RF EXPOSURE EVALUATION REPORT

APPLICANT	:	Anker Innovations Limited
PRODUCT NAME	:	Nebula Mars 3
MODEL NAME	:	D2333
BRAND NAME	:	NEBULA
FCC ID	:	2AOKB-D2333
STANDARD(S)	:	47 CFR Part 2(2.1091)
RECEIPT DATE	:	2023-03-02
TEST DATE	:	2023-03-15 to 2023-05-19
ISSUE DATE	:	2023-05-31

Edited by: Zeng Xiaoying (Rapporteur)

Approved by: Shen Junsheng (Supervisor)

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DIRECTORY

Change History		
Version	**Date**	**Reason for change**
1.0	2022-05-31	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 Mars 3	
Sample No.:	1#, 5#	
Hardware Version:	V5.0	
Software Version:	V11.0.0	
Frequency Bands:	Bluetooth	2402MHz-2480MHz
	WLAN 2.4GHz	2412MHz-2462MHz
	WLAN 5GHz	5180MHz-5240MHz; 5260MHz-5320MHz; 5500MHz-5720MHz; 5745MHz-5825MHz
Modulation Mode:	Bluetooth	GFSK(1Mbps), π/4-DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps)
	WLAN 2.4GHz	DSSS, OFDM
	WLAN 5GHz	OFDM
Antenna Information:	Bluetooth	
	Antenna Type:	Dipole Antenna
	Antenna Gain:	3.97dBi
	WLAN 2.4GHz	
	Antenna Type:	Dipole Antenna
	Antenna Gain:	ANT 0:4.37dBi; ANT 1: 3.81dBi
	WLAN 5GHz	
	Antenna Type:	Dipole Antenna
	Antenna Gain:	ANT 0: 4.95dBi; ANT 1: 4.94dBi

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 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

Mode	Channel	Frequency (MHz)	Average Power (dBm)
			GFSK
Bluetooth LE (1Mbps)	CH 00	2402	3.70
	CH 19	2440	4.89
	CH 39	2480	6.26
Tune-up Limit			6.50
Bluetooth LE (2Mbps)	CH 00	2402	3.72
	CH 19	2440	4.97
	CH 39	2480	6.23
Tune-up Limit			6.50

Mode	Channel	Frequency (MHz)	Average Power (dBm)		
			GFSK	π/4-DQPSK	8-DPSK
Bluetooth Classic	CH 00	2402	12.20	9.75	10.28
	CH 39	2441	**12.49**	10.13	9.79
	CH 78	2480	12.32	9.44	9.97
Tune-up Limit			12.50	10.50	10.50

WLAN 2.4GHz					
Mode	Frequency (MHz)	Antenna	Total Conducted Power (dBm)	Tune-up Power	Duty Cycle (%)
b	2412	Ant0	16.85	17.00	99.45
b	2412	Ant1	17.22	17.50	99.45
b	2437	Ant0	17.19	17.50	99.45
b	2437	**Ant1**	**17.58**	**18.00**	99.45
b	2462	Ant0	16.88	17.00	99.43
b	2462	Ant1	17.00	17.50	99.45
g	2412	Ant0	16.34	16.50	96.47
g	2412	Ant1	16.62	17.00	96.33
g	2437	Ant0	16.37	16.50	96.47
g	2437	Ant1	16.71	17.00	96.27
g	2462	Ant0	16.32	16.50	96.40
g	2462	Ant1	16.47	16.50	96.40
n20	2412	Ant0	15.30	15.50	96.16
n20	2412	Ant1	15.45	15.50	96.01
n20	2412	Sum	15.01	15.50	96.16
n20	2437	Ant0	15.15	15.50	96.31
n20	2437	Ant1	15.51	16.00	96.01
n20	2437	Sum	15.07	15.50	96.16
n20	2462	Ant0	15.13	15.50	96.16
n20	2462	Ant1	15.30	15.50	96.01
n20	2462	Sum	15.08	15.50	96.16
n40	2422	Ant0	15.36	15.50	92.72
n40	2422	Ant1	15.60	16.00	92.51
n40	2422	Sum	15.05	15.50	92.51
n40	2437	Ant0	15.44	15.50	92.65
n40	2437	Ant1	15.79	16.00	92.51
n40	2437	**Sum**	**15.17**	**15.50**	92.51
n40	2452	Ant0	15.31	15.50	92.65
n40	2452	Ant1	15.55	16.00	92.52
n40	2452	Sum	15.11	15.50	92.58

WLAN 5GHz					
Mode	Frequency (MHz)	Antenna	Total Conducted Power (dBm)	Tune-up Power	Duty Cycle (%)
a	5180	Ant0	16.52	17.00	96.27
a	5180	Ant1	16.41	16.50	96.27
a	5220	Ant0	16.35	16.50	96.27
a	5220	Ant1	16.11	16.50	96.27
a	5240	Ant0	16.13	16.50	96.27
a	5240	Ant1	15.99	16.50	96.27
a	5260	Ant0	16.20	16.50	96.27
a	5260	Ant1	15.79	16.00	96.27
a	5300	Ant0	15.77	16.00	96.27
a	5300	Ant1	15.30	15.50	96.27
a	5320	Ant0	15.33	15.50	96.27
a	5320	Ant1	15.45	16.00	96.27
a	5500	Ant0	15.78	16.00	96.27
a	5500	Ant1	15.81	16.00	96.27
a	5580	Ant0	15.83	16.00	96.27
a	5580	Ant1	16.05	16.50	96.27
a	5600	Ant0	16.28	16.50	96.27
a	5600	Ant1	16.24	16.50	96.27
a	5720	Ant0	16.70	17.00	96.27
a	5720	**Ant1**	**17.09**	**17.50**	96.27
a	5745	Ant0	16.74	17.00	96.27
a	5745	Ant1	17.10	17.50	96.27
a	5785	Ant0	16.63	17.00	96.27
a	5785	Ant1	17.03	17.50	96.27
a	5825	Ant0	16.72	17.00	96.27
a	5825	Ant1	16.96	17.50	96.27
n20	5180	Ant0	15.50	16.00	96.01
n20	5180	Ant1	15.30	15.50	96.01
n20	5180	Sum	15.68	16.00	96.01
n20	5220	Ant0	15.27	15.50	96.01
n20	5220	Ant1	15.11	15.50	96.01
n20	5220	Sum	15.66	16.00	96.01
n20	5240	Ant0	15.08	15.50	96.01
n20	5240	Ant1	15.17	15.50	96.01
n20	5240	Sum	15.36	15.50	96.01

n20	5260	Ant0	15.17	15.50	96.01
n20	5260	Ant1	15.00	15.50	96.01
n20	5260	Sum	15.38	15.50	96.01
n20	5300	Ant0	14.75	15.00	96.01
n20	5300	Ant1	14.58	15.00	96.01
n20	5300	Sum	15.05	15.50	96.01
n20	5320	Ant0	14.30	14.50	96.01
n20	5320	Ant1	14.87	15.00	96.01
n20	5320	Sum	14.92	15.50	96.01
n20	5500	Ant0	14.76	15.00	96.01
n20	5500	Ant1	15.04	15.50	96.01
n20	5500	Sum	15.18	15.50	96.01
n20	5580	Ant0	14.95	15.50	96.01
n20	5580	Ant1	14.99	15.50	96.01
n20	5580	Sum	15.32	15.50	96.01
n20	5600	Ant0	15.34	15.50	96.01
n20	5600	Ant1	15.19	15.50	96.01
n20	5600	Sum	15.64	16.00	96.01
n20	5720	Ant0	15.77	16.00	96.01
n20	5720	Ant1	15.77	16.00	96.01
n20	5720	Sum	16.06	16.50	96.01
n20	5745	Ant0	15.79	16.00	96.01
n20	5745	Ant1	15.84	16.00	96.01
n20	5745	Sum	16.06	16.50	96.01
n20	5785	Ant0	16.01	16.50	96.01
n20	5785	Ant1	15.89	16.00	96.01
n20	5785	Sum	16.08	16.50	96.01
n20	5825	Ant0	16.11	16.50	96.01
n20	5825	Ant1	15.92	16.50	96.01
n20	5825	Sum	16.15	16.50	96.01
n40	5190	Ant0	15.48	15.50	92.44
n40	5190	Ant1	15.42	15.50	92.44
n40	5190	Sum	15.64	16.00	92.44
n40	5230	Ant0	15.34	15.50	92.44
n40	5230	Ant1	15.33	15.50	92.44
n40	5230	Sum	15.51	16.00	92.44
n40	5270	Ant0	14.93	15.50	92.44
n40	5270	Ant1	15.24	15.50	92.44

n40	5270	Sum	15.39	15.50	92.44
n40	5310	Ant0	14.63	15.00	92.44
n40	5310	Ant1	14.89	15.50	92.44
n40	5310	Sum	15.00	15.50	92.44
n40	5510	Ant0	14.85	15.00	92.44
n40	5510	Ant1	15.05	15.50	92.44
n40	5510	Sum	15.17	15.50	92.44
n40	5550	Ant0	15.13	15.50	92.44
n40	5550	Ant1	14.97	15.50	92.44
n40	5550	Sum	15.23	15.50	92.44
n40	5630	Ant0	15.82	16.00	92.44
n40	5630	Ant1	15.62	16.00	92.44
n40	5630	Sum	15.86	16.00	92.44
n40	5710	Ant0	15.93	16.50	92.44
n40	5710	Ant1	15.91	16.50	92.44
n40	5710	Sum	16.11	16.50	92.44
n40	5755	Ant0	16.14	16.50	92.44
n40	5755	Ant1	16.07	16.50	92.44
n40	5755	Sum	16.30	16.50	92.44
n40	5795	Ant0	15.84	16.00	92.44
n40	5795	Ant1	16.13	16.50	92.44
n40	5795	Sum	16.15	16.50	92.44
ac20	5180	Ant0	15.51	16.00	96.12
ac20	5180	Ant1	15.43	16.00	96.05
ac20	5180	Sum	15.67	16.00	96.12
ac20	5220	Ant0	15.32	15.50	96.12
ac20	5220	Ant1	15.18	15.50	96.05
ac20	5220	Sum	15.55	16.00	96.12
ac20	5240	Ant0	15.11	15.50	96.12
ac20	5240	Ant1	15.12	15.50	96.05
ac20	5240	Sum	15.38	15.50	96.12
ac20	5260	Ant0	15.10	15.50	96.12
ac20	5260	Ant1	15.04	15.50	96.05
ac20	5260	Sum	15.32	15.50	96.12
ac20	5300	Ant0	14.78	15.00	96.12
ac20	5300	Ant1	14.62	15.00	96.05
ac20	5300	Sum	14.99	15.50	96.12
ac20	5320	Ant0	14.34	14.50	96.12

ac20	5320	Ant1	14.81	15.00	96.05
ac20	5320	Sum	14.92	15.50	96.12
ac20	5500	Ant0	14.80	15.00	96.12
ac20	5500	Ant1	15.06	15.50	96.05
ac20	5500	Sum	15.17	15.50	96.12
ac20	5580	Ant0	14.97	15.50	96.12
ac20	5580	Ant1	15.02	15.50	96.05
ac20	5580	Sum	15.35	15.50	96.12
ac20	5600	Ant0	15.29	15.50	96.12
ac20	5600	Ant1	15.24	15.50	96.05
ac20	5600	Sum	15.60	16.00	96.12
ac20	5720	Ant0	15.82	16.00	96.12
ac20	5720	Ant1	15.83	16.00	96.05
ac20	5720	Sum	16.09	16.50	96.12
ac20	5745	Ant0	15.72	16.00	96.12
ac20	5745	Ant1	15.80	16.00	96.05
ac20	5745	Sum	16.06	16.50	96.12
ac20	5785	Ant0	15.71	16.00	96.12
ac20	5785	Ant1	15.88	16.00	96.05
ac20	5785	Sum	16.11	16.50	96.12
ac20	5825	Ant0	15.75	16.00	96.12
ac20	5825	Ant1	15.86	16.00	96.05
ac20	5825	Sum	16.14	16.50	96.12
ac40	5190	Ant0	15.62	16.00	92.48
ac40	5190	Ant1	15.41	16.50	92.48
ac40	5190	Sum	15.69	16.00	92.48
ac40	5230	Ant0	15.40	15.50	92.48
ac40	5230	Ant1	15.25	15.50	92.48
ac40	5230	Sum	15.50	16.00	92.48
ac40	5270	Ant0	15.26	15.50	92.48
ac40	5270	Ant1	15.20	15.50	92.48
ac40	5270	Sum	15.37	15.50	92.48
ac40	5310	Ant0	15.00	15.50	92.48
ac40	5310	Ant1	14.84	15.00	92.48
ac40	5310	Sum	15.02	15.50	92.48
ac40	5510	Ant0	14.89	15.00	92.48
ac40	5510	Ant1	15.03	15.50	92.48
ac40	5510	Sum	15.16	15.50	92.48

ac40	5550	Ant0	15.07	15.50	92.48
ac40	5550	Ant1	14.91	15.50	92.48
ac40	5550	Sum	15.25	15.50	92.48
ac40	5630	Ant0	15.88	16.00	92.48
ac40	5630	Ant1	15.56	16.00	92.48
ac40	5630	Sum	15.86	16.00	92.48
ac40	5710	Ant0	15.98	16.50	92.48
ac40	5710	Ant1	15.95	16.50	92.48
ac40	5710	Sum	16.12	16.50	92.48
ac40	5755	Ant0	16.10	16.50	92.48
ac40	5755	Ant1	16.10	16.50	92.48
ac40	5755	**Sum**	**16.32**	**16.50**	92.48
ac40	5795	Ant0	15.85	16.00	92.48
ac40	5795	Ant1	16.17	16.50	92.48
ac40	5795	Sum	16.22	16.50	92.48
ac80	5210	Ant0	8.37	8.50	86.06
ac80	5210	Ant1	8.42	8.50	86.06
ac80	5210	Sum	11.41	11.50	86.06
ac80	5290	Ant0	8.69	7.00	86.06
ac80	5290	Ant1	8.72	7.00	86.06
ac80	5290	Sum	11.58	12.00	86.06
ac80	5530	Ant0	10.69	11.00	86.06
ac80	5530	Ant1	10.51	11.00	86.06
ac80	5530	Sum	13.68	14.00	86.06
ac80	5610	Ant0	15.39	15.50	86.06
ac80	5610	Ant1	15.30	15.50	86.06
ac80	5610	Sum	15.47	15.50	86.06
ac80	5690	Ant0	15.77	16.00	86.06
ac80	5690	Ant1	15.75	16.00	86.06
ac80	5690	Sum	15.82	16.00	86.06
ac80	5775	Ant0	15.86	16.00	86.06
ac80	5775	Ant1	15.86	16.00	86.06
ac80	5775	Sum	15.94	16.50	86.06

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 output power refers to report (Report No.: SZ23030005W01/W02/W03/W04).

4. RF Exposure Assessment

➢ **Standalone 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	2441	12.50	3.97	44.36	0.009	1.0
WLAN 2.4GHz	2437	18.00	3.81	151.71	0.030	1.0
WLAN 5GHz	5720	17.50	4.94	175.39	0.035	1.0

➢ **MIMO 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)
WLAN 2.4GHz	2437	15.50	4.37	97.05	0.019	1.0
WLAN 5GHz	5755	16.50	4.95	139.64	0.028	1.0

Note 1: For 2.4G/5G WLAN, only the worst case will be used for calculating the power density.

Note 2: 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 2.4GHz 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/cm^2)	Limit (mW/cm^2)	Simultaneous Transmission Result
WLAN 2.4GHz MIMO+ Bluetooth	WLAN 2.4GHz MIMO	0.019	1.0	0.028
	Bluetooth	0.009	1.0	
WLAN 5GHz MIMO+ Bluetooth	**WLAN 5GHz MIMO**	**0.028**	**1.0**	**0.037**
	Bluetooth	**0.009**	**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.

Annex A Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Laboratory Address:	FL.1-3, 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.
Address:	FL.1-3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013 and CISPR Publication 22; the FCC designation number is CN1192, the test firm registration number is 226174.

END OF REPORT