

Output Power Measurement

1.1.11. Test Limit

For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm). If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

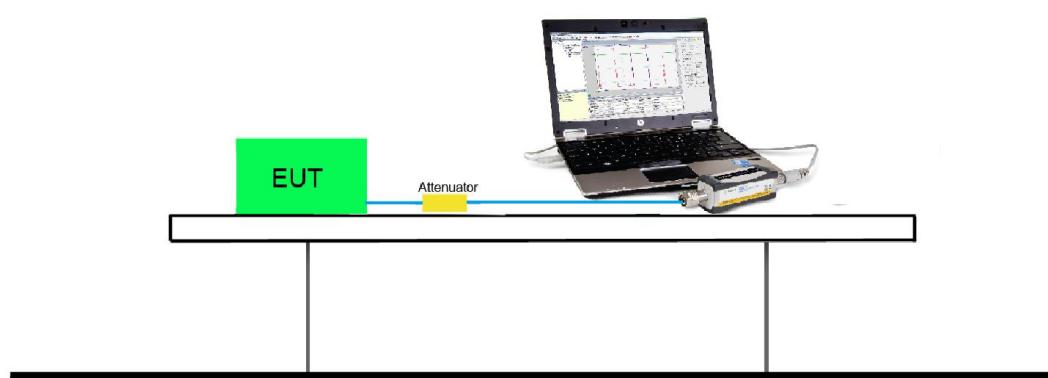
1.1.12. Test Procedure Used

KDB 789033 D02v01r03 - Section E) 3) b) Method PM-G

1.1.13. Test Setting

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

1.1.14. Test Setup



1.1.15. Test Result

Power output test was verified over all data rates of each mode shown as below, and then choose the maximum power output (yellow marker) for final test of each channel.

N _{Tx}	a	MCS Index for 802.11n	Data Rate (Mbps)			
			20MHz Bandwidth		40MHz Bandwidth	
			800ns GI	400ns GI	800ns GI	400ns GI
2	6	8	13.0	14.4	27.0	30.0
2	9	9	26.0	28.9	54.0	60.0
2	12	10	39.0	43.3	81.0	90.0
2	18	11	52.0	57.8	108.0	120.0
2	24	12	78.0	86.7	162.0	180.0
2	36	13	104.0	115.6	216.0	240.0
2	48	14	117.0	130.0	243.0	270.0
2	54	15	130.0	144.4	270.0	300.0

N _{Tx}	MCS Index for 802.11ac	Data Rate (Mbps)					
		20MHz Bandwidth		40MHz Bandwidth		80MHz Bandwidth	
		800ns GI	400ns GI	800ns GI	400ns GI	800ns GI	400ns GI
2	0	13.0	14.4	27.0	30.0	58.6	65.0
2	1	26.0	28.8	54.0	60.0	117.0	130.0
2	2	39.0	43.4	81.0	90.0	175.6	195.0
2	3	52.0	57.8	108.0	120.0	234.0	260.0
2	4	78.0	86.6	162.0	180.0	351.0	390.0
2	5	104.0	115.6	216.0	240.0	468.0	520.0
2	6	117.0	130.0	243.0	270.0	526.6	585.0
2	7	130.0	144.4	270.0	300.0	585.0	650.0
2	8	156.0	173.4	324.0	360.0	702.0	780.0
2	9	--	--	360.0	400.0	780.0	866.6

Note: Power output test was verified over all data rates of each mode shown as above, and then choose the maximum power output (yellow marker) for final test of each channel.

Output power at various data rates for Ant 0:

Test Mode	Bandwidth	Channel	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)
802.11a	20	44	5220	6	14.86
				24	14.43
				54	14.04
802.11n	20	44	5220	13.0	14.22
				26.0	13.87
				52.0	13.51
				78.0	13.19
				117.0	12.91
				130.0	12.62
802.11n	40	46	5230	27.0	14.28
				54.0	13.97
				108.0	13.62
				162.0	13.25
				243.0	12.90
				270.0	12.51
802.11ac	20	44	5220	13.0	13.96
				26.0	13.67
				52.0	13.31
				78.0	13.02
				130.0	12.69
				156.0	12.24
802.11ac	40	46	5230	27.0	14.25
				54.0	13.98
				162.0	13.62
				216.0	13.29
				324.0	12.88
				360.0	12.53

802.11ac	80	42	5210	58.6	12.89
				117.0	12.56
				351.0	12.11
				468.0	11.89
				702.0	11.46
				780.0	11.07

Test Mode	N _{Tx}	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Total Average Power (dBm)	Limit (dBm)	Result
2Tx - Ant 0 + 1									
802.11a	2	6	36	5180	14.98	15.18	18.09	≤ 24.00	Pass
802.11a	2	6	44	5220	14.86	15.09	17.99	≤ 24.00	Pass
802.11a	2	6	48	5240	14.72	15.06	17.90	≤ 24.00	Pass
802.11a	2	6	52	5260	14.86	14.96	17.92	≤ 24.00	Pass
802.11a	2	6	60	5300	14.92	15.21	18.08	≤ 24.00	Pass
802.11a	2	6	64	5320	14.86	15.08	17.98	≤ 24.00	Pass
802.11a	2	6	100	5500	14.82	15.83	18.36	≤ 24.00	Pass
802.11a	2	6	120	5600	15.58	15.67	18.64	≤ 24.00	Pass
802.11a	2	6	140	5700	15.57	14.30	17.99	≤ 24.00	Pass
802.11a	2	6	149	5745	16.04	15.03	18.57	≤ 30.00	Pass
802.11a	2	6	157	5785	15.52	14.38	18.00	≤ 30.00	Pass
802.11a	2	6	165	5825	15.21	13.79	17.57	≤ 30.00	Pass
802.11n-HT20	2	13.0	36	5180	14.20	14.96	17.61	≤ 24.00	Pass
802.11n-HT20	2	13.0	44	5220	14.22	14.83	17.55	≤ 24.00	Pass
802.11n-HT20	2	13.0	48	5240	14.35	14.82	17.60	≤ 24.00	Pass
802.11n-HT20	2	13.0	52	5260	14.36	14.68	17.53	≤ 24.00	Pass
802.11n-HT20	2	13.0	60	5300	14.23	14.93	17.60	≤ 24.00	Pass
802.11n-HT20	2	13.0	64	5320	14.29	14.78	17.55	≤ 24.00	Pass
802.11n-HT20	2	13.0	100	5500	15.48	15.60	18.55	≤ 24.00	Pass
802.11n-HT20	2	13.0	120	5600	15.84	15.23	18.56	≤ 24.00	Pass
802.11n-HT20	2	13.0	140	5700	15.42	14.06	17.80	≤ 24.00	Pass
802.11n-HT20	2	13.0	149	5745	16.12	14.77	18.51	≤ 30.00	Pass
802.11n-HT20	2	13.0	157	5785	15.60	14.25	17.99	≤ 30.00	Pass
802.11n-HT20	2	13.0	165	5825	15.40	13.61	17.61	≤ 30.00	Pass
802.11n-HT40	2	27.0	38	5190	14.14	14.68	17.43	≤ 24.00	Pass
802.11n-HT40	2	27.0	46	5230	14.28	14.62	17.46	≤ 24.00	Pass
802.11n-HT40	2	27.0	54	5270	14.24	14.70	17.49	≤ 24.00	Pass
802.11n-HT40	2	27.0	62	5310	13.70	14.73	17.26	≤ 24.00	Pass
802.11n-HT40	2	27.0	102	5510	13.50	13.13	16.33	≤ 24.00	Pass
802.11n-HT40	2	27.0	118	5590	15.03	15.29	18.17	≤ 24.00	Pass
802.11n-HT40	2	27.0	134	5670	15.08	14.82	17.96	≤ 24.00	Pass
802.11n-HT40	2	27.0	151	5755	14.98	14.52	17.77	≤ 30.00	Pass

802.11n-HT40	2	27.0	159	5795	14.54	14.47	17.52	≤ 30.00	Pass
802.11ac-VHT20	2	13.0	36	5180	14.04	14.60	17.34	≤ 24.00	Pass
802.11ac-VHT20	2	13.0	44	5220	13.96	14.59	17.30	≤ 24.00	Pass
802.11ac-VHT20	2	13.0	48	5240	13.86	14.44	17.17	≤ 24.00	Pass
802.11ac-VHT20	2	13.0	52	5260	13.96	14.33	17.16	≤ 24.00	Pass
802.11ac-VHT20	2	13.0	60	5300	13.94	14.47	17.22	≤ 24.00	Pass
802.11ac-VHT20	2	13.0	64	5320	14.06	14.57	17.33	≤ 24.00	Pass
802.11ac-VHT20	2	13.0	100	5500	15.36	15.30	18.34	≤ 24.00	Pass
802.11ac-VHT20	2	13.0	120	5600	15.72	14.95	18.36	≤ 24.00	Pass
802.11ac-VHT20	2	13.0	140	5700	15.10	14.03	17.61	≤ 24.00	Pass
802.11ac-VHT20	2	13.0	144	5720	15.46	14.01	17.81	≤ 24.00	Pass
802.11ac-VHT20	2	13.0	149	5745	15.96	14.46	18.28	≤ 30.00	Pass
802.11ac-VHT20	2	13.0	157	5785	15.64	13.71	17.79	≤ 30.00	Pass
802.11ac-VHT20	2	13.0	165	5825	15.08	13.19	17.25	≤ 30.00	Pass
802.11ac-VHT40	2	27.0	38	5190	14.26	14.73	17.51	≤ 24.00	Pass
802.11ac-VHT40	2	27.0	46	5230	14.25	14.67	17.48	≤ 24.00	Pass
802.11ac-VHT40	2	27.0	54	5270	14.16	14.60	17.40	≤ 24.00	Pass
802.11ac-VHT40	2	27.0	62	5310	14.18	14.85	17.54	≤ 24.00	Pass
802.11ac-VHT40	2	27.0	102	5510	13.57	13.17	16.38	≤ 24.00	Pass
802.11ac-VHT40	2	27.0	118	5590	14.94	15.20	18.08	≤ 24.00	Pass
802.11ac-VHT40	2	27.0	134	5670	14.98	14.82	17.91	≤ 24.00	Pass
802.11ac-VHT40	2	27.0	142	5710	15.16	14.40	17.81	≤ 24.00	Pass
802.11ac-VHT40	2	27.0	151	5755	14.88	14.45	17.68	≤ 30.00	Pass
802.11ac-VHT40	2	27.0	159	5795	14.64	13.93	17.31	≤ 30.00	Pass
802.11ac-VHT80	2	58.6	42	5210	12.89	13.67	16.31	≤ 24.00	Pass
802.11ac-VHT80	2	58.6	58	5290	13.16	13.60	16.40	≤ 24.00	Pass
802.11ac-VHT80	2	58.6	106	5530	13.15	13.04	16.11	≤ 24.00	Pass
802.11ac-VHT80	2	58.6	122	5610	13.84	14.17	17.02	≤ 24.00	Pass
802.11ac-VHT80	2	58.6	138	5690	13.88	13.64	16.77	≤ 24.00	Pass
802.11ac-VHT80	2	58.6	155	5775	13.42	13.29	16.37	≤ 30.00	Pass

Note: Total Average Power (dBm) = $10 \cdot \log\{10^{(\text{Ant 0 Average Power /}10)} + 10^{(\text{Ant 1 Average Power /}10)}\}$ (dBm).

Power Spectral Density Measurement

1.1.16. Test Limit

For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

5150~5250MHz: Limit (dBm/MHz) = 11dBm - (7.81dBi - 6dBi) = 9.19dBm/MHz

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

5250~5725MHz: Limit (dBm/MHz) = 11dBm - (7.81dBi - 6dBi) = 9.19dBm/MHz

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

5725~5850MHz: Limit (dBm/500KHz) = 30dBm/KHz - (7.81dBi - 6dBi) = 28.19dBm/500KHz

1.1.17. Test Procedure Used

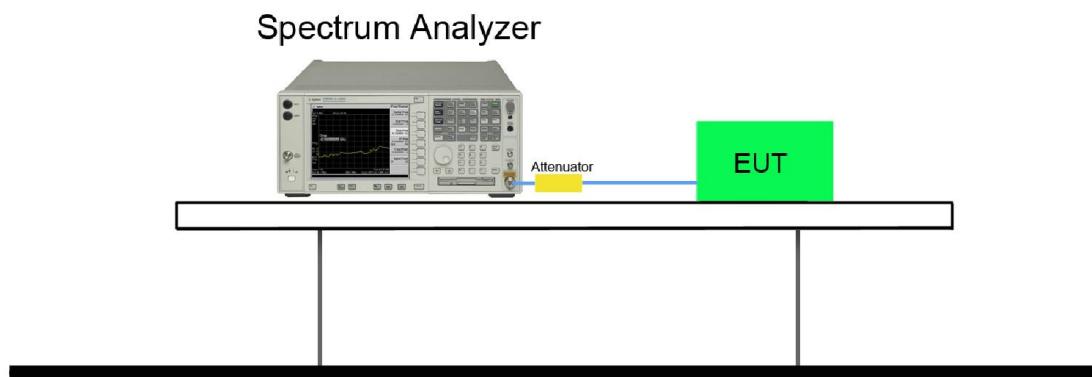
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1.1.18. Test Setting

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire 26dB EBW of the signal.
3. RBW = 1MHz, if measurement bandwidth of Maximum PSD is specified in 500 kHz,
RBW = 100 kHz
4. VBW = 3MHz
5. Number of sweep points $\geq 2 \times (\text{span} / \text{RBW})$
6. Detector = power averaging (RMS)
7. Sweep time = auto
8. Trigger = free run
9. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
10. Add $10 \cdot \log(1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add $10 \cdot \log(1/0.25) = 6$ dB if the duty cycle is 25 percent.

11. When the measurement bandwidth of Maximum PSD is specified in 500 kHz, add a constant factor $10 \log(500\text{kHz}/100\text{kHz}) = 7 \text{ dB}$ to the measured result

1.1.19. Test Setup



1.1.20. Test Result

Test Mode	N _{Tx}	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 PSD (dBm)	Ant 1 PSD (dBm)	Duty Cycle (%)	Total PSD (dBm)	Limit (dBm /MHz)	Result
2Tx – Ant 0 + 1										
802.11a	2	6	36	5180	2.84	2.45	97.2	5.8	≤ 9.19	Pass
802.11a	2	6	44	5220	2.98	2.67	97.2	6.0	≤ 9.19	Pass
802.11a	2	6	48	5240	3.12	2.67	97.2	6.0	≤ 9.19	Pass
802.11a	2	6	52	5260	3.34	2.80	97.2	6.2	≤ 9.19	Pass
802.11a	2	6	60	5300	3.33	2.89	97.2	6.2	≤ 9.19	Pass
802.11a	2	6	64	5320	3.41	3.11	97.2	6.4	≤ 9.19	Pass
802.11a	2	6	100	5500	5.03	3.55	97.2	7.5	≤ 9.19	Pass
802.11a	2	6	120	5600	4.76	2.98	97.2	7.1	≤ 9.19	Pass
802.11a	2	6	140	5700	4.36	1.93	97.2	6.4	≤ 9.19	Pass
802.11n-HT20	2	13	36	5180	2.51	2.30	94.4	5.7	≤ 9.19	Pass
802.11n-HT20	2	13	44	5220	2.35	2.36	94.4	5.6	≤ 9.19	Pass
802.11n-HT20	2	13	48	5240	2.68	2.41	94.4	5.8	≤ 9.19	Pass
802.11n-HT20	2	13	52	5260	2.97	2.53	94.4	6.0	≤ 9.19	Pass
802.11n-HT20	2	13	60	5300	3.07	2.44	94.4	6.0	≤ 9.19	Pass
802.11n-HT20	2	13	64	5320	3.07	2.46	94.4	6.0	≤ 9.19	Pass
802.11n-HT20	2	13	100	5500	4.66	2.74	94.4	7.1	≤ 9.19	Pass
802.11n-HT20	2	13	120	5600	4.64	2.66	94.4	7.0	≤ 9.19	Pass
802.11n-HT20	2	13	140	5700	4.22	1.67	94.4	6.4	≤ 9.19	Pass
802.11n-HT40	2	27	38	5190	-0.26	-0.61	78.0	3.7	≤ 9.19	Pass
802.11n-HT40	2	27	46	5230	-0.47	-0.20	78.0	3.8	≤ 9.19	Pass
802.11n-HT40	2	27	54	5270	-0.10	-0.57	78.0	3.8	≤ 9.19	Pass
802.11n-HT40	2	27	62	5310	-0.20	-0.42	78.0	3.8	≤ 9.19	Pass
802.11n-HT40	2	27	102	5510	1.00	0.01	78.0	4.6	≤ 9.19	Pass
802.11n-HT40	2	27	118	5590	1.36	-0.35	78.0	4.7	≤ 9.19	Pass
802.11n-HT40	2	27	134	5670	0.59	-0.72	78.0	4.1	≤ 9.19	Pass
802.11ac-VHT20	2	13	36	5180	2.50	1.92	86.3	5.9	≤ 9.19	Pass
802.11ac-VHT20	2	13	44	5220	2.53	2.25	86.3	6.0	≤ 9.19	Pass
802.11ac-VHT20	2	13	48	5240	2.48	2.05	86.3	5.9	≤ 9.19	Pass
802.11ac-VHT20	2	13	52	5260	2.56	2.38	86.3	6.1	≤ 9.19	Pass
802.11ac-VHT20	2	13	60	5300	3.01	2.24	86.3	6.3	≤ 9.19	Pass
802.11ac-VHT20	2	13	64	5320	2.77	2.35	86.3	6.2	≤ 9.19	Pass

802.11ac-VHT20	2	13	100	5500	4.69	2.49	86.3	7.4	≤ 9.19	Pass
802.11ac-VHT20	2	13	120	5600	4.59	2.42	86.3	7.3	≤ 9.19	Pass
802.11ac-VHT20	2	13	140	5700	4.09	1.94	86.3	6.8	≤ 9.19	Pass
802.11ac-VHT20	2	13	144	5720	3.80	1.85	86.3	6.6	≤ 9.19	Pass
802.11ac-VHT40	2	27	38	5190	-0.06	-0.18	78.3	4.0	≤ 9.19	Pass
802.11ac-VHT40	2	27	46	5230	0.41	-0.14	78.3	4.2	≤ 9.19	Pass
802.11ac-VHT40	2	27	54	5270	0.41	-0.48	78.3	4.1	≤ 9.19	Pass
802.11ac-VHT40	2	27	62	5310	0.31	-0.19	78.3	4.1	≤ 9.19	Pass
802.11ac-VHT40	2	27	102	5510	1.15	0.16	78.3	4.8	≤ 9.19	Pass
802.11ac-VHT40	2	27	118	5590	1.37	0.01	78.3	4.8	≤ 9.19	Pass
802.11ac-VHT40	2	27	134	5670	0.86	-0.58	78.3	4.3	≤ 9.19	Pass
802.11ac-VHT40	2	27	142	5710	1.15	-0.82	78.3	4.3	≤ 9.19	Pass
802.11ac-VHT80	2	58.6	42	5210	-4.33	-4.46	89.0	-0.9	≤ 9.19	Pass
802.11ac-VHT80	2	58.6	58	5290	-4.01	-4.65	89.0	-0.8	≤ 9.19	Pass
802.11ac-VHT80	2	58.6	106	5530	-2.77	-3.91	89.0	0.2	≤ 9.19	Pass
802.11ac-VHT80	2	58.6	122	5610	-3.13	-4.65	89.0	-0.3	≤ 9.19	Pass
802.11ac-VHT80	2	58.6	138	5690	-3.46	-4.85	89.0	-0.6	≤ 9.19	Pass

Note: When EUT duty cycle < 98%, the total PSD = $10^{\log\{10^{(\text{Ant 0 PSD}/10)} + 10^{(\text{Ant 1 PSD}/10)}\}} + 10^{\log(1/\text{duty cycle})}$.

Test Mode	N _{Tx}	Data Rate	Channel No.	Freq. (MHz)	Ant 0 PSD (dBm)	Ant 1 PSD (dBm)	Duty Cycle (%)	Constant Factor	Total PSD (dBm)	Limit (dBm/ 500KHz)	Result
2Tx – Ant 0 + 1											
802.11a	2	6	149	5745	-3.80	-5.74	97.2	7	5.5	≤ 28.19	Pass
802.11a	2	6	157	5785	-4.48	-7.32	97.2	7	4.5	≤ 28.19	Pass
802.11a	2	6	165	5825	-5.24	-7.90	97.2	7	3.8	≤ 28.19	Pass
802.11n-HT20	2	13	149	5745	-3.79	-6.67	94.4	7	5.3	≤ 28.19	Pass
802.11n-HT20	2	13	157	5785	-5.01	-6.81	94.4	7	4.4	≤ 28.19	Pass
802.11n-HT20	2	13	165	5825	-4.62	-7.97	94.4	7	4.3	≤ 28.19	Pass
802.11n-HT40	2	27	151	5755	-7.94	-9.45	78.0	7	2.5	≤ 28.19	Pass
802.11n-HT40	2	27	159	5795	-8.51	-9.60	78.0	7	2.1	≤ 28.19	Pass
802.11ac-VHT20	2	13	149	5745	-3.50	-6.07	86.3	7	6.1	≤ 28.19	Pass
802.11ac-VHT20	2	13	157	5785	-4.40	-6.36	86.3	7	5.4	≤ 28.19	Pass
802.11ac-VHT20	2	13	165	5825	-4.59	-7.40	86.3	7	4.9	≤ 28.19	Pass
802.11ac-VHT40	2	27	151	5755	-6.90	-7.76	78.3	7	3.8	≤ 28.19	Pass
802.11ac-VHT40	2	27	159	5795	-7.70	-8.04	78.3	7	3.2	≤ 28.19	Pass
802.11ac-VHT80	2	58.6	155	5775	-11.95	-12.83	89.0	7	-1.9	≤ 28.19	Pass

Note: When EUT duty cycle < 98%, the total PSD = $10^{\log\{10^{(Ant 0 PSD/10)}+10^{(Ant 1 PSD/10)}\}} + 10^{\log(1/duty cycle)} + Constant Factor.$

