FCC RF Exposure Evaluation

1. Product Information

FCC ID	:	2AVTH-14CB7
Product name	:	HYBOOK_PLUS
Test Model	:	14CB7S01
Power supply	:	Input: 19.0V⎓2.1A For AC Adapter Input: 100-240V~, 50/60Hz, 1.7A Max Adapter Output: 19.0V⎓2.1A, 39.9W DC 7.6V by Rechargeable Li-ion Battery, 5000mAh
Frequency Range	:	2402MHz-2480MHz 2412MHz-2462MHz 5180-5240MHz 5745MHz-5825MHz
Channel Number	:	79 channels for Bluetooth V4.2(DSS) 40 channels for Bluetooth V4.2 (DTS) 11 Channels for 20MHz bandwidth (2412~2462MHz) 7 Channels for 40MHz bandwidth (2422~2452MHz) 4 Channels for 20MHz bandwidth(5180MHz-5240MHz) 2 channels for 40MHz bandwidth(5190MHz~5230MHz) 1 channels for 80MHz bandwidth(5210MHz)
Channel Spacing	:	1MHz for Bluetooth V4.2 (DSS) 2MHz for Bluetooth V4.2 (DTS) 5MHz
Modulation Type	:	GFSK, π/4-DQPSK, 8-DPSK for Bluetooth V4.2(DSS) GFSK for Bluetooth V4.2 (DTS) 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/n/ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Bluetooth Version	:	V4.2
Antenna Type	:	PIFA Antenna
Antenna Gain	:	0dBi(Max.)
Hardware version	:	/
Software version	:	/
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."
[(max. power of channel, including tune-up tolerance, mW)/ (min. test separation distance, mm)] · [√f (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.

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 [∑ of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg] + [∑ of MPE ratios] is ≤ 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 [∑ of MPE ratios] is ≤ 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

[BT Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	4.48
	39	2441	3.89
	78	2480	3.06
π/4DQPSK	0	2402	0.83
	39	2441	0.26
	78	2480	-0.52
8DPSK	0	2402	1.15
	19	2440	0.42
	39	2480	-0.34

[BT LE Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	2.76
	19	2440	2.18
	39	2480	1.34

[2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)		
			Ant 0	Ant 1	Sum
11B	1	2412	6.07	7.06	/
	6	2437	6.47	7.91	/
	11	2462	6.31	7.27	/
11G	1	2412	5.49	7.46	/
	6	2437	5.95	7.93	/
	11	2462	5.79	7.80	/
11N20SISO	1	2412	4.86	6.02	8.49
	6	2437	5.89	6.17	8.85
	11	2462	5.76	5.86	8.82
11N40SISO	3	2422	5.28	6.00	8.67
	6	2437	5.49	6.20	8.87
	9	2452	4.60	6.29	8.54

[5.2G WLAN Max Conducted Power]

Mode	Channel	Frequency (MHz)	Average Conducted Output Power (dBm)		
			Ant 0	Ant 1	Sum
IEEE 802.11a	36	5180	5.88	5.87	/
	40	5200	5.77	5.54	/
	48	5240	5.45	5.74	/
IEEE 802.11n HT20	36	5180	4.17	4.43	7.63
	40	5200	4.45	4.45	7.77
	48	5240	4.38	4.49	7.87
IEEE 802.11n HT40	38	5190	4.19	4.62	7.75
	46	5230	3.38	4.69	7.45
IEEE 802.11ac VHT20	36	5180	3.91	4.39	7.49
	40	5200	3.84	4.84	7.72
	48	5240	3.62	4.61	7.50
IEEE 802.11ac VHT40	38	5190	4.11	4.90	7.87
	46	5230	3.11	4.98	7.52
IEEE 802.11ac VHT80	42	5210	3.65	4.93	7.70

[5.8G WIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)		
			Ant 0	Ant 1	Sum
11A	149	5745	5.23	4.98	/
	157	5785	5.92	5.60	/
	165	5825	5.44	5.91	/
11N20 SISO	149	5745	3.21	3.45	6.99
	157	5785	3.89	3.77	7.70
	165	5825	3.87	3.45	7.54
11N40 SISO	151	5755	3.52	3.47	7.06
	159	5795	3.92	3.72	7.69
11AC20 SISO	149	5745	3.49	3.31	7.01
	157	5785	3.77	3.53	7.52
	165	5825	3.91	3.97	7.80
11AC40 SISO	151	5755	3.39	3.35	6.88
	159	5795	3.89	3.92	7.87
11AC80 SISO	155	5775	3.91	3.63	7.64

5. Manufacturing Tolerance

[BT]

GFSK			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	4.0	3.0	3.0
Tolerance ±(dB)	1.0	1.0	1.0
π/4DQPSK			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	0	0	0
Tolerance ±(dB)	1.0	1.0	1.0
8DPSK			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	1.0	0	0
Tolerance ±(dB)	1.0	1.0	1.0

[BT LE]

GFSK			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	2.0	2.0	2.0
Tolerance ±(dB)	1.0	1.0	1.0

[2.4GWIFI_ANT 0]

11B			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	6.0	6.0	6.0
Tolerance ±(dB)	1.0	1.0	1.0
11G			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	5.0	5.0	5.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20SISO			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	5.0	5.0	5.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40SISO			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	5.0	5.0	5.0
Tolerance ±(dB)	1.0	1.0	1.0

[2.4GWIFI_ANT 1]

11B			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	7.0	7.0	7.0
Tolerance ±(dB)	1.0	1.0	1.0
11G			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	7.0	7.0	7.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20SISO			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	6.0	6.0	6.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40SISO			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	6.0	6.0	6.0
Tolerance ±(dB)	1.0	1.0	1.0

[5.2GWIFI_ANT 0]

IEEE 802.11a			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	5.0	5.0	5.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n HT20			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	4.0	4.0	4.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n HT40			
Channel	Channel 38		Channel 46
Target (dBm)	4.0		4.0
Tolerance ± (dB)	1.0		1.0
IEEE 802.11ac VHT20			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	4.0	4.0	4.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11ac VHT40			
Channel	Channel 38		Channel 46
Target (dBm)	4.0		4.0
Tolerance ± (dB)	1.0		1.0
IEEE 802.11ac VHT80			
Channel	Channel 42		
Target (dBm)	4.0		
Tolerance ± (dB)	1.0		

[5.2GWIFI_ANT 1]

IEEE 802.11a			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	5.0	5.0	5.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n HT20			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	4.0	4.0	4.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n HT40			
Channel	Channel 38	Channel 46	
Target (dBm)	4.0	4.0	
Tolerance ± (dB)	1.0	1.0	
IEEE 802.11ac VHT20			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	4.0	4.0	4.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11ac VHT40			
Channel	Channel 38	Channel 46	
Target (dBm)	4.0	4.0	
Tolerance ± (dB)	1.0	1.0	
IEEE 802.11ac VHT80			
Channel	Channel 42		
Target (dBm)	4.0		
Tolerance ± (dB)	1.0		

[5.8GWIFI_ANT 0]

11A			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	5.0	5.0	5.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20 SISO			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	3.0	3.0	3.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40 SISO			
Channel	Channel 151		Channel 159
Target (dBm)	3.0		3.0
Tolerance ±(dB)	1.0		1.0
11AC20 SISO			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	3.0	3.0	3.0
Tolerance ±(dB)	1.0	1.0	1.0
11AC40 SISO			
Channel	Channe151		Channel 159
Target (dBm)	3.0		3.0
Tolerance ±(dB)	1.0		1.0
11AC80 SISO			
Channel	Channel 155		
Target (dBm)	3.0		
Tolerance ±(dB)	1.0		

[5.8GWIFI_ANT 1]

11A			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	5.0	5.0	5.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20 SISO			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	3.0	3.0	3.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40 SISO			
Channel	Channel 151		Channel 159
Target (dBm)	3.0		3.0
Tolerance ±(dB)	1.0		1.0
11AC20 SISO			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	3.0	3.0	3.0
Tolerance ±(dB)	1.0	1.0	1.0
11AC40 SISO			
Channel	Channe151		Channel 159
Target (dBm)	3.0		3.0
Tolerance ±(dB)	1.0		1.0
11AC80 SISO			
Channel	Channel 155		
Target (dBm)	3.0		
Tolerance ±(dB)	1.0		

6. Evaluation Results

6.1 Standalone Evaluation

[BT]

Band/Mode	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	SAR Exclusion Threshold Limit	SAR Test Exclusion
		dBm	mW			
GFSK	5	5.0	3.16	0.980	< 3.0	Yes
π/4DQPSK	5	1.0	1.26	0.397	< 3.0	Yes
8DPSK	5	2.0	1.58	0.499	< 3.0	Yes

[BT LE]

Band/Mode	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	SAR Exclusion Threshold Limit	SAR Test Exclusion
		dBm	mW			
GFSK	5	3.0	2.00	0.628	< 3.0	Yes

[2.4GWIFI]

Band/Mode	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	SAR Exclusion Threshold Limit	SAR Test Exclusion
		dBm	mW			
IEEE 802.11b (ANT0)	5	7.0	5.01	1.573	< 3.0	Yes
IEEE 802.11g (ANT0)	5	6.0	3.98	1.249	< 3.0	Yes
IEEE 802.11n20 (ANT0)	5	6.0	3.98	1.249	< 3.0	Yes
IEEE 802.11n40 (ANT0)	5	6.0	3.98	1.249	< 3.0	Yes
IEEE 802.11b (ANT1)	5	8.0	6.31	1.980	< 3.0	Yes
IEEE 802.11g (ANT1)	5	8.0	6.31	1.980	< 3.0	Yes
IEEE 802.11n20 (ANT1)	5	7.0	5.01	1.573	< 3.0	Yes
IEEE 802.11n40 (ANT1)	5	7.0	5.01	1.573	< 3.0	Yes

[5.2GWIFI]

Band/Mode	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	SAR Exclusion Threshold Limit	SAR Test Exclusion
		dBm	mW			
IEEE 802.11a(ANT0)	5	6.0	3.98	1.823	< 3.0	Yes
IEEE 802.11n20(ANT0)	5	5.0	3.16	1.448	< 3.0	Yes
IEEE 802.11n40(ANT0)	5	5.0	3.16	1.448	< 3.0	Yes
IEEE 802.11ac20(ANT0)	5	5.0	3.16	1.448	< 3.0	Yes
IEEE 802.11ac40(ANT0)	5	5.0	3.16	1.448	< 3.0	Yes
IEEE 802.11ac80(ANT0)	5	5.0	3.16	1.448	< 3.0	Yes
IEEE 802.11a(ANT1)	5	6.0	3.98	1.823	< 3.0	Yes
IEEE 802.11n20(ANT1)	5	5.0	3.16	1.448	< 3.0	Yes
IEEE 802.11n40(ANT1)	5	5.0	3.16	1.448	< 3.0	Yes
IEEE 802.11ac20(ANT1)	5	5.0	3.16	1.448	< 3.0	Yes
IEEE 802.11ac40(ANT1)	5	5.0	3.16	1.448	< 3.0	Yes
IEEE 802.11ac80(ANT1)	5	5.0	3.16	1.448	< 3.0	Yes

[5.8GWIFI]

Band/Mode	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	SAR Exclusion Threshold Limit	SAR Test Exclusion
		dBm	mW			
IEEE 802.11a(ANT0)	5	6.0	3.98	1.922	< 3.0	Yes
IEEE 802.11n20(ANT0)	5	4.0	2.51	1.212	< 3.0	Yes
IEEE 802.11n40(ANT0)	5	4.0	2.51	1.212	< 3.0	Yes
IEEE 802.11ac20(ANT0)	5	4.0	2.51	1.212	< 3.0	Yes
IEEE 802.11ac40(ANT0)	5	4.0	2.51	1.212	< 3.0	Yes
IEEE 802.11ac80(ANT0)	5	4.0	2.51	1.212	< 3.0	Yes
IEEE 802.11a(ANT1)	5	6.0	3.98	1.922	< 3.0	Yes
IEEE 802.11n20(ANT1)	5	4.0	2.51	1.212	< 3.0	Yes
IEEE 802.11n40(ANT1)	5	4.0	2.51	1.212	< 3.0	Yes
IEEE 802.11ac20(ANT1)	5	4.0	2.51	1.212	< 3.0	Yes
IEEE 802.11ac40(ANT1)	5	4.0	2.51	1.212	< 3.0	Yes
IEEE 802.11ac80(ANT1)	5	4.0	2.51	1.212	< 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.

3. We choose highest frequency (2480MHz at Bluetooth Band, 2462MHz at 2.4G WIFI Band, 5240MHz at 5.2G WIFI Band and 5825MHz at 5.8G WIFI Band) to calculate SAR Exclusion Threshold as higher frequency will have higher Exclusion Threshold.

6.2 Simultaneous Transmission for SAR Exclusion

The sample support one BT&BLE&2.4G WIFI &5.2G WIFI &5.8G WIFI antenna and another one 2.4G WIFI &5.2G WIFI &5.8G WIFI transmit antenna, so need consider simultaneous transmission.

Mode	Exclusion Threshold Rate ANT 0	Exclusion Threshold Rate ANT 1	∑Exclusion Threshold Rate	Limit	Results
BT(Ant 0)+2.4G WIFI (Ant 1)	0.980/3.0	1.980/3.0	0.987	< 1.0	PASS
BT(Ant 0)+5.2G WIFI (Ant 1)	0.980/3.0	1.823/3.0	0.934	< 1.0	PASS
BT(Ant 0)+5.8G WIFI (Ant 1)	0.980/3.0	1.922/3.0	0.967	< 1.0	PASS
BLE(Ant 0)+2.4G WIFI (Ant 1)	0.628/3.0	1.980/3.0	0.868	< 1.0	PASS
BLE(Ant 0)+5.2G WIFI (Ant 1)	0.628/3.0	1.823/3.0	0.816	< 1.0	PASS
BLE(Ant 0)+5.8G WIFI (Ant 1)	0.628/3.0	1.922/3.0	0.849	< 1.0	PASS
2.4G WIFI (MIMO)	1.249/3.0	1.573/3.0	0.941	< 1.0	PASS
5.2G WIFI (MIMO)	1.448/3.0	1.448/3.0	0.965	< 1.0	PASS
5.8G WIFI (MIMO)	1.212/3.0	1.212/3.0	0.808	< 1.0	PASS

Remark:

1. Ratio = Exclusion / Exclusion Limits, ∑ of Exclusion ratios ≤ 1.0

2. IEEE 802.11n/ac mode can transmit MIMO, and the 2.4G WIFI and 5G WIFI can't transmit at the same time.

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.

.....THE END OF REPORT.....