



Radio Frequency Exposure

LIMIT

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this chapter.

EUT Specification

EUT	AOPEN Chromebox Commercial
Frequency band (Operating)	<input checked="" type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input checked="" type="checkbox"/> WLAN: 5.150GHz ~ 5.250GHz <input checked="" type="checkbox"/> WLAN: 5.250GHz ~ 5.350GHz <input checked="" type="checkbox"/> WLAN: 5.470GHz ~ 5.725GHz <input checked="" type="checkbox"/> WLAN: 5.725GHz ~ 5.850GHz <input checked="" type="checkbox"/> Bluetooth: 2.402GHz ~ 2.480 GHz
Device category	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation)
Exposure classification	<input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm ²) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm ²)
Antenna diversity	<input type="checkbox"/> Single antenna <input checked="" type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input checked="" type="checkbox"/> Tx/Rx diversity
Max. output power	<p>Band: 2402-2462MHz 802.11b: 20.47 dBm (111.4 mW) 802.11g: 23.74 dBm (236.6 mW) 802.11n (20MHz): 23.49 dBm (223.4 mW) 802.11n (40MHz): 23.51 dBm (224.4 mW)</p> <p>Band: 2402-2480MHz GFSK: 3.66 dBm(2.3mW) π/4-DQPSK: 2.15 dBm(1.6mW) 8DPSK: 1.24 dBm(1.3mW) GFSK(BLE): 2.77 dBm(1.9mW)</p> <p>Band: 5150-5250 MHz 802.11a: 21.6 dBm (144.5mW) 802.11an (20MHz): 19.97 dBm (99.3 mW) 802.11an (40MHz): 19.75 dBm (94.4 mW) 802.11ac (20MHz): 19.83 dBm (96.2 mW) 802.11ac (40MHz): 19.88 dBm (97.3 mW) 802.11ac (80MHz): 18.48 dBm (70.5 mW)</p> <p>Band: 5250-5350 MHz 802.11a: 21.77 dBm (150.3mW) 802.11an (20MHz): 19.74 dBm (94.2 mW) 802.11an (40MHz): 18.01 dBm (63.2 mW) 802.11ac (20MHz): 19.64 dBm (92.0 mW) 802.11ac (40MHz): 18.56 dBm (71.8 mW) 802.11ac (80MHz): 18.61 dBm (72.6 mW)</p>



	Band: 5470-5725 MHz 802.11a: 22.57 dBm (180.7mW) 802.11an (20MHz): 21.22 dBm (132.4 mW) 802.11an (40MHz): 20.7 dBm (117.5 mW) 802.11ac (20MHz): 21.36 dBm (136.8 mW) 802.11ac (40MHz): 20.44 dBm (110.7 mW) 802.11ac (80MHz): 19.12 dBm (81.7 mW) Band: 5725-5850 MHz 802.11a: 22.7 dBm (186.2mW) 802.11an (20MHz): 20.94 dBm (124.2 mW) 802.11an (40MHz): 21.18 dBm (131.2 mW) 802.11ac (20MHz): 20.84 dBm (121.3 mW) 802.11ac (40MHz): 20.63 dBm (115.6 mW) 802.11ac (80MHz): 21.3 dBm (134.9 mW)
Antenna gain (Max)	Antenna A: 2dBi Antenna B: 2dBi Directional gain: 5dBi
Evaluation applied	<input checked="" type="checkbox"/> MPE Evaluation* <input type="checkbox"/> SAR Evaluation <input type="checkbox"/> N/A
Remark: 1. The maximum output power is <u>23.74dBm (236.6 mW)</u> at <u>2437 MHz</u> (with numeric 5 antenna gain.) 2. DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance. 3. For mobile or fixed location transmitters, no SAR consideration applied. The maximum power density is 1.0 mW/cm ² even if the calculation indicates that the power density would be larger.	

*Note: Simultaneous transmission is not applicable for this EUT.



TEST RESULTS

No non-compliance noted.

Calculation

$$\text{Given } E = \frac{\sqrt{30 \times P \times G}}{d} \quad \& \quad S = \frac{E^2}{3770}$$

Where E = Field strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \text{Equation 1}$$

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

**Maximum Permissible Exposure**

Modulation Mode	Frequency band (MHz)	Max. Conducted output power(dBm)			Antenna gain (dBi)	Distance (cm)	Power density (mW/cm ²)	Limit (mW/cm ²)
		ANT A	ANT B	ANT A+B			ANT A+B	
802.11b	2412-2462	17.55	17.37	20.47	2	20	0.035	1
802.11g	2412-2462	21.18	20.22	23.74	2	20	0.075	1
802.11n (20MHz)	2412-2462	20.28	20.67	23.49	5	20	0.141	1
802.11n (40MHz)	2422-2452	20.44	20.56	23.51	5	20	0.141	1
GFSK	2402-2480	3.66	---	---	2	20	0.001	1
$\pi/4$ -DQPSK	2402-2480	2.15	---	---	2	20	0.001	1
8DPSK	2402-2480	1.24	---	---	2	20	0	1
GFSK(BLE)	2402-2480	2.77	---	---	2	20	0.001	1
802.11a	5150-5250	17.63	19.37	21.60	2	20	0.046	1
802.11an (20MHz)	5150-5250	17.13	16.78	19.97	5	20	0.062	1
802.11an (40MHz)	5150-5250	16.23	17.2	19.75	5	20	0.059	1
802.11ac (20MHz)	5150-5250	16.88	16.75	19.83	5	20	0.060	1
802.11ac (40MHz)	5150-5250	16.86	16.87	19.88	5	20	0.061	1
802.11ac (80MHz)	5150-5250	15.56	15.37	18.48	5	20	0.044	1
802.11a	5250-5350	17.59	19.68	21.77	2	20	0.047	1
802.11an (20MHz)	5250-5350	16.69	16.77	19.74	5	20	0.059	1
802.11an (40MHz)	5250-5350	15.13	14.87	18.01	5	20	0.040	1
802.11ac (20MHz)	5250-5350	16.37	16.88	19.64	5	20	0.058	1
802.11ac (40MHz)	5250-5350	15.43	15.67	18.56	5	20	0.045	1
802.11ac (80MHz)	5250-5350	15.69	15.51	18.61	5	20	0.046	1
802.11a	5470-5725	19.22	19.88	22.57	2	20	0.057	1
802.11an (20MHz)	5470-5725	18.19	18.23	21.22	5	20	0.083	1
802.11an (40MHz)	5470-5725	17.92	17.45	20.70	5	20	0.074	1
802.11ac (20MHz)	5470-5725	18.22	18.48	21.36	5	20	0.086	1
802.11ac (40MHz)	5470-5725	17.32	17.53	20.44	5	20	0.070	1
802.11ac (80MHz)	5470-5725	16.03	16.18	19.12	5	20	0.051	1
802.11a	5725-5850	18.77	20.44	22.70	2	20	0.059	1
802.11an (20MHz)	5725-5850	17.78	18.07	20.94	5	20	0.078	1
802.11an (40MHz)	5725-5850	17.76	18.55	21.18	5	20	0.083	1
802.11ac (20MHz)	5725-5850	17.77	17.89	20.84	5	20	0.076	1
802.11ac (40MHz)	5725-5850	17.58	17.66	20.63	5	20	0.073	1
802.11ac (80MHz)	5725-5850	18.35	18.22	21.30	5	20	0.085	1



NOTE:

Total (Chain0+Chain1) , the formula of calculated the MPE is:

$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$

CPD = Calculation power density

LPD = Limit of power density