RF EXPOSURE EVALUATION REPORT

APPLICANT	:	Anker Innovations Limited
PRODUCT NAME	:	Nebula Capsule 3
MODEL NAME	:	D2425
BRAND NAME	:	NEBULA
FCC ID	:	2AOKB-D2425
STANDARD(S)	:	47 CFR Part 2(2.1091)
RECEIPT DATE	:	2023-09-22
TEST DATE	:	2023-09-26 to 2023-10-31
ISSUE DATE	:	2023-10-31

DIRECTORY

Change History		
Version	Date	Reason for change
1.0	2023-10-31	First edition

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 Capsule 3	
Sample No.:	1#	
Hardware Version:	V03	
Software Version:	V11.0.26.3	
Frequency Bands:	Bluetooth	2402MHz-2480MHz
	WLAN 2.4GHz	2412MHz-2462MHz
	WLAN 5GHz	5180MHz-5240MHz; 5260MHz-5320MHz; 5500MHz-5720MHz; 5745MHz-5825MHz
Modulation Mode:	Bluetooth	BR/EDR: GFSK(1Mbps),π/4-DQPSK(2Mbps),8-DPSK(3Mbps) BLE: GFSK(1Mbps) , GFSK (2Mbps)
	WLAN 2.4GHz	DSSS, OFDM
	WLAN 5GHz	OFDM
Antenna Information:	Bluetooth	
	Antenna Type:	FPC Antenna
	Antenna Gain:	2.67dBi
	WLAN 2.4GHz	
	Antenna Type:	FPC Antenna
	Antenna Gain:	ANT 1: 2.79dBi; ANT 2: 2.55dBi
	WLAN 5GHz	
	Antenna Type:	FPC Antenna

	Antenna Gain:	ANT 1: 4.89dBi; ANT 2: 4.54dBi

1.3 Applied Reference Documents

Leading reference documents for testing:

Identity	Document Title	Method Determination /Remark
47 CFR Part 2(2.1091)	Radio Frequency Radiation Exposure Assessment: mobile devices	No deviation
KDB 447498 D01v06	General RF Exposure Guidance	No deviation

Note 1: 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.

Note 2: When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% confidence intervals.

2. Device Category and RF Exposure Limit

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

Mobile Devices:

47 CFR 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 1Limits 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. Maximum Average Power Summary

➢ **Maximum Average Power for Bluetooth**

Wireless Mode	Channel	Frequency (MHz)	Max. Average Power (dBm)	Tune-up Limit (dBm)
Bluetooth	CH 00	2402	11.76	12.00

➢ **Maximum Average Power for Antenna 1**

Wireless Mode	Channel	Frequency (MHz)	Max. Average Power (dBm)	Tune-up Limit (dBm)
WLAN 2.4GHz	CH 6	2437	15.99	16.50
WLAN 5GHz	CH 120	5600	17.11	17.50

➢ **Maximum Average Power for Antenna 2**

Wireless Mode	Channel	Frequency (MHz)	Max. Average Power (dBm)	Tune-up Limit (dBm)
WLAN 2.4GHz	CH 11	2462	16.59	17.00
WLAN 5GHz	CH 144	5720	17.72	18.00

➢ **Maximum Average Power for MIMO**

Wireless Mode	Channel	Frequency (MHz)	Max. Average Power (dBm)	Tune-up Limit (dBm)
WLAN 2.4GHz	CH 11	2462	17.83	18.00
WLAN 5GHz	CH 120	5600	19.47	20.00

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.

Note 2: The maximum average power (e.i.r.p) of WLAN & Bluetooth refers to the RF report SZ23090233W01/W02/W03/W04.

4. RF Exposure Assessment

➢ **Standalone Transmission Assessment**

<Standalone Antenna Transmission Assessment>

Bands	Frequency (MHz)	Tune-up Power(dBm)	Antenna Gain(dBi)	E.I.R.P. (mW)	Power Density (mW/cm²)	Limit for MPE (mW/cm²)
Bluetooth	2402	12.00	2.67	29.31	0.006	1.0
WLAN 2.4GHz ANT1	2437	16.50	2.79	84.92	0.017	1.0
WLAN 2.4GHz ANT2	2462	17.00	2.55	90.16	0.018	1.0
WLAN 5GHz ANT1	5600	17.50	4.89	173.38	0.035	1.0
WLAN 5GHz ANT2	5720	18.00	4.54	179.47	0.036	1.0

<MIMO Transmission Assessment>

Bands	Frequency (MHz)	Tune-up Power(dBm)	Directional Gain(dBi)	E.I.R.P. (mW)	Power Density (mW/cm²)	Limit for MPE (mW/cm²)
WLAN 2.4GHz	2462	18.00	5.68	233.35	0.046	1.0
WLAN 5GHz	5600	20.00	7.73	592.93	0.118	1.0

Note 1: The WLAN 2.4GHz directional gain = $10\log[(10^{G1/20}+10^{G2/20})^2/2$ = 5.68dBi; WLAN 5GHz directional gain = $10\log[(10^{G1/20}+10^{G2/20})^2/2$ = 7.73dBi.

Note 2: For 2.4G/5G WLAN, only the worst case will be used for calculating the power density.

Note 3: MPE calculate method

$$S = PG/4\pi R^2$$

Where: S= Power density (in appropriate units, e.g. mW/cm^2)

P = Time-average maximum tune-up power (in appropriate units, e.g. dBm)

G = numeric gain of the antenna (in appropriate units, e.g. dBi)

R = Separation distance to the centre of radiation of the antenna (20cm)

➢ **Simultaneous Transmission Assessment:**

Multi-Band Simultaneous Transmission Consideration

	Position	Applicable Combination
Simultaneous Transmission Consideration	Body	WLAN 2.4GHz MIMO
		WLAN 5GHz MIMO
		WLAN 2.4GHz MIMO + Bluetooth
		WLAN 5GHz MIMO + Bluetooth
		WLAN 2.4GHz MIMO + WLAN 5GHz MIMO
		WLAN 2.4GHz MIMO + WLAN 5GHz MIMO + Bluetooth

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

Applicable Combination	Transmission Bands	Power Density (mW/cm²)	Limit (mW/cm²)	Simultaneous Transmission Result
WLAN 2.4GHz MIMO + Bluetooth	WLAN 2.4GHz MIMO	0.046	1.0	0.052
	Bluetooth	0.006	1.0	
WLAN 5GHz MIMO + Bluetooth	WLAN 5GHz MIMO	0.118	1.0	0.124
	Bluetooth	0.006	1.0	
WLAN 2.4GHz MIMO + WLAN 5GHz MIMO	WLAN 2.4GHz MIMO	0.046	1.0	0.164
	WLAN 5GHz MIMO	0.118	1.0	
WLAN 2.4GHz MIMO + WLAN 5GHz MIMO + Bluetooth	**WLAN 2.4GHz MIMO**	**0.046**	**1.0**	**0.17**
	WLAN 5GHz MIMO	**0.118**	**1.0**	
	Bluetooth	**0.006**	**1.0**	
Note 1: Formula for result=Power density$_1$/ limit$_1$ + Power density$_2$/ limit$_2$ ≤1. **Note 2:**The black bold applicable combination was the worst condition.				

➢ **Conclusion:**

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

END OF REPORT