RF EXPOSURE

EVALUATION REPORT

APPLICANT	:	Anker Innovations Limited
PRODUCT NAME	:	Nebula Soundbar-Fire TV Edition
MODEL NAME	:	D3000
BRAND NAME	:	NEBULA
FCC ID	:	2AOKB-D3000
STANDARD(S)	:	47CFR 2.1091 KDB 447498
RECEIPT DATE	:	2019-07-31
TEST DATE	:	2019-08-27 to 2019-09-05
ISSUE DATE	:	2019-09-05

Edited by: _Gan Yueming_

Gan Yueming (Rapporteur)

Approved by: _Peng Hua_

Peng Huarui (Supervisor)

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Change history		
Version	**Date**	**Reason of changed**
1.0	2019-09-05	Original

1. Technical Information

Note: Provide by manufacturer.

1.1 Applicant and Manufacturer Information

Applicant:	Anker Innovations Limited
Applicant Address:	Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong
Manufacturer:	Anker Innovations Limited
Manufacturer Address:	Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong

1.2 Equipment under Test (EUT) Description

EUT Name:	Nebula Soundbar-Fire TV Edition
Hardware Version:	V0.3
Software Version:	V1.1.13
Frequency Bands:	WLAN 2.4GHz: 2412 MHz ~2472 MHz WLAN 5.2GHz: 5180 MHz ~ 5240 MHz WLAN 5.8GHz: 5745 MHz ~ 5825 MHz Bluetooth：2402 MHz ~2480 MHz
Modulation Mode:	802.11b: DSSS 802.11g/n-HT20: OFDM 802.11a, 802.11n(HT20), 802.11n(HT40)：OFDM 802.11ac(VHT20), 802.11ac(VHT40), 802.11ac(VHT80): OFDM BR/EDR:FHSS (GFSK(1Mbps), π/4-DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps)) BLE: GFSK(1Mbps)
WLAN MIMO：	Supports
Module：	Module 1：ActionsBlue Stack Dual 5.0 Module 2：E9L29Y
Antenna Type:	WLAN: Fixed Internal Antenna Bluetooth：Fixed Internal Antenna
Antenna Gain:	WLAN 2.4GHz：Ant1: 3.21 dBi; Ant2: 1.10dBi WLAN 5GHz：Ant1: 1.15 dBi; Ant2: 5.30dBi Bluetooth: 1.10dBi

1.3 Identification of all used EUT

The EUT identity consists of numerical and letter characters, the letter character indicates the test sample, and the following two numerical characters indicate the software version of the test sample.

EUT Identity	Hardware Version	Software Version
1#	V0.3	V1.1.13

1.4 Applied Reference Documents

Leading reference documents for testing:

No.	Identity	Document Title	Method determination /Remark
1	47 CFR§2.1091	Radio Frequency Radiation Exposure Evaluation: mobile devices	No deviation
2	KDB 447498 D01v06	General RF Exposure Guidance	No deviation

2. Device Category and RF Exposure Limit

Per user manual, Based on 47CFR 2.1091, this device belongs to mobile device category with General Population/Uncontrolled exposure.

Mobile Devices:

47CFR 2.1091(b)

For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term "fixed location" means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

GENERAL POPULATION / UNCONTROLLED EXPOSURE

The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f^2)	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	f/1500	30
1500-100,000	-	-	1.0	30

f = frequency in MHz* = Plane-wave equivalent power density

3. Conducted Power

<WLAN 2.4GHz mode>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN ANT 0	802.11b 1Mbps	CH 1	2412	**19.40**	**20.0**	100.0
		CH 6	2437	18.78	19.5	
		CH 7	2442	18.80	19.5	
		CH 12	2467	18.87	19.5	
		CH 13	2472	18.89	19.5	
	802.11g 6Mbps	CH 1	2412	17.00	17.5	93.29
		CH 6	2437	17.05	17.5	
		CH 7	2442	16.90	17.5	
		CH 12	2467	16.96	17.5	
		CH 13	2472	16.82	17.5	
	802.11n-HT20 MCS0	CH 1	2412	15.96	16.5	92.86
		CH 6	2437	15.42	16.0	
		CH 7	2442	15.18	16.0	
		CH 12	2467	15.13	16.0	
		CH 13	2472	15.12	16.0	

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN ANT 1	802.11b 1Mbps	CH 1	2412	19.45	20.0	100.0
		CH 6	2437	19.17	20.0	
		CH 7	2442	19.60	20.0	
		CH 12	2467	**19.86**	**20.0**	
		CH 13	2472	19.73	20.0	
	802.11g 6Mbps	CH 1	2412	17.64	18.0	93.29
		CH 6	2437	17.73	18.0	
		CH 7	2442	18.42	19.0	
		CH 12	2467	18.34	19.0	
		CH 13	2472	18.36	19.0	
	802.11n-HT20 MCS0	CH 1	2412	16.06	16.5	92.86
		CH 6	2437	15.95	16.5	
		CH 7	2442	16.42	16.5	

| | | CH 12 | 2467 | 16.57 | 17.0 | |
| | | CH 13 | 2472 | 16.60 | 17.0 | |

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN ANT 0+1	802.11n-HT20 MCS0	CH 1	2412	19.34	20.0	92.86
		CH 6	2437	19.03	20.0	
		CH 7	2442	19.18	20.0	
		CH 12	2467	19.24	20.0	
		CH 13	2472	19.25	20.0	

<WLAN 5GHz mode>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN ANT 0	802.11a 6Mbps	CH 36	5180	**10.68**	**11.0**	93.22
		CH 40	5200	10.43	11.0	
		CH 48	5240	10.47	11.0	
	802.11n-HT20 MCS0	CH 36	5180	10.29	11.0	92.88
		CH 40	5200	10.01	11.0	
		CH 48	5240	10.05	11.0	
	802.11n-HT40 MCS0	CH 38	5190	10.22	11.0	87.1
		CH 46	5230	10.09	11.0	
	802.11ac-VHT20 MCS0	CH 36	5180	10.30	11.0	93.26
		CH 40	5200	10.53	11.0	
		CH 48	5240	10.19	11.0	
	802.11ac-VHT40 MCS0	CH 38	5190	10.25	11.0	87.2
		CH 46	5230	10.04	11.0	
	802.11ac-VHT80 MCS0	CH 42	5210	8.96	9.5	76.78

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	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN ANT 1	802.11a 6Mbps	CH 36	5180	9.83	10.5	93.22
		CH 40	5200	9.80	10.5	
		CH 48	5240	9.89	10.5	
	802.11n-HT20 MCS0	CH 36	5180	9.79	10.5	92.88
		CH 40	5200	9.68	10.5	
		CH 48	5240	9.64	10.5	
	802.11n-HT40 MCS0	CH 38	5190	9.62	10.5	87.1
		CH 46	5230	9.56	10.5	
	802.11ac-VHT20 MCS0	CH 36	5180	**10.01**	**10.5**	93.26
		CH 40	5200	9.76	10.5	
		CH 48	5240	9.83	10.5	
	802.11ac-VHT40 MCS0	CH 38	5190	9.66	10.5	87.2
		CH 46	5230	9.57	10.5	
	802.11ac-VHT80 MCS0	CH 42	5210	8.47	9.0	76.78

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN ANT 0+1	802.11n-HT20 MCS0	CH 36	5180	13.38	14.0	92.88
		CH 40	5200	13.18	14.0	
		CH 48	5240	13.18	14.0	
	802.11n-HT40 MCS0	CH 38	5190	13.54	14.0	87.1
		CH 46	5230	13.44	14.0	
	802.11ac-VHT20 MCS0	CH 36	5180	13.47	14.0	93.26
		CH 40	5200	13.48	14.0	
		CH 48	5240	13.33	14.0	
	802.11ac-VHT40 MCS0	CH 38	5190	**13.57**	**14.0**	87.2
		CH 46	5230	13.42	14.0	
	802.11ac-VHT80 MCS0	CH 42	5210	12.88	13.5	92.88

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN ANT 0	802.11a 6Mbps	CH 149	5745	19.86	20.5	93.22
		CH 157	5785	20.20	20.5	
		CH 165	5825	**20.74**	**21.0**	
	802.11n-HT20 MCS0	CH 149	5745	19.64	20.0	92.88
		CH 157	5785	19.75	20.0	
		CH 165	5825	20.13	20.5	
	802.11n-HT40 MCS0	CH 151	5755	18.97	19.5	87.1
		CH 159	5795	19.07	19.5	
	802.11ac-VHT20 MCS0	CH 149	5745	19.84	20.5	93.26
		CH 157	5785	19.67	20.0	
		CH 165	5825	19.91	20.5	
	802.11ac-VHT40 MCS0	CH 151	5755	19.02	19.5	87.2
		CH 159	5795	19.09	19.5	
	802.11ac-VHT80 MCS0	CH 155	5775	19.15	19.5	93.22

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN ANT 1	802.11a 6Mbps	CH 149	5745	**20.19**	**20.5**	93.22
		CH 157	5785	20.06	20.5	
		CH 165	5825	19.77	20.0	
	802.11n-HT20 MCS0	CH 149	5745	19.55	20.0	92.88
		CH 157	5785	19.52	20.0	
		CH 165	5825	19.35	20.0	
	802.11n-HT40 MCS0	CH 151	5755	18.80	19.5	87.1
		CH 159	5795	18.71	19.0	
	802.11ac-VHT20 MCS0	CH 149	5745	19.22	19.5	93.26
		CH 157	5785	19.19	19.5	
		CH 165	5825	18.93	19.5	
	802.11ac-VHT40 MCS0	CH 151	5755	18.83	19.5	87.2
		CH 159	5795	18.72	19.5	
	802.11ac-VHT80 MCS0	CH 155	5775	19.00	19.5	93.22

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN ANT 0+1	802.11n-HT20 MCS0	CH 149	5745	22.93	23.5	92.88
		CH 157	5785	22.97	23.5	
		CH 165	5825	23.09	23.5	
	802.11n-HT40 MCS0	CH 151	5755	22.50	23.0	87.1
		CH 159	5795	22.50	23.0	
	802.11ac-VHT20 MCS0	CH 149	5745	22.85	23.5	93.26
		CH 157	5785	22.75	23.5	
		CH 165	5825	22.76	23.5	
	802.11ac-VHT40 MCS0	CH 151	5755	22.53	23.0	87.2
		CH 159	5795	22.51	23.0	
	802.11ac-VHT80 MCS0	CH 155	5775	**23.23**	**23.5**	93.22

<Bluetooth Mode>

Mode	Channel	Frequency (MHz)	Average power (dBm)		
			1Mbps	2Mbps	3Mbps
BR / EDR	CH 00	2402	3.45	0.41	0.48
	CH 39	2441	4.30	1.28	1.26
	CH 78	2480	4.77	1.72	1.73
Tune-up Limit			5.0	2.0	2.0

Mode	Channel	Frequency (MHz)	Average power (dBm)	
			1Mbps	2Mbps
LE	CH 00	2402	3.24	3.26
	CH 19	2440	3.95	3.85
	CH 39	2480	4.34	4.30
Tune-up Limit			5.0	5.0

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4. RF Exposure Evaluation

➢ **Standalone transmission evaluation:**

<Non-beamforming mode>

Bands	Antenna Type	Max. Tune-up (dBm)	Antenna Gain(dBi)	EIRP (mW)	Power density (mW/cm²)	Limit for MPE (mW/cm²)
WLAN 2.4GHz	Ant.0	20.0	3.21	209.41	0.042	1.0
	Ant.1	20.0	1.10	128.82	0.026	1.0
WLAN 5GHz	Ant.0	21.0	1.15	164.06	0.033	1.0
	Ant.1	20.5	5.30	380.19	0.076	1.0
WLAN 2.4GHz	Ant.(0+1)	20.0	3.21	209.41	0.042	1.0
WLAN 5GHz	Ant.(0+1)	23.5	6.4	977.24	**0.195**	1.0
Bluetooth	-	5.0	1.10	4.07	0.001	1.0

<beamforming mode>

Bands	Antenna Type	Max. Tune-up (dBm)	Antenna Gain(dBi)	EIRP (mW)	Power density (mW/cm²)	Limit for MPE (mW/cm²)
WLAN 5GHz	Ant.(0+1)	23.5	7.87	1339.68	**0.267**	1.0

Note:

1. According to KDB 447498, SAR 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.

2. This device supports beamforming for WLAN 5GHz VHT20/VHT40/VHT80, therefore the most maximum directional gain 7.87dBi will used for calculating the MPE of beamforming mode.

3. MPE calculate method

$$Power\ Density = EIRP/4\pi R^2$$

Where: EIRP = P+G

P = Output Power (dBm)

G = Antenna Gain (dBi)

R = Separation Distance (20cm)

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➢ **Simultaneous transmission evaluation:**

Multi-Band simultaneous Transmission Consideration

	Position	Applicable Combination
Simultaneous Transmission Consideration	Body	WLAN 2.4GHz + Bluetooth
		WLAN 5GHz + Bluetooth
		WLAN 2.4GHz Ant.(0+1) + Bluetooth
		WLAN 5GHz Ant.(0+1) + Bluetooth

1. This device contains transmitters that may operate simultaneously, therefore simultaneous transmission analysis is required.

2. The worst condition for WLAN & Bluetooth will be calculated for transmitting simultaneously.

   Formula: Result=Power density $_1$/ limit $_1$ + Power density $_2$/ limit $_2$ ≤1.

Transmission Bands	Power Density (mW/cm²)	Limit	Simultaneous Transmission Result
WLAN 5GHz Ant.(0+1)	0.267	1.0	0.268
Bluetooth	0.001	1.0	

Annex A General Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
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2. Identification of the Responsible Testing Location

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