

FCC RF Exposure Evaluation

1. Product Information

FCC ID:	OYRCF-917AC
Product name	11AC Dual Band Wireless Adapter
Model number	CF-917AC, CF-913AC, CF-915AC, CF-916AC, CF-7500AC, CF-923AC, CF-926AC, CF-WU910A, CF-WU925A, CF-WU710N, CF-WU757F, CF-WU772AC, CF-918AC, CF-925AC, CF-927AC, CF-928AC, CF-930AC, CF-933AC, CF-935AC, CF-936AC
Power supply	DC 5V by USB Port of PC
Modulation Type	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Type	PCB Antenna
Antenna Gain	2.0 dBi (maximum)
Hardware version	V1.3
Software version	1030.4
WLAN FCC Operation frequency	IEEE 802.11b:2412-2462MHz IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz / 5745-5825MHz IEEE 802.11n HT40:2422-2452MHz / 5755-5795MHz IEEE 802.11a: 5745-5825MHz IEEE 802.11ac VHT20: 5745-5825MHz IEEE 802.11ac VHT40: 5755-5795MHz IEEE 802.11ac VHT80: 5775MHz
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Portable Device

2. Evaluation method and Limit

According to KDB447498 D01 General RF Exposure Guidance v06 Section 4.3.1 Standalone SAR test exclusion considerations: "Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition, listed below, is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.22 The minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander (see 5) of section 4.1). To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, typically in the SAR measurement or SAR analysis report, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for the SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops & tablets etc.23 "

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f} (\text{GHz})]$
 ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where:

- f (GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to f) in section 4.1 is applied to determine SAR test exclusion.

Per KDB447498 requires when the standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion;

- $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})/x}] \text{ W/kg}$ for test separation distances ≤ 50 mm;
 Where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR;
- 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is >50 mm

When one of the following test exclusion conditions is satisfied for all combinations of simultaneous transmission configurations, further equipment approval is not required to incorporate transmitter modules in host devices that operate in the mixed mobile and portable host platform exposure conditions. The grantee is responsible for documenting this according to Class I permissive change requirements. Antennas that qualify for standalone SAR test exclusion must apply the estimated standalone SAR to determine simultaneous transmission test exclusion.

- a) The $[\sum \text{ of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg}] + [\sum \text{ of MPE ratios}] \leq 1.0$.
- b) The SAR to peak location separation ratios of all simultaneously transmitting antenna pairs operating in portable device exposure conditions are all ≤ 0.04 , and the $[\sum \text{ of MPE ratios}] \leq 1.0$.

3. Refer evaluation method

[ANSI C95.1-1999](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

[FCC KDB publication 447498 D01 General RF Exposure Guidance v06](#): Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

[FCC CFR 47 part1 1.1310](#): Radiofrequency radiation exposure limits.

[FCC CFR 47 part2 2.1093](#): Radiofrequency radiation exposure evaluation: portable devices

4. Conducted Power Results

Test Mode	Channel	Frequency (MHz)	Measured Average Output Power (dBm)			
			Antenna 0	Antenna 1	Antenna 2	Sum
IEEE 802.11b	1	2412	8.77	8.95	8.79	-/-
	6	2437	8.81	9.03	8.71	-/-
	11	2462	8.45	8.72	8.42	-/-
IEEE 802.11g	1	2412	8.12	8.09	8.23	-/-
	6	2437	8.01	8.22	8.11	-/-
	11	2462	8.29	8.25	8.05	-/-
IEEE 802.11n HT20	1	2412	3.41	3.42	3.37	8.17
	6	2437	3.55	3.52	3.48	8.29
	11	2462	3.28	3.33	3.29	8.07
IEEE 802.11n HT40	3	2422	3.70	3.61	3.68	8.43
	6	2437	3.59	3.54	3.53	8.32
	9	2452	3.37	3.28	3.32	8.09

Test Mode	Channel	Frequency (MHz)	Measured Average Output Power (dBm)			
			Antenna 0	Antenna 1	Antenna 2	Sum
IEEE 802.11a	149	5745	2.94	2.91	2.84	-/-
	157	5785	2.78	2.75	2.71	-/-
	165	5825	2.66	2.56	2.55	-/-
IEEE 802.11n HT20	149	5745	2.63	2.51	2.53	7.33
	157	5785	2.47	2.40	2.46	7.21
	165	5825	2.64	2.51	2.58	7.35
IEEE 802.11n HT40	151	5755	2.51	2.47	2.48	7.26
	159	5795	2.44	2.41	2.35	7.17
IEEE 802.11ac VHT20	149	5745	2.76	2.73	2.73	7.51
	157	5785	2.60	2.56	2.53	7.33
	165	5825	2.40	2.44	2.38	7.18
IEEE 802.11ac VHT40	151	5755	2.37	2.31	2.35	7.11
	159	5795	2.55	2.52	2.45	7.28
IEEE 802.11ac VHT80	155	5775	2.38	2.31	2.32	7.11

5. Manufacturing tolerance

IEEE 802.11b (Average)									
Frequency (MHz)	Antenna 0			Antenna 1			Antenna 2		
	2412	2437	2462	2412	2437	2462	2412	2437	2462
Target (dBm)	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Tolerance \pm (dB)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11g (Average)									
Frequency (MHz)	Antenna 0			Antenna 1			Antenna 2		
	2412	2437	2462	2412	2437	2462	2412	2437	2462
Target (dBm)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Tolerance \pm (dB)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)									
Frequency (MHz)	Antenna 0			Antenna 1			Antenna 2		
	2412	2437	2462	2412	2437	2462	2412	2437	2462
Target (dBm)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Tolerance \pm (dB)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	Antenna 0			Antenna 1			Antenna 2		
	5745	5785	5825	5745	5785	5825	5745	5785	5825
Target (dBm)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Tolerance \pm (dB)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)									
Frequency (MHz)	Antenna 0			Antenna 1			Antenna 2		
	2422	2437	2452	2422	2437	2452	2422	2437	2452
Target (dBm)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Tolerance \pm (dB)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (MHz)	Antenna 0			Antenna 1			Antenna 2		
	5755	-/-	5795	5755	-/-	5795	5755	-/-	5795
Target (dBm)	2.0	-/-	2.0	2.0	-/-	2.0	2.0	-/-	2.0
Tolerance \pm (dB)	1.0	-/-	1.0	1.0	-/-	1.0	1.0	-/-	1.0
IEEE 802.11a (Average)									
Frequency (MHz)	Antenna 0			Antenna 1			Antenna 2		
	5745	5785	5825	5745	5785	5825	5745	5785	5825
Target (dBm)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Tolerance \pm (dB)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11ac VHT20 (Average)									
Frequency (MHz)	Antenna 0			Antenna 1			Antenna 2		
	5745	5785	5825	5745	5785	5825	5745	5785	5825
Target (dBm)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Tolerance \pm (dB)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11ac VHT40 (Average)									
Frequency (MHz)	Antenna 0			Antenna 1			Antenna 2		
	5755	-/-	5795	5755	-/-	5795	5755	-/-	5795
Target (dBm)	2.0	-/-	2.0	2.0	-/-	2.0	2.0	-/-	2.0
Tolerance \pm (dB)	1.0	-/-	1.0	1.0	-/-	1.0	1.0	-/-	1.0

IEEE 802.11ac VHT80 (Average)									
Frequency (MHz)	Antenna 0			Antenna 1			Antenna 2		
	-/-	5775	-/-	-/-	5775	-/-	-/-	5775	-/-
Target (dBm)	-/-	2.0	-/-	-/-	2.0	-/-	-/-	2.0	-/-
Tolerance \pm (dB)	-/-	1.0	-/-	-/-	1.0	-/-	-/-	1.0	-/-

6. Evaluation Results

6.1 Standalone

Antenna 0

Band/Mode	f (GHz)	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	SAR Test Exclusion
			dBm	mW		
IEEE 802.11b	2.50	5	9.50	8.9125	2.8 < 3.0	Yes
IEEE 802.11g	2.50	5	9.00	7.9433	2.5 < 3.0	Yes
IEEE 802.11n HT20	2.50	5	4.00	2.5119	0.8 < 3.0	Yes
	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11n HT40	2.50	5	4.00	2.5119	0.8 < 3.0	Yes
	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11a	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11ac VHT20	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11ac VHT40	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11ac VHT80	5.85	5	3.00	1.9953	1.0 < 3.0	Yes

Antenna 1

Band/Mode	f (GHz)	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	SAR Test Exclusion
			dBm	mW		
IEEE 802.11b	2.50	5	9.50	8.9125	2.8 < 3.0	Yes
IEEE 802.11g	2.50	5	9.00	7.9433	2.5 < 3.0	Yes
IEEE 802.11n HT20	2.50	5	4.00	2.5119	0.8 < 3.0	Yes
	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11n HT40	2.50	5	4.00	2.5119	0.8 < 3.0	Yes
	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11a	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11ac VHT20	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11ac VHT40	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11ac VHT80	5.85	5	3.00	1.9953	1.0 < 3.0	Yes

Antenna 2

Band/Mode	f (GHz)	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	SAR Test Exclusion
			dBm	mW		
IEEE 802.11b	2.50	5	9.50	8.9125	2.8 < 3.0	Yes
IEEE 802.11g	2.50	5	9.00	7.9433	2.5 < 3.0	Yes
IEEE 802.11n HT20	2.50	5	4.00	2.5119	0.8 < 3.0	Yes
	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11n HT40	2.50	5	4.00	2.5119	0.8 < 3.0	Yes
	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11a	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11ac VHT20	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11ac VHT40	5.85	5	3.00	1.9953	1.0 < 3.0	Yes
IEEE 802.11ac VHT80	5.85	5	3.00	1.9953	1.0 < 3.0	Yes

Remark:

1. Output power including tune up tolerance;
2. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to f) in section 4.1 is applied to determine SAR test exclusion.

6.2 Simultaneous Transmission for SAR Exclusion

The sample support one WLAN modular and supports three transmit antennas, need consider simultaneous transmission;

6.2.1 Estimated Standalone SAR*Antenna 0*

Band/Mode	f (GHz)	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	Estimated SAR _{1-g} (W/kg)
			dBm	mW		
IEEE 802.11b	2.50	5	9.50	8.9125	2.8 < 3.0	0.3734
IEEE 802.11g	2.50	5	9.00	7.9433	2.5 < 3.0	0.3333
IEEE 802.11n HT20	2.50	5	4.00	2.5119	0.8 < 3.0	0.1067
	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11n HT40	2.50	5	4.00	2.5119	0.8 < 3.0	0.1067
	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11a	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11ac VHT20	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11ac VHT40	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11ac VHT80	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333

Antenna 1

Band/Mode	f (GHz)	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	Estimated SAR _{1-g} (W/kg)
			dBm	mW		
IEEE 802.11b	2.50	5	9.50	8.9125	2.8 < 3.0	0.3734
IEEE 802.11g	2.50	5	9.00	7.9433	2.5 < 3.0	0.3333
IEEE 802.11n HT20	2.50	5	4.00	2.5119	0.8 < 3.0	0.1067
	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11n HT40	2.50	5	4.00	2.5119	0.8 < 3.0	0.1067
	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11a	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11ac VHT20	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11ac VHT40	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11ac VHT80	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333

Antenna 2

Band/Mode	f (GHz)	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	Estimated SAR _{1-g} (W/kg)
			dBm	mW		
IEEE 802.11b	2.50	5	9.50	8.9125	2.8 < 3.0	0.3734
IEEE 802.11g	2.50	5	9.00	7.9433	2.5 < 3.0	0.3333
IEEE 802.11n HT20	2.50	5	4.00	2.5119	0.8 < 3.0	0.1067
	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11n HT40	2.50	5	4.00	2.5119	0.8 < 3.0	0.1067
	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11a	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11ac VHT20	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11ac VHT40	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333
IEEE 802.11ac VHT80	5.85	5	3.00	1.9953	1.0 < 3.0	0.1333

Σ of (the highest measured or estimated SAR_{Antenna 0} + SAR_{Antenna 1} + SAR_{Antenna 2})/1.6 = (0.1333+0.1333+0.1333)/1.6 = 0.3 < 1.0;

Remark:

1. Output power including tune up tolerance;
2. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to f) in section 4.1 is applied to determine SAR test exclusion.

7. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB 447498 v06.

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