



# RF EXPOSURE EVALUATION REPORT

**APPLICANT** : Anker Innovations Limited

**PRODUCT NAME** : Nebula Astro

**MODEL NAME** : D2400

**BRAND NAME** : NEBULA

**FCC ID** : 2AOKB-D2400

**STANDARD(S)** : 47CFR 2.1091  
KDB 447498

**RECEIPT DATE** : 2020-04-10

**TEST DATE** : 2020-05-27 to 2020-06-19

**ISSUE DATE** : 2020-06-28

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 Evaluation ..... 8
- Annex A General Information ..... 9

| Change History |            |                   |
|----------------|------------|-------------------|
| Version        | Date       | Reason of Changed |
| 1.0            | 2020-06-28 | Original          |
|                |            |                   |



# 1. Technical Information

Note: Provide by applicant.

## 1.1 Applicant and Manufacturer Information

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

## 1.2 Equipment under Test (EUT) Description

|                          |  |
|--------------------------|--|
| <b>Product Name:</b>     | Nebula Astro   |
| <b>Serial No:</b>        | (N/A, marked #1 by test site)  |
| <b>Hardware Version:</b> | V0.3   |
| <b>Software Version:</b> | msm8909.Astro_V6.0.8-master  |
| <b>Frequency Bands:</b>  | WLAN 2.4GHz: 2412 MHz ~ 2462 MHz<br>WLAN 5.2GHz: 5180 MHz ~ 5240 MHz<br>WLAN 5.8GHz: 5745 MHz ~ 5825 MHz<br>Bluetooth: 2402 MHz ~ 2480 MHz |
| <b>Modulation Mode:</b>  | 802.11b: DSSS<br>802.11a/g/n-HT20/HT40: OFDM<br>Bluetooth BR+EDR: GFSK, $\pi/4$ -DQPSK, 8-DPSK<br>Bluetooth LE: GFSK                       |
| <b>Antenna Type:</b>     | FPC Antenna  |
| <b>Antenna Gain:</b>     | Bluetooth: 0dBi<br>WLAN 2.4GHz: 0dBi<br>WLAN 5GHz: 0dBi  |



### 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 Evaluation: mobile devices | No deviation                 |
| 2   | 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.



## 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 <sup>2</sup> ) | Averaging time (minutes) |
|--|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3-1.34   | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34-30  | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 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>

|             | Mode              | Channel | Frequency (MHz) | Average power (dBm) | Tune-up Power | Duty Cycle % |
|-------------|-------------------|---------|-----------------|---------------------|---------------|--------------|
| 2.4GHz WLAN | 802.11b 1Mbps     | CH 1    | 2412            | 21.58               | 22.00         | 97.51        |
|             |                   | CH 6    | 2437            | 21.54               | 22.00         |              |
|             |                   | CH 11   | 2462            | 21.40               | 22.00         |              |
|             | 802.11g 6Mbps     | CH 1    | 2412            | <b>22.00</b>        | 22.50         | 87.82        |
|             |                   | CH 6    | 2437            | 17.89               | 18.00         |              |
|             |                   | CH 11   | 2462            | 17.75               | 18.00         |              |
|             | 802.11n-HT20 MCS0 | CH 1    | 2412            | 17.98               | 18.00         | 86.49        |
|             |                   | CH 6    | 2437            | 18.05               | 19.00         |              |
|             |                   | CH 11   | 2462            | 17.89               | 18.00         |              |

<WLAN 5GHz>

|             | Mode              | Channel | Frequency (MHz) | Average power (dBm) | Tune-up Power | Duty Cycle % |
|-------------|-------------------|---------|-----------------|---------------------|---------------|--------------|
| 5.2GHz WLAN | 802.11a 6Mbps     | CH 36   | 5180            | 14.77               | 16.00         | 87.18        |
|             |                   | CH 40   | 5200            | 14.98               | 16.00         |              |
|             |                   | CH 48   | 5240            | 15.83               | 16.00         |              |
|             | 802.11n-HT20 MCS0 | CH 36   | 5180            | 14.74               | 16.00         | 86.49        |
|             |                   | CH 40   | 5200            | 14.61               | 16.00         |              |
|             |                   | CH 48   | 5240            | 15.57               | 16.00         |              |
|             | 802.11n-HT40 MCS0 | CH 38   | 5190            | 14.21               | 15.00         | 77.11        |
|             |                   | CH 46   | 5230            | 14.97               | 15.00         |              |



|             | Mode              | Channel | Frequency (MHz) | Average power (dBm) | Tune-up Power | Duty Cycle % |
|-------------|-------------------|---------|-----------------|---------------------|---------------|--------------|
| 5.8GHz WLAN | 802.11a MCS0      | CH 149  | 5745            | 16.76               | 17.00         | 97.21        |
|             |                   | CH 157  | 5785            | 16.34               | 17.00         |              |
|             |                   | CH 165  | 5825            | 16.01               | 17.00         |              |
|             | 802.11n-HT20 MCS0 | CH 149  | 5745            | 16.44               | 17.00         | 97.03        |
|             |                   | CH 157  | 5785            | 16.05               | 17.00         |              |
|             |                   | CH 165  | 5825            | 15.62               | 17.00         |              |
|             | 802.11n-HT40 MCS0 | CH 151  | 5755            | <b>23.77</b>        | 24.00         | 97.32        |
|             |                   | CH 159  | 5795            | 16.33               | 17.00         |              |

<Bluetooth>

| Mode          | Channel | Frequency (MHz) | Average power (dBm) |
|---------------|---------|-----------------|---------------------|
|               |         |                 | GFSK                |
| Bluetooth LE  | CH 00   | 2402            | 1.65                |
|               | CH 19   | 2440            | 1.29                |
|               | CH 39   | 2480            | 0.95                |
| Tune-up Limit |         |                 | 2.00                |

| Mode              | Channel | Frequency (MHz) | Average power (dBm) |       |       |
|-------------------|---------|-----------------|---------------------|-------|-------|
|                   |         |                 | 1Mbps               | 2Mbps | 3Mbps |
| Bluetooth classic | CH 00   | 2402            | 10.01               | 8.68  | 8.65  |
|                   | CH 39   | 2441            | <b>10.91</b>        | 8.47  | 8.71  |
|                   | CH 78   | 2480            | 10.60               | 8.46  | 8.33  |
| Tune-up Limit     |         |                 | 11.00               | 9.00  | 9.00  |

**Note 1:** According to KDB 447498 Section 4.3, MPE evaluation is 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.

**Note 2:** The output power refers to report (Report No.: SZ20040073W01/W02/W03/W04).



## 4. RF Exposure Evaluation

### ➤ Standalone Transmission Evaluation:

| Bands       | Maximum Tune-up Power(dBm) | Antenna Gain (dBi) | EIRP (mW) | Power Density (mW/cm <sup>2</sup> ) | Limit for MPE (mW/cm <sup>2</sup> ) |
|-------------|----------------------------|--------------------|-----------|-------------------------------------|-------------------------------------|
| WLAN 2.4GHz | 22.50                      | 0                  | 177.83    | 0.035                               | 1.0                                 |
| WLAN 5GHz   | 24.00                      | 0                  | 251.19    | 0.050                               | 1.0                                 |
| Bluetooth   | 11.00                      | 0                  | 12.59     | 0.003                               | 1.0                                 |

### Note:

1. The WLAN 2.4G, WLAN 5G and Bluetooth transmitter share the same antenna, Therefore simultaneous transmission assessment is not required.
2. For 5GHz WLAN, only the worst case will be used for calculating the power density.
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 Evaluation:

This device contains transmitters that 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

|                            |  |
|----------------------------|--|
| <b>Laboratory Name:</b>    | Shenzhen Morlab Communications Technology Co., Ltd.<br>Morlab Laboratory   |
| <b>Laboratory Address:</b> | FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China |
| <b>Telephone:</b>          | +86 755 36698555   |
| <b>Facsimile:</b>          | +86 755 36698525   |

## 2. Identification of the Responsible Testing Location

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

## 3. Facilities and Accreditations

The FCC designation number is CN1192, the test firm registration number is 226174.

————— END OF REPORT —————