apple MacBook Pro w/AC/DC Adapter	Model: A2141 Model: A2166	S/N: C02DV7VKMD6T S/N: N/A		
2	Apple USB-C Cable	Model: Spartan	S/N: 000MKTR02U		
3	USB-C Cable w/ AC Adapter	Model: A246 Model: A2305	S/N: N/A S/N: N/A		
4	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.

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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: 24Mbps
 - High Data Rate: 54Mbps
- 802.11n HT20/40:
 - Low Data Rate: MCS0/MCS8 (SISO/CDD)
 - Mid Data Rate: MCS4/MCS12 (SISO/CDD)
 - High Data Rate: MCS7/MCS15 (SISO/CDD)
- 802.11ac VHT80:
 - Low Data Rate: MCS0
 - Mid Data Rate: MCS4
 - High Data Rate: MCS9
- 802.11ax(SU) HE20/HE40/HE80:
 - Low Data Rate: MCS0
 - Mid Data Rate: MCS4
 - High Data Rate: MCS11

2.6 Software and Firmware

The test was conducted with firmware version 20A32640u 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.

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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.

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

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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.

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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 (\pm dB)
Conducted Bench Top Measurements	1.77
Line Conducted Disturbance	2.70
Radiated Disturbance (<30MHz)	4.38
Radiated Disturbance (30MHz - 1GHz)	4.75
Radiated Disturbance (1 - 18GHz)	5.20
Radiated Disturbance (>18GHz)	4.72

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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	6/10/2022	Annual	6/10/2023	MY49430244
Anritsu	ML2496A	Power Meter	11/29/2021	Annual	11/29/2022	1840005
Anritsu	MA2411B	Pulse Power Sensor	11/30/2021	Annual	11/30/2022	1726261
Anritsu	MA2411B	Pulse Power Sensor	11/30/2021	Annual	11/30/2022	1726262
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	8/13/2021	Annual	8/13/2022	T058701-01
ETS-Lindgren	3142E	BiConiLog Antenna (30MHz - 6GHz)	10/21/2021	Annual	10/21/2022	208204
ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	5/11/2022	Annual	5/11/2023	205956
Keysight Technology	N9040B	UXA Signal Analyzer	2/8/2022	Annual	2/8/2023	MY57212015
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	1/6/2022	Annual	1/6/2023	101639
Rohde & Schwarz	FSV40	Signal Analyzer (10Hz-40GHz)	3/4/2022	Annual	3/4/2023	101619
Rohde & Schwarz	ESW26	EMI Test Receiver	5/19/2022	Annual	5/19/2023	101299
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	1/6/2022	Annual	1/6/2023	102327
Rohde & Schwarz	ESW44	EMI Test Receiver	12/2/2021	Annual	12/2/2022	101570
Rohde & Schwarz	ENV216	Two-Line V-Network	1/14/2022	Annual	1/14/2023	101364
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	4/18/2022	Annual	4/18/2023	100050
Rohde & Schwarz	TC-TA18	Cross Polarized Vivaldi Antenna (400MHz-18GHz)	1/25/2022	Annual	1/25/2023	101063
Rohde & Schwarz	HFH2-Z2	Loop Antenna	4/3/2022	Annual	4/3/2023	100546

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.

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7.0 TEST RESULTS

7.1 Summary

Company Name: Apple Inc.
 FCC ID: BCGA2757
 IC: 579C-A2757
 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		PASS	See DFS Test Report (1C22050900 23-15.BCG)
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])	RADIATED	PASS	Section 7.6
15.205; 15.209	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

FCC ID: BCGA2757 IC: 579C-A2757	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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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 Element "UNII Automation," Version 7.0.
- 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 Element "Chamber Automation," Version 1.3.2.
- 6) Per RSS-247 Section 6.2.3, transmission on channels which overlap the 5600-5650 MHz is prohibited. This device operates under these frequencies only under the control of a certified master device and does not support active scanning on these channels. This device does not transmit any beacons or initiate any transmissions in UNII Bands 2A or 2C.

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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 $\geq 3 \times$ 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 data 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 channel bandwidth plots have been reported.

FCC ID: BCGA2757 IC: 579C-A2757	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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Antenna 3c 26dB & 99% Bandwidth Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	n (20MHz)	6.5/7.2 (MCS0)	17.88	21.19
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	17.79	20.90
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	17.77	20.87
	5180	36	ax (SU) (20MHz)	8/8.6 (MCS0)	18.96	21.48
	5200	40	ax (SU) (20MHz)	8/8.6 (MCS0)	18.95	21.10
	5240	48	ax (SU) (20MHz)	8/8.6 (MCS0)	18.93	20.85
	5190	38	n (40MHz)	13.5/15 (MCS0)	36.46	43.76
	5230	46	n (40MHz)	13.5/15 (MCS0)	36.29	41.01
	5190	38	ax (SU) (40MHz)	16/17.2 (MCS0)	38.29	44.59
	5230	46	ax (SU) (40MHz)	16/17.2 (MCS0)	37.91	40.84
	5210	42	ac (80MHz)	29.3/32.5 (MCS0)	75.32	82.39
	5210	42	ax (SU) (80MHz)	34/36 (MCS0)	77.26	81.31
Band 2A	5260	52	n (20MHz)	6.5/7.2 (MCS0)	17.78	20.99
	5280	56	n (20MHz)	6.5/7.2 (MCS0)	17.73	20.97
	5320	64	n (20MHz)	6.5/7.2 (MCS0)	17.87	22.31
	5260	52	ax (SU) (20MHz)	8/8.6 (MCS0)	18.93	21.16
	5280	56	ax (SU) (20MHz)	8/8.6 (MCS0)	18.92	20.80
	5320	64	ax (SU) (20MHz)	8/8.6 (MCS0)	18.92	21.13
	5270	54	n (40MHz)	13.5/15 (MCS0)	36.30	41.06
	5310	62	n (40MHz)	13.5/15 (MCS0)	36.45	43.17
	5270	54	ax (SU) (40MHz)	16/17.2 (MCS0)	38.03	41.39
	5310	62	ax (SU) (40MHz)	16/17.2 (MCS0)	38.00	43.04
	5290	58	ac (80MHz)	29.3/32.5 (MCS0)	75.41	83.55
	5290	58	ax (SU) (80MHz)	34/36 (MCS0)	77.18	82.99
Band 2C	5500	100	n (20MHz)	6.5/7.2 (MCS0)	17.87	21.46
	5580	116	n (20MHz)	6.5/7.2 (MCS0)	17.69	20.55
	5720	144	n (20MHz)	6.5/7.2 (MCS0)	17.78	21.13
	5500	100	ax (SU) (20MHz)	8/8.6 (MCS0)	19.13	21.27
	5580	116	ax (SU) (20MHz)	8/8.6 (MCS0)	19.00	21.14
	5720	144	ax (SU) (20MHz)	8/8.6 (MCS0)	18.94	20.86
	5510	102	n (40MHz)	13.5/15 (MCS0)	36.50	44.56
	5550	110	n (40MHz)	13.5/15 (MCS0)	36.32	41.01
	5710	142	n (40MHz)	13.5/15 (MCS0)	36.38	41.45
	5510	102	ax (SU) (40MHz)	16/17.2 (MCS0)	38.05	46.06
	5550	110	ax (SU) (40MHz)	16/17.2 (MCS0)	37.99	41.45
	5710	142	ax (SU) (40MHz)	16/17.2 (MCS0)	37.97	40.93
	5530	106	ac (80MHz)	29.3/32.5 (MCS0)	75.41	82.65
	5690	138	ac (80MHz)	29.3/32.5 (MCS0)	75.44	81.49
	5530	106	ax (SU) (80MHz)	34/36 (MCS0)	77.18	82.41
	5690	138	ax (SU) (80MHz)	34/36 (MCS0)	77.15	81.59

Table 7-2. Conducted Bandwidth Measurements Antenna 3c (Low Data Rate)

FCC ID: BCGA2757 IC: 579C-A2757	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	n (20MHz)	39/43.3 (MCS4)	17.72	20.51
	5200	40	n (20MHz)	39/43.3 (MCS4)	17.71	20.82
	5240	48	n (20MHz)	39/43.3 (MCS4)	17.71	20.70
	5180	36	ax (SU) (20MHz)	49/51.6 (MCS4)	18.96	21.02
	5200	40	ax (SU) (20MHz)	49/51.6 (MCS4)	18.92	20.88
	5240	48	ax (SU) (20MHz)	49/51.6 (MCS4)	18.90	20.97
	5190	38	n (40MHz)	81/90 (MCS4)	36.23	41.67
	5230	46	n (40MHz)	81/90 (MCS4)	36.41	41.89
	5190	38	ax (SU) (40MHz)	98/103.2 (MCS4)	37.93	42.68
	5230	46	ax (SU) (40MHz)	98/103.2 (MCS4)	37.93	41.44
	5210	42	ac (80MHz)	175.5/195 (MCS4)	75.32	80.44
	5210	42	ax (SU) (80MHz)	204/216.2 (MCS4)	77.13	81.49
	5260	52	n (20MHz)	39/43.3 (MCS4)	17.74	20.84
	5280	56	n (20MHz)	39/43.3 (MCS4)	17.71	20.65
Band 2A	5320	64	n (20MHz)	39/43.3 (MCS4)	17.77	20.87
	5260	52	ax (SU) (20MHz)	49/51.6 (MCS4)	18.92	20.76
	5280	56	ax (SU) (20MHz)	49/51.6 (MCS4)	18.94	20.60
	5320	64	ax (SU) (20MHz)	49/51.6 (MCS4)	18.93	20.81
	5270	54	n (40MHz)	81/90 (MCS4)	36.30	40.81
	5310	62	n (40MHz)	81/90 (MCS4)	36.23	41.70
	5270	54	ax (SU) (40MHz)	98/103.2 (MCS4)	37.95	41.31
	5310	62	ax (SU) (40MHz)	98/103.2 (MCS4)	37.90	41.27
	5290	58	ac (80MHz)	175.5/195 (MCS4)	75.35	81.05
	5290	58	ax (SU) (80MHz)	204/216.2 (MCS4)	77.09	81.52
	5500	100	n (20MHz)	39/43.3 (MCS4)	17.71	20.86
	5580	116	n (20MHz)	39/43.3 (MCS4)	17.66	20.56
	5720	144	n (20MHz)	39/43.3 (MCS4)	17.69	20.74
Band 2C	5500	100	ax (SU) (20MHz)	49/51.6 (MCS4)	18.91	20.73
	5580	116	ax (SU) (20MHz)	49/51.6 (MCS4)	18.90	21.15
	5720	144	ax (SU) (20MHz)	49/51.6 (MCS4)	18.90	20.64
	5510	102	n (40MHz)	81/90 (MCS4)	36.30	42.14
	5550	110	n (40MHz)	81/90 (MCS4)	36.25	41.25
	5710	142	n (40MHz)	81/90 (MCS4)	36.29	41.92
	5510	102	ax (SU) (40MHz)	98/103.2 (MCS4)	37.96	41.52
	5550	110	ax (SU) (40MHz)	98/103.2 (MCS4)	37.87	41.51
	5710	142	ax (SU) (40MHz)	98/103.2 (MCS4)	37.95	41.75
	5530	106	ac (80MHz)	175.5/195 (MCS4)	75.43	80.73
	5690	138	ac (80MHz)	175.5/195 (MCS4)	75.46	80.70
	5530	106	ax (SU) (80MHz)	204/216.2 (MCS4)	77.16	82.12
	5690	138	ax (SU) (80MHz)	204/216.2 (MCS4)	77.26	81.87

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

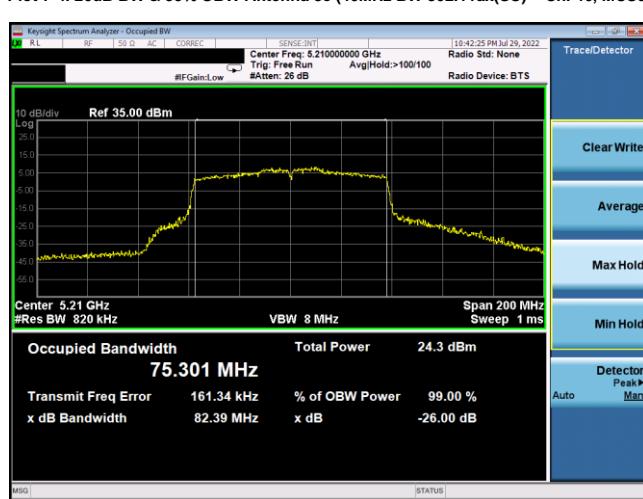
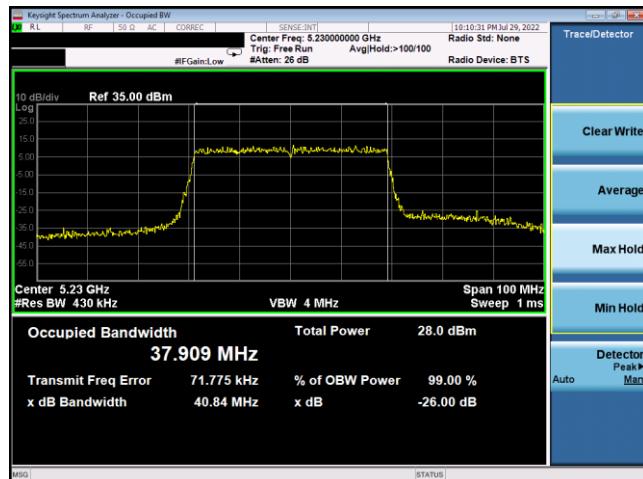
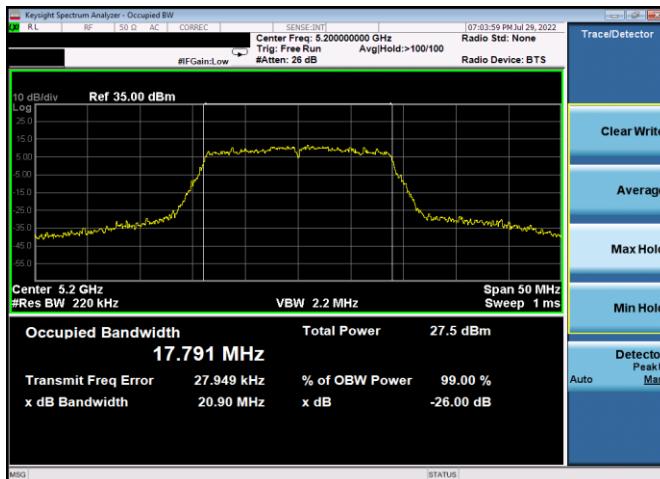
FCC ID: BCGA2757 IC: 579C-A2757	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 99% Occupied Bandwidth [MHz]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	n (20MHz)	65/72.2 (MCS7)	17.81	21.09
	5200	40	n (20MHz)	65/72.2 (MCS7)	17.86	21.00
	5240	48	n (20MHz)	65/72.2 (MCS7)	17.86	21.06
	5180	36	ax (SU) (20MHz)	135/143.4 (MCS11)	19.01	21.16
	5200	40	ax (SU) (20MHz)	135/143.4 (MCS11)	19.05	24.78
	5240	48	ax (SU) (20MHz)	135/143.4 (MCS11)	19.10	25.46
	5190	38	n (40MHz)	135/150 (MCS7)	36.47	41.19
	5230	46	n (40MHz)	135/150 (MCS7)	36.46	41.08
	5190	38	ax (SU) (40MHz)	271/286.8 (MCS11)	37.85	41.08
	5230	46	ax (SU) (40MHz)	271/286.8 (MCS11)	37.88	41.19
	5210	42	ac (80MHz)	390/433.3 (MCS9)	75.79	81.08
	5210	42	ax (SU) (80MHz)	567/600.5 (MCS11)	76.83	80.93
Band 2A	5260	52	n (20MHz)	65/72.2 (MCS7)	17.85	21.30
	5280	56	n (20MHz)	65/72.2 (MCS7)	17.87	21.37
	5320	64	n (20MHz)	65/72.2 (MCS7)	17.84	20.84
	5260	52	ax (SU) (20MHz)	135/143.4 (MCS11)	19.03	21.18
	5280	56	ax (SU) (20MHz)	135/143.4 (MCS11)	19.02	21.12
	5320	64	ax (SU) (20MHz)	135/143.4 (MCS11)	19.00	20.96
	5270	54	n (40MHz)	135/150 (MCS7)	36.52	44.72
	5310	62	n (40MHz)	135/150 (MCS7)	36.43	40.84
	5270	54	ax (SU) (40MHz)	271/286.8 (MCS11)	37.97	47.55
	5310	62	ax (SU) (40MHz)	271/286.8 (MCS11)	37.81	41.07
	5290	58	ac (80MHz)	390/433.3 (MCS9)	75.95	81.25
	5290	58	ax (SU) (80MHz)	567/600.5 (MCS11)	77.14	81.58
Band 2C	5500	100	n (20MHz)	65/72.2 (MCS7)	17.82	21.07
	5580	116	n (20MHz)	65/72.2 (MCS7)	17.89	21.33
	5720	144	n (20MHz)	65/72.2 (MCS7)	17.83	21.08
	5500	100	ax (SU) (20MHz)	135/143.4 (MCS11)	18.99	20.85
	5580	116	ax (SU) (20MHz)	135/143.4 (MCS11)	19.06	21.01
	5720	144	ax (SU) (20MHz)	135/143.4 (MCS11)	19.03	23.66
	5510	102	n (40MHz)	135/150 (MCS7)	36.47	40.98
	5550	110	n (40MHz)	135/150 (MCS7)	36.57	40.96
	5710	142	n (40MHz)	135/150 (MCS7)	36.49	44.65
	5510	102	ax (SU) (40MHz)	271/286.8 (MCS11)	37.88	41.15
	5550	110	ax (SU) (40MHz)	271/286.8 (MCS11)	37.92	41.06
	5710	142	ax (SU) (40MHz)	271/286.8 (MCS11)	38.02	49.80
	5530	106	ac (80MHz)	390/433.3 (MCS9)	75.89	81.66
	5690	138	ac (80MHz)	390/433.3 (MCS9)	76.11	81.43
	5530	106	ax (SU) (80MHz)	567/600.5 (MCS11)	77.06	81.51
	5690	138	ax (SU) (80MHz)	567/600.5 (MCS11)	77.14	82.89

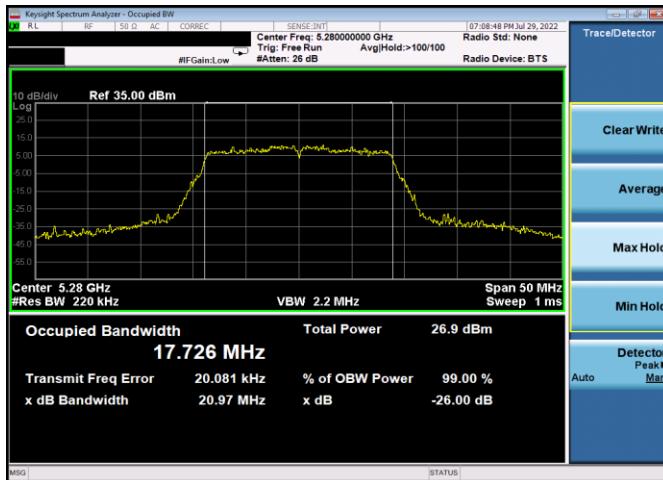
Table 7-4. Conducted Bandwidth Measurements Antenna 3c (High Data Rate)

FCC ID: BCGA2757 IC: 579C-A2757	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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Low Data Rate



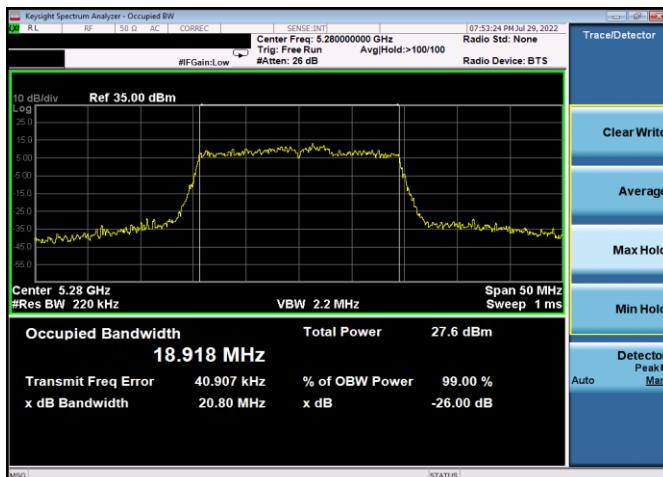
FCC ID: BCGA2757 IC: 579C-A2757	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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Plot 7-7. 26dB BW & 99% OBW Antenna 3c (20MHz BW 802.11n – Ch. 56, MCS0)



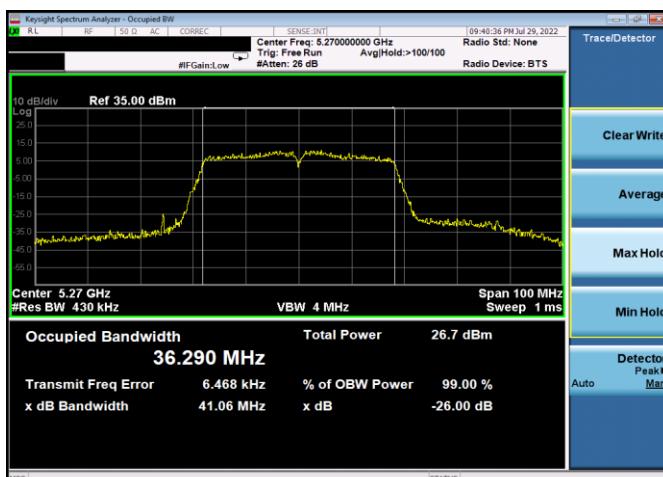
Plot 7-10. 26dB BW & 99% OBW Antenna 3c (40MHz BW 802.11ax(SU) – Ch. 54, MCS0)



Plot 7-8. 26dB BW & 99% OBW Antenna 3c (20MHz BW 802.11ax(SU) – Ch. 56, MCS0)



Plot 7-11. 26dB BW & 99% OBW Antenna 3c (80MHz BW 802.11ac – Ch. 58, MCS0)

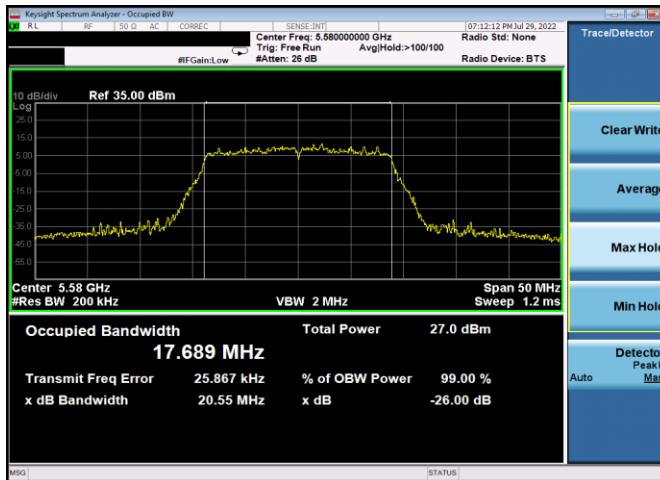


Plot 7-9. 26dB BW & 99% OBW Antenna 3c (40MHz BW 802.11n – Ch. 54, MCS0)

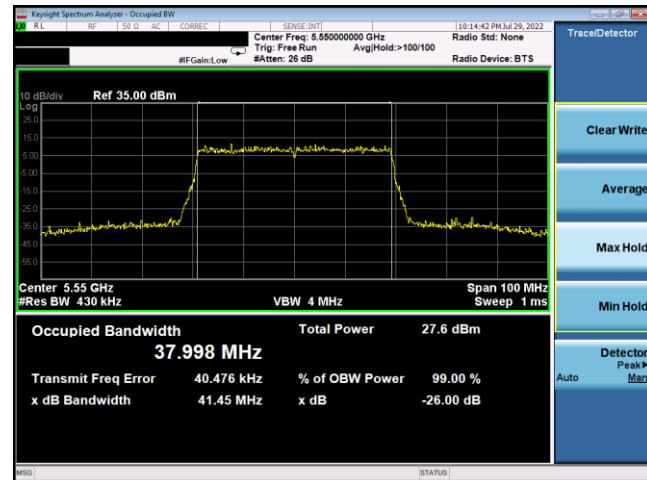


Plot 7-12. 26dB BW & 99% OBW Antenna 3c (80MHz BW 802.11ax(SU) – Ch. 58, MCS0)

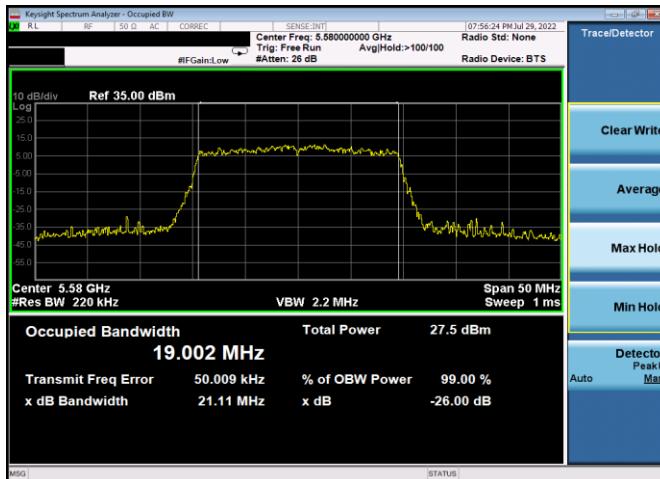
FCC ID: BCGA2757 IC: 579C-A2757	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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Plot 7-13. 26dB BW & 99% OBW Antenna 3c (20MHz BW 802.11n – Ch. 116, MCS0)



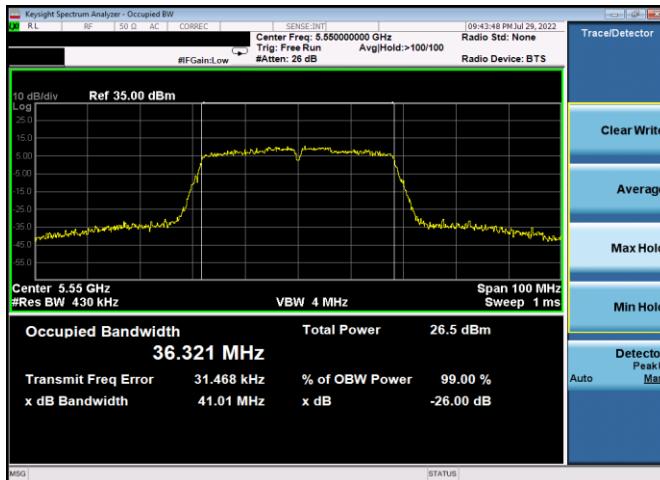
Plot 7-16. 26dB BW & 99% OBW Antenna 3c (40MHz BW 802.11ax(SU) – Ch. 110, MCS0)



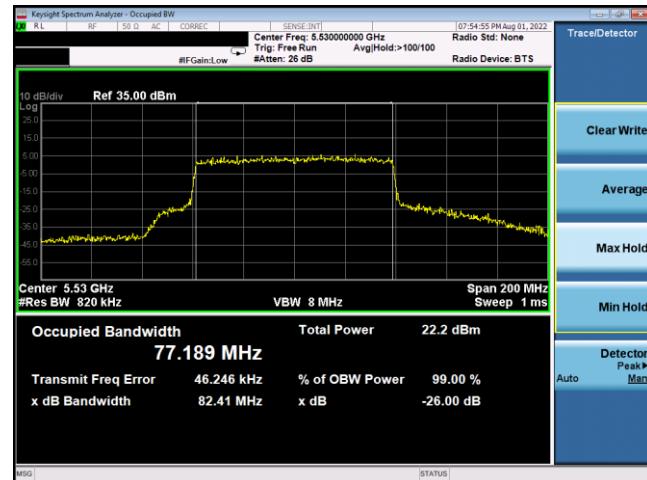
Plot 7-14. 26dB BW & 99% OBW Antenna 3c (20MHz BW 802.11ax(SU) – Ch. 116, MCS0)



Plot 7-17. 26dB BW & 99% OBW Antenna 3c (80MHz BW 802.11ac – Ch. 106, MCS0)

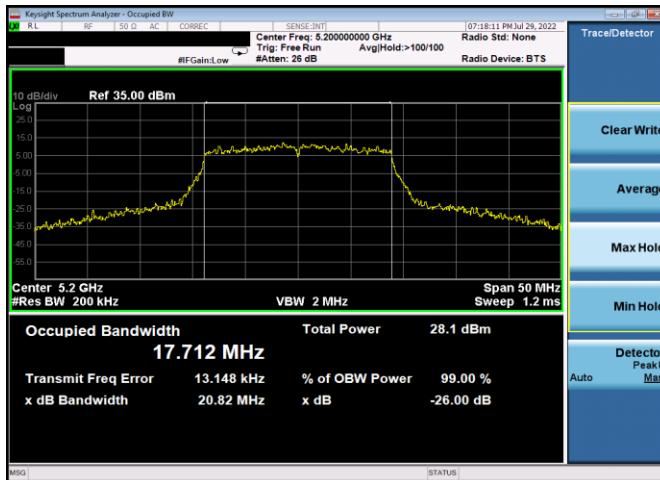


Plot 7-15. 26dB BW & 99% OBW Antenna 3c (40MHz BW 802.11n – Ch. 110, MCS0)



Plot 7-18. 26dB BW & 99% OBW Antenna 3c (80MHz BW 802.11ax(SU) – Ch. 106, MCS0)

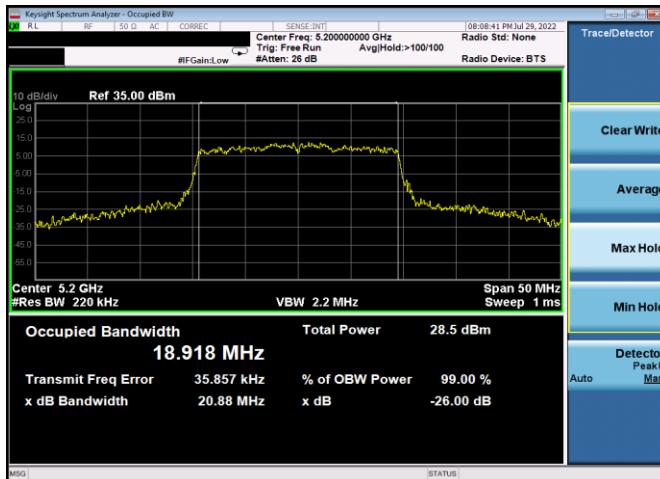
FCC ID: BCGA2757 IC: 579C-A2757		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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Plot 7-19. 26dB BW & 99% OBW Antenna 3c (20MHz BW 802.11n – Ch. 40, MCS4)



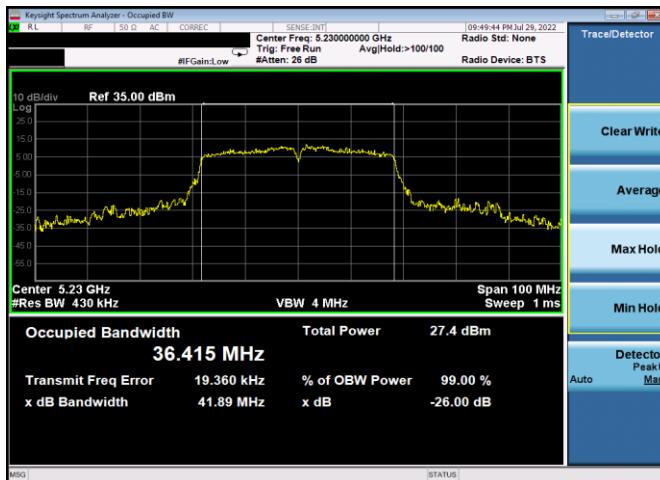
Plot 7-22. 26dB BW & 99% OBW Antenna 3c (40MHz BW 802.11ax(SU) – Ch. 46, MCS4)



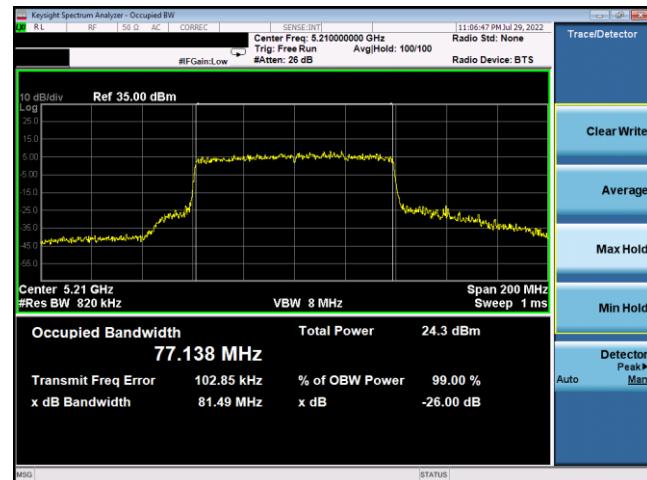
Plot 7-20. 26dB BW & 99% OBW Antenna 3c (20MHz BW 802.11ax(SU) – Ch. 40, MCS4)



Plot 7-23. 26dB BW & 99% OBW Antenna 3c (80MHz BW 802.11ac – Ch. 42, MCS4)



Plot 7-21. 26dB BW & 99% OBW Antenna 3c (40MHz BW 802.11n – Ch. 46, MCS4)



Plot 7-24. 26dB BW & 99% OBW Antenna 3c (80MHz BW 802.11ax(SU) – Ch. 42, MCS4)

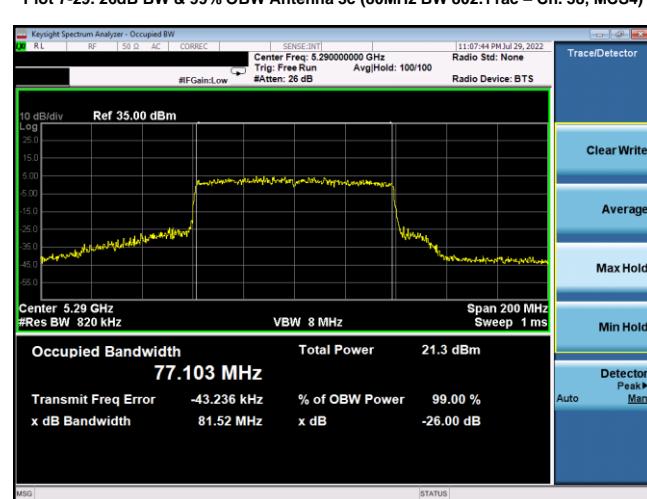
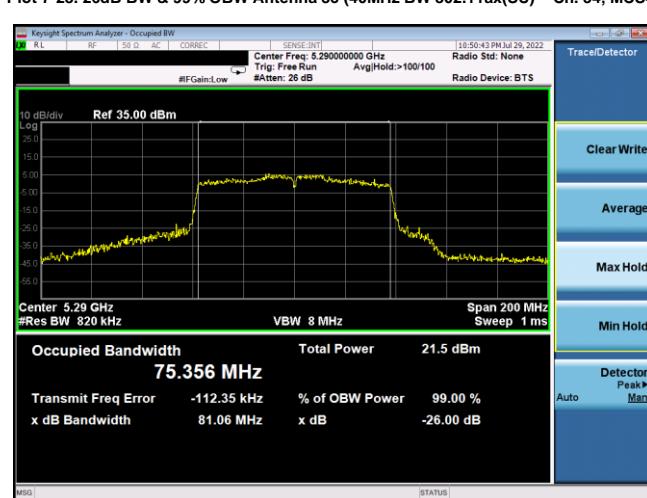
FCC ID: BCGA2757	IC: 579C-A2757
Test Report S/N: 1C2205090023-16.BCG	Test Dates: 08/02/2022 – 09/14/2022



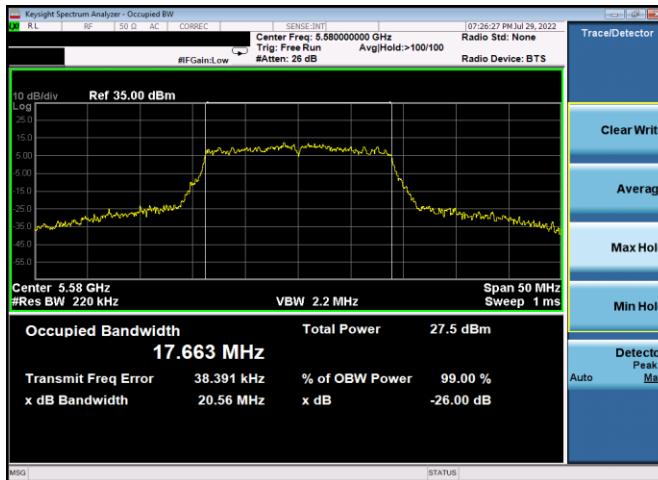
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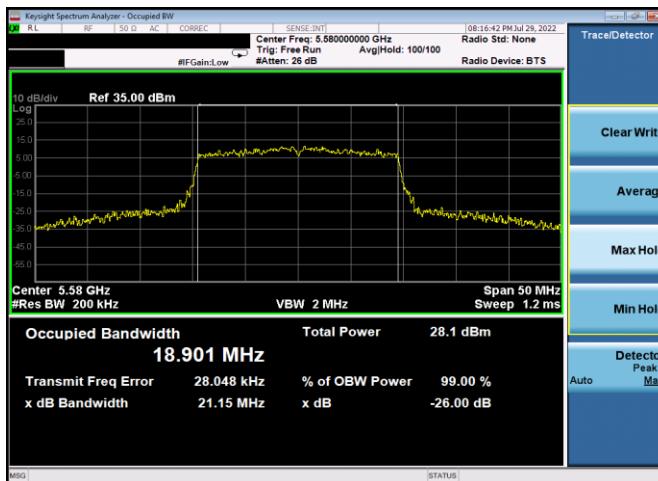
FCC ID: BCGA2757 IC: 579C-A2757		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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Plot 7-31. 26dB BW & 99% OBW Antenna 3c (20MHz BW 802.11n – Ch. 116, MCS4)



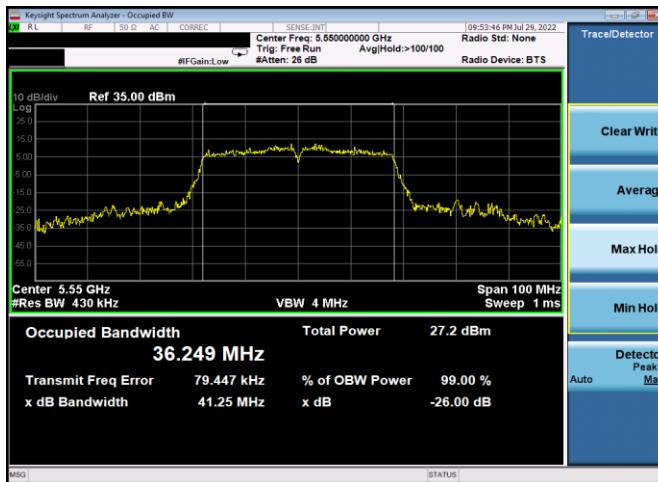
Plot 7-34. 26dB BW & 99% OBW Antenna 3c (40MHz BW 802.11ax(SU) – Ch. 110, MCS4)



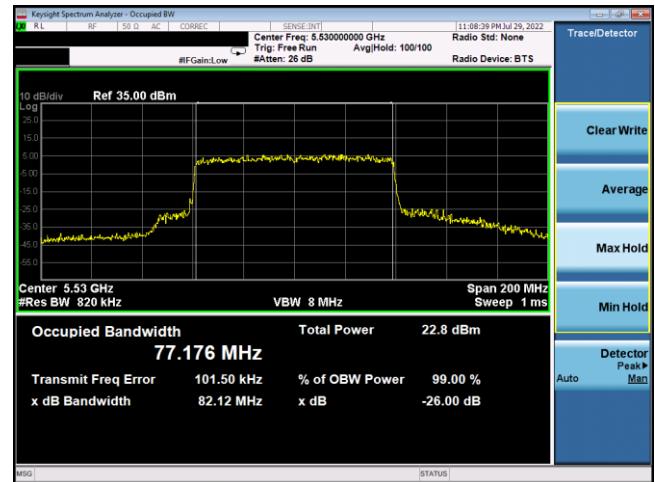
Plot 7-32. 26dB BW & 99% OBW Antenna 3c (20MHz BW 802.11ax(SU) – Ch. 116, MCS4)



Plot 7-35. 26dB BW & 99% OBW Antenna 3c (80MHz BW 802.11ac – Ch. 106, MCS4)



Plot 7-33. 26dB BW & 99% OBW Antenna 3c (40MHz BW 802.11n – Ch. 110, MCS4)



Plot 7-36. 26dB BW & 99% OBW Antenna 3c (80MHz BW 802.11ax(SU) – Ch. 106, MCS4)

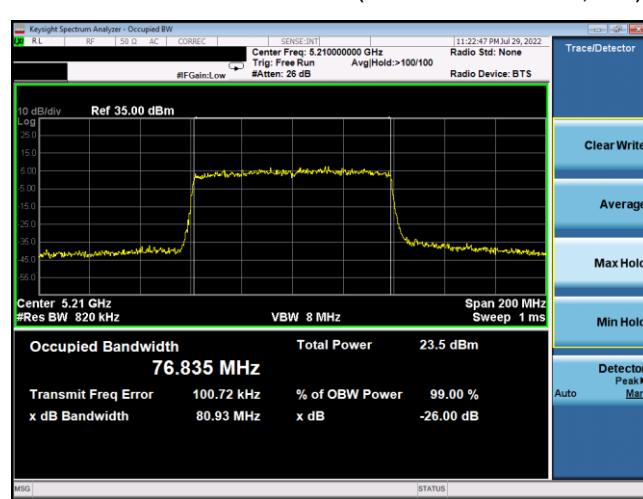
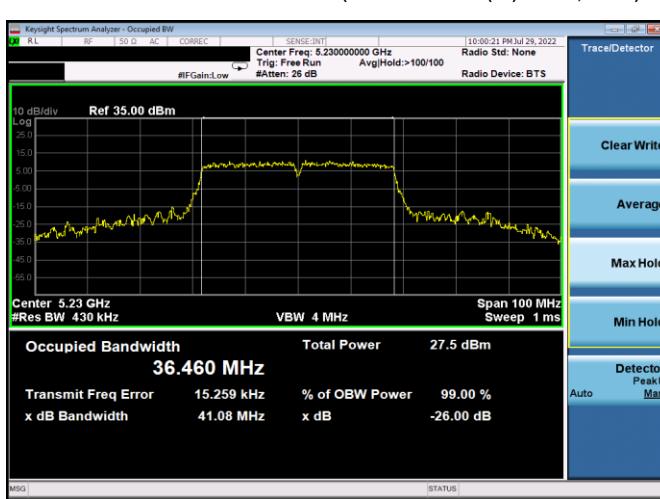
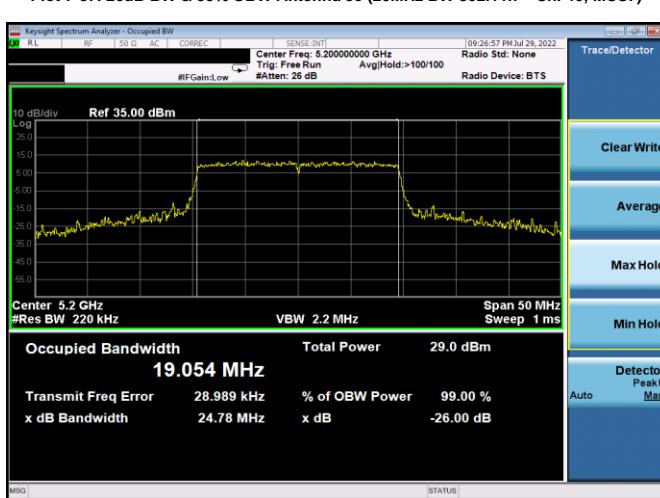
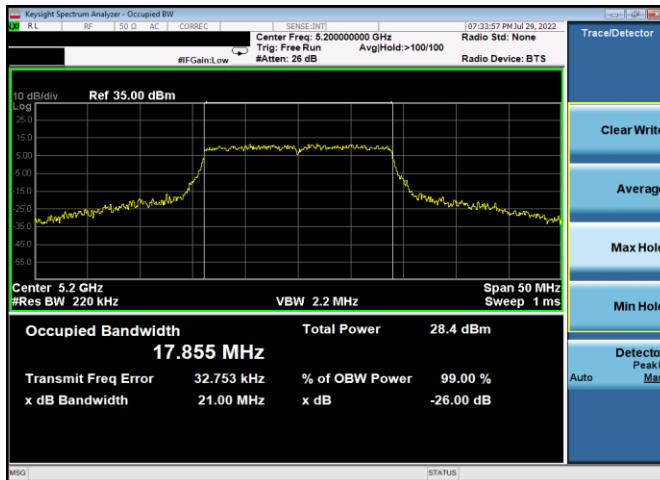
FCC ID: BCGA2757	IC: 579C-A2757
Test Report S/N: 1C2205090023-16.BCG	Test Dates: 08/02/2022 – 09/14/2022



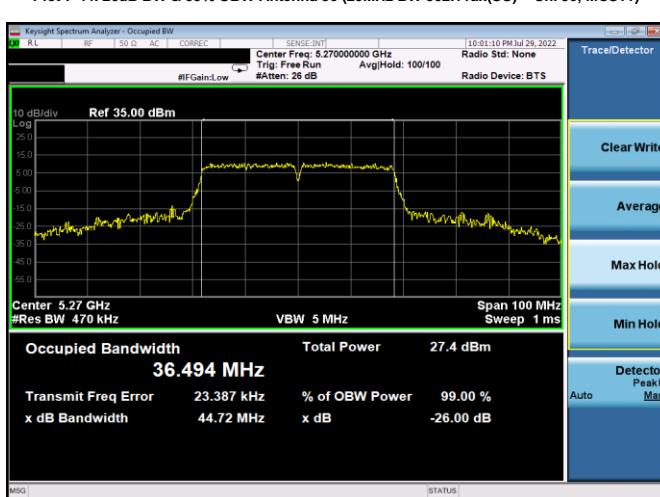
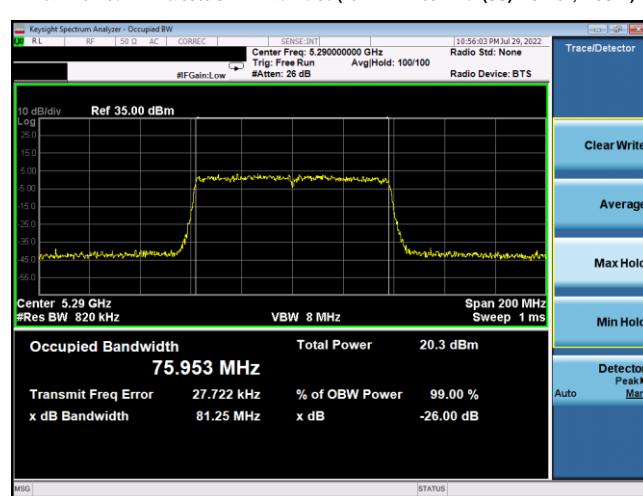
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Approved by:
Technical Manager

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FCC ID: BCGA2757 IC: 579C-A2757		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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FCC ID: BCGA2757 IC: 579C-A2757	 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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