



RF EXPOSURE ASSESSMENT REPORT

APPLICANT : Anker Innovations Limited
PRODUCT NAME : Nebula Cosmos Max
MODEL NAME : D2150
BRAND NAME : NEBULA
FCC ID : 2AOKB-D2150
STANDARD(S) : 47CFR 2.1091
KDB 447498
RECEIPT DATE : 2020-04-28
TEST DATE : 2020-05-09 to 2020-07-06
ISSUE DATE : 2020-07-20

Edited by: Chen Bilian
Chen Bilian (Rapporteur)
Approved by: Peng Huarui
Peng Huarui (Supervisor)

NOTE: This document is issued by MORLAB, the test report shall not be reproduced except in full without prior written permission of the company. The test results apply only to the particular sample(s) tested and to the specific tests carried out which is available on request for validation and information confirmed at our website.





DIRECTORY

- 1. Technical Information 3
- 1.1 Applicant and Manufacturer Information 3
- 1.2 Equipment under Test (EUT) Description 3
- 1.3 Applied Reference Documents 4
- 2. Device Category and RF Exposure Limit 5
- 3. RF Output Power 6
- 4. RF Exposure Assessment 11
- Annex A General Information 12

Change History		
Version	Date	Reason of Changed
1.0	2020-07-20	Original



1. Technical Information

Note: Provide by applicant.

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

Product Name:	Nebula Cosmos Max
Serial No.:	(N/A, marked #1 by test site)
Hardware Version:	A435C V3.0
Software Version:	ATV9.0.2
Frequency Bands:	WLAN 2.4GHz: 2412 MHz ~ 2462 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 802.11a/g/n-HT20/HT40/ac-VHT20/ac-VHT40/VHT80:OFDM Bluetooth BR+EDR: GFSK, $\pi/4$ -DQPSK, 8-DPSK Bluetooth LE: GFSK
Antenna Type:	FPC Antenna
Antenna Gain:	Bluetooth: 3.7dBi WLAN 2.4GHz: ANT 1: 3.7dBi; ANT 2: 3.1dBi WLAN 5GHz: ANT 1: 3.5dBi; ANT 2: 2.3dBi



1.3 Applied Reference Documents

Leading reference documents for testing:

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

Note 1: The test item is not applicable.

Note 2: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.



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. RF Output Power

<WLAN 2.4GHz> ANT1

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-up Power	Duty Cycle %
2.4GHz WLAN	802.11b 1Mbps	CH 1	2412	14.24	16.00	100.00
		CH 6	2437	14.81	16.00	
		CH 11	2462	15.02	16.00	
	802.11g 6Mbps	CH 1	2412	14.63	16.00	96.67
		CH 6	2437	14.98	16.00	
		CH 11	2462	15.13	16.00	
	802.11n-HT20 MCS0	CH 1	2412	14.66	16.00	97.03
		CH 6	2437	14.93	16.00	
		CH 11	2462	15.12	16.00	

<WLAN 2.4GHz> ANT2

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-up Power	Duty Cycle %
2.4GHz WLAN	802.11b 1Mbps	CH 1	2412	13.98	15.00	100.00
		CH 6	2437	14.35	15.00	
		CH 11	2462	14.78	15.00	
	802.11g 6Mbps	CH 1	2412	14.06	15.00	96.67
		CH 6	2437	14.52	15.00	
		CH 11	2462	14.81	15.00	
	802.11n-HT20 MCS0	CH 1	2412	14.06	15.00	97.03
		CH 6	2437	14.44	15.00	
		CH 11	2462	14.73	15.00	



ANT1+ ANT2

2.4GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-up Power	Duty Cycle %
	802.11n-HT20 MCS0	CH 1	2412	17.40	18.00	97.03
		CH 6	2437	17.71	18.00	
		CH 11	2462	17.92	18.00	

<WLAN 5GHz> ANT1

5.2GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-up Power	Duty Cycle %
	802.11a 6Mbps	CH 36	5180	17.35	18.00	97.21
		CH 40	5200	17.43	18.00	
		CH 48	5240	17.37	18.00	
	802.11n-HT20 MCS0	CH 36	5180	17.36	18.00	97.02
		CH 40	5200	17.49	18.00	
		CH 48	5240	17.48	18.00	
	802.11n-HT40 MCS0	CH 38	5190	16.64	18.00	93.02
		CH 46	5230	16.72	18.00	
	802.11ac-VHT20 MCS0	CH 36	5180	17.41	18.00	96.76
CH 40		5200	17.46	18.00		
CH 48		5240	17.55	18.00		
802.11ac-VHT40 MCS0	CH 38	5190	16.64	17.00	93.64	
	CH 46	5230	16.7	17.00		
802.11ac-VHT80 MCS0	CH 42	5210	16.01	17.00	88.52	



5.8GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-up Power	Duty Cycle %
	802.11a 6Mbps	CH 149	5745	17.27	18.00	97.21
		CH 157	5785	17.45	18.00	
		CH 165	5825	17.52	18.00	
	802.11n-HT20 MCS0	CH 149	5745	16.69	18.00	97.02
		CH 157	5785	16.6	18.00	
		CH 165	5825	16.74	18.00	
	802.11n-HT40 MCS0	CH 151	5755	16.59	18.00	93.02
		CH 159	5795	16.68	18.00	
	802.11ac-VHT20 MCS0	CH 149	5745	17.31	18.00	96.76
CH 157		5785	17.39	18.00		
CH 165		5825	17.57	18.00		
802.11ac-VHT40 MCS0	CH 151	5755	16.4	17.00	93.64	
	CH 159	5795	16.52	17.00		
802.11ac-VHT80 MCS0	CH 155	5775	15.85	17.00	88.52	

ANT2

5.2GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-up Power	Duty Cycle %
	802.11a 6Mbps	CH 36	5180	17.24	18.00	97.21
		CH 40	5200	17.2	18.00	
		CH 48	5240	17.17	18.00	
	802.11n-HT20 MCS0	CH 36	5180	17.02	18.00	97.02
		CH 40	5200	17.22	18.00	
		CH 48	5240	17.05	18.00	
	802.11n-HT40 MCS0	CH 38	5190	16.33	17.00	93.02
		CH 46	5230	16.42	17.00	
	802.11ac-VHT20 MCS0	CH 36	5180	16.53	17.00	96.76
CH 40		5200	16.77	17.00		
CH 48		5240	16.86	17.00		
802.11ac-VHT40 MCS0	CH 38	5190	16.42	17.00	93.64	
	CH 46	5230	16.37	17.00		
802.11ac-VHT80 MCS0	CH 42	5210	15.64	16.00	88.52	



	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-up Power	Duty Cycle %
5.8GHz WLAN	802.11a 6Mbps	CH 149	5745	17.16	18.00	97.21
		CH 157	5785	16.9	18.00	
		CH 165	5825	17.35	18.00	
	802.11n-HT20 MCS0	CH 149	5745	16.35	17.00	97.02
		CH 157	5785	16.3	17.00	
		CH 165	5825	16.45	17.00	
	802.11n-HT40 MCS0	CH 151	5755	16.39	17.00	93.02
		CH 159	5795	16.4	17.00	
	802.11ac-VHT20 MCS0	CH 149	5745	17.01	18.00	96.76
		CH 157	5785	16.72	18.00	
		CH 165	5825	17.16	18.00	
	802.11ac-VHT40 MCS0	CH 151	5755	16.11	17.00	93.64
		CH 159	5795	16.08	17.00	
	802.11ac-VHT80 MCS0	CH 155	5775	15.57	17.00	88.52

ANT1+ ANT2

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-up Power	Duty Cycle %
5.2GHz WLAN	802.11n-HT20 MCS0	CH 36	5180	20.21	21.00	97.02
		CH 40	5200	20.37	21.00	
		CH 48	5240	20.29	21.00	
	802.11n-HT40 MCS0	CH 38	5190	19.49	21.00	93.02
		CH 46	5230	19.59	21.00	
	802.11ac-VHT20 MCS0	CH 36	5180	20.00	21.00	96.76
		CH 40	5200	20.13	21.00	
		CH 48	5240	20.25	21.00	
	802.11ac-VHT40 MCS0	CH 38	5190	19.54	20.00	93.64
		CH 46	5230	19.54	20.00	
	802.11ac-VHT80 MCS0	CH 42	5210	18.86	19.00	88.52



	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-up Power	Duty Cycle %
5.8GHz WLAN	802.11n-HT20 MCS0	CH 149	5745	19.54	20.00	97.02
		CH 157	5785	19.44	20.00	
		CH 165	5825	19.59	20.00	
	802.11n-HT40 MCS0	CH 151	5755	19.49	20.00	93.02
		CH 159	5795	19.54	20.00	
	802.11ac-VHT20 MCS0	CH 149	5745	20.17	21.00	96.76
		CH 157	5785	20.09	21.00	
		CH 165	5825	20.37	21.00	
	802.11ac-VHT40 MCS0	CH 151	5755	19.24	20.00	93.64
		CH 159	5795	19.29	20.00	
	802.11ac-VHT80 MCS0	CH 155	5775	18.75	20.00	88.52

<Bluetooth>

Mode	Channel	Frequency (MHz)	Average power (dBm)
			GFSK
BLE	CH 00	2402	5.04
	CH 19	2440	5.74
	CH 39	2480	6.47
Tune-up Limit			7.00

Mode	Channel	Frequency (MHz)	Average power (dBm)		
			1Mbps	2Mbps	3Mbps
BT classic	CH 00	2402	6.47	1.77	1.68
	CH 39	2441	7.32	2.45	2.48
	CH 78	2480	6.82	2.98	2.99
Tune-up Limit			8.00	4.00	4.00

Note:

1. According to KDB 447498 Section 4.3, MPE assessment is based on source-based time-averaged maximum conducted output power of the RF channel requiring assessment, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.
2. The output power is refer from the report SZ20040288W01/W02/W03/W04.

4. RF Exposure Assessment

➤ Standalone Transmission Assessment:

<Standalone Antenna Transmission Assessment>

Bands	Frequency (MHz)	Maximum Tune-up Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Power Density (mW/cm ²)	Limit for MPE (mW/cm ²)
WLAN 2.4GHz	2462	16.00	3.7	93.33	0.019	1.0
WLAN 5GHz	5825	18.00	3.5	141.25	0.028	1.0
Bluetooth	2441	8.00	3.7	14.79	0.003	1.0

<MIMO Transmission Assessment>

Bands	Frequency (MHz)	Maximum Tune-up Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Power Density (mW/cm ²)	Limit for MPE (mW/cm ²)
WLAN 2.4GHz	2462	18.00	3.7	147.91	0.029	1.0
WLAN 5GHz	5825	21.00	3.5	281.84	0.056	1.0

Note:

1. According to KDB 447498, MPE assessment is based on source-based time-averaged maximum conducted output power of the RF channel requiring assessment, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.
2. This device supports WLAN MIMO Transmission, only the worst antenna of WLAN 2.4GHz & WLAN 5GHz was used for calculating MPE.
3. MPE calculate method

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

Where: EIRP = P+G

P = Output Power (dBm)

G = Antenna Gain (dBi)

R = Separation Distance (20cm)

➤ Simultaneous Transmission Assessment:

According to the user manual, both the WLAN and transmitters in the device cannot operate simultaneously, therefore simultaneous transmission analysis is not required.

➤ Conclusion:

According to 47 CFR §2.1091, this device complies with human exposure basic restrictions.



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
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

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

————— END OF REPORT —————