

# ANN-MB2

**L1/L2/L5/E6/B3/L all-band high precision GNSS antenna**

Data sheet



## Abstract

This Data sheet describes the ANN-MB2 all-band L1/L2/L5/E6/B3/L active external GNSS antenna that supports all major GNSS systems for maximum position availability. The antenna provides a fast and easy solution for u-blox high precision solution applications with an excellent price-to-performance ratio.

# Document information

|                               |                                                       |             |
|-------------------------------|-------------------------------------------------------|-------------|
| <b>Title</b>                  | <b>ANN-MB2</b>                                        |             |
| <b>Subtitle</b>               | L1/L2/L5/E6/B3/L all-band high precision GNSS antenna |             |
| <b>Document type</b>          | Data sheet                                            |             |
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| <b>Disclosure restriction</b> | C1-Public                                             |             |

| <b>Product status</b>                | <b>Corresponding content status</b> |                                                                                        |
|--------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------|
| <b>Functional sample</b>             | Draft                               | For functional testing. Revised and supplementary data will be published later.        |
| <b>In development / prototype</b>    | Objective specification             | Target values. Revised and supplementary data will be published later.                 |
| <b>Engineering sample</b>            | Advance information                 | Data based on early testing. Revised and supplementary data will be published later.   |
| <b>Initial production</b>            | Early production information        | Data from product verification. Revised and supplementary data may be published later. |
| <b>Mass production / End of life</b> | Production information              | Document contains the final product specification.                                     |

This document applies to the following products:

| <b>Product name</b> | <b>Type number</b> | <b>Connector type</b> | <b>IN/PCN reference</b> | <b>Product status</b> |
|---------------------|--------------------|-----------------------|-------------------------|-----------------------|
| ANN-MB2             | ANN-MB2-00-00      | SMA                   | UBXDOC-304424225-19586  | Mass production       |

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# Contents

|                                                 |           |
|-------------------------------------------------|-----------|
| <b>1 Overview.....</b>                          | <b>4</b>  |
| <b>2 Electrical specifications.....</b>         | <b>5</b>  |
| 2.1 Patch antenna specification.....            | 5         |
| 2.2 RF front-end specification.....             | 5         |
| <b>3 Mechanical specifications.....</b>         | <b>6</b>  |
| 3.1 Mechanical drawing.....                     | 6         |
| 3.2 Mechanical data.....                        | 6         |
| 3.3 Connector type.....                         | 7         |
| <b>4 Absolute maximum ratings.....</b>          | <b>8</b>  |
| <b>5 Antenna characteristics.....</b>           | <b>9</b>  |
| 5.1 Block diagram.....                          | 9         |
| 5.2 Phase center.....                           | 9         |
| 5.3 Radiation pattern.....                      | 9         |
| <b>6 Labeling and ordering information.....</b> | <b>11</b> |
| 6.1 Product label.....                          | 11        |
| 6.2 Product identifiers.....                    | 11        |
| 6.3 Part identification.....                    | 11        |
| 6.4 Ordering codes.....                         | 12        |
| <b>7 Qualifications and approvals.....</b>      | <b>13</b> |
| 7.1 Safety.....                                 | 13        |
| <b>Related documents.....</b>                   | <b>14</b> |
| <b>Revision history.....</b>                    | <b>15</b> |

# 1 Overview

The u-blox ANN-MB2 multi-band (L1/L2/L5/E6/B3/L) active GNSS antenna is designed to reduce time-to-market for modern wide-frequency, multi-constellation, high precision GNSS applications. These require centimeter-level accuracy and a reliable RTK positioning fix even in challenging environments. Its robust design, excellent price-to-performance ratio, and flexible mounting options make ANN-MB2 an ideal choice for mass market applications requiring an all-band high precision GNSS antenna.

ANN-MB2 is a perfect match to the u-blox all-band X20 high precision platform (e.g. ZED-X20P), and the u-blox F9 high precision products that support L1, L2, and L5 bands along with the L-band for RTK corrections (e.g. ZED-F9K, ZED-F9P, LEA-F9T, and ZED-F9T). With ANN-MB2, customers have a reliable, ready-to-use all-band antenna that streamlines evaluation, minimizes design efforts, and speeds up mass adoption.

## 2 Electrical specifications

### 2.1 Patch antenna specification

| Parameter                    | L/L1 band                                   | L5/L2/B3/E6/L6 band                                                  |
|------------------------------|---------------------------------------------|----------------------------------------------------------------------|
| Frequency <sup>1</sup>       | 1535 – 1602 MHz                             | 1166 – 1285 MHz                                                      |
| Impedance <sup>1</sup>       | 50 Ω                                        | 50 Ω                                                                 |
| Gain <sup>1</sup>            | L: Typical 5.4 dBic<br>L1: Typical 5.0 dBic | L5: Typical 4.5 dBic<br>L2: Typical 5.0 dBic<br>E6: Typical 4.2 dBic |
| Efficiency data <sup>1</sup> | L: Typical 64%<br>L1: Typical 56%           | L5: Typical 55%<br>L2: Typical 60%<br>E6: Typical 50%                |
| Axial ratio <sup>1</sup>     | Typical 0.5-1.3 dB (Zenith)                 | Typical 1.9-2.9 dB (Zenith)                                          |
| Polarization <sup>1</sup>    | RHCP                                        | RHCP                                                                 |

**Table 1: ANN-MB2 patch antenna element specification**

### 2.2 RF front-end specification

| Parameter                                                                                | L/L1 band                                                                                                                   | L5/L2/B3/E6/L6 band                                                                                                         |
|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Frequency                                                                                | 1535 – 1602 MHz                                                                                                             | 1166 – 1285 MHz                                                                                                             |
| Impedance                                                                                | 50 Ω                                                                                                                        | 50 Ω                                                                                                                        |
| LNA gain <sup>2,3</sup>                                                                  | Typical 31.0 ± 3 dB                                                                                                         | Typical 31.5 ± 3 dB                                                                                                         |
| LNA noise figure <sup>2,3</sup>                                                          | Typical 3 dB                                                                                                                | Typical 2.5 dB                                                                                                              |
| Output VSWR                                                                              | Typical 2.0                                                                                                                 | Typical 2.0                                                                                                                 |
| Cable insertion loss (RG-174, length 5 m)                                                | Typical 6.5 dB                                                                                                              | Typical 5.5 dB                                                                                                              |
| Total gain <sup>2,4</sup>                                                                | Typical 23.0 dB                                                                                                             | Typical 23.0 dB                                                                                                             |
| In-band group delay variation                                                            | Typical < 8 ns                                                                                                              | Typical < 6 ns                                                                                                              |
| Out-of-band rejection<br>min. 100 MHz from GNSS band edges<br>at selected cellular bands | Typical 45 dB (at < 1435 MHz), 50 dB (> 1702 MHz) Typical 60 / 60 / 50 / 45 / 45 dB (at 698 / 960 / 1710 / 2170 / 2690 MHz) | Typical 40 dB (at < 1066 MHz), 40 dB (> 1385 MHz) Typical 65 / 45 / 35 / 55 / 50 dB (at 698 / 960 / 1710 / 2170 / 2690 MHz) |
| Supply voltage <sup>5</sup>                                                              | 3.0 – 5.0 V                                                                                                                 |                                                                                                                             |
| Supply current <sup>2,5</sup>                                                            | Typical 15.0 mA                                                                                                             |                                                                                                                             |

**Table 2: ANN-MB2 RF front-end specifications**

<sup>1</sup> Measured on a ø12 cm ground plane. Measured values include the antenna feed network (hybrid coupler).

<sup>2</sup> Measured using 5.0 V supply voltage

<sup>3</sup> Includes LNA and SAW pre-filter section

<sup>4</sup> Includes LNA gain and cable insertion loss

<sup>5</sup> Single supply for L/L1 and L5/L2/B3/E6 bands

## 3 Mechanical specifications

### 3.1 Mechanical drawing

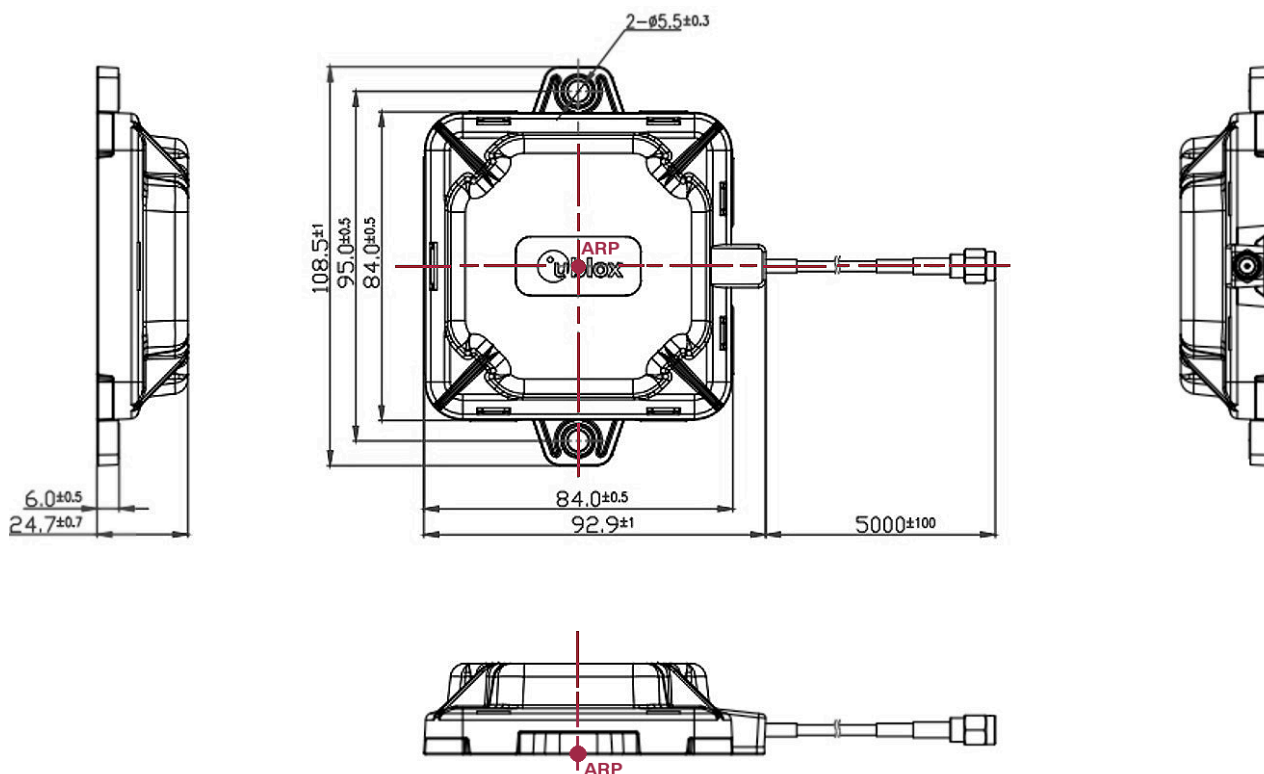


Figure 1: ANN-MB2 mechanical drawing. Dimensions are given in mm.

### 3.2 Mechanical data

| Parameter                    | Specification                                                         |
|------------------------------|-----------------------------------------------------------------------|
| Weight (typical incl. cable) | 260 g                                                                 |
| Size                         | 108.5(L) x 92.9(W) x 24.7(H) mm                                       |
| Connector options            | SMA (plug)                                                            |
| Cable type, length           | RG174, 5.0 m                                                          |
| Mounting                     | Magnetic base, fixed installation option (screw mount, 2 x M4 screws) |
| Housing color                | Black                                                                 |

Table 3: ANN-MB2 Mechanical specifications

### 3.3 Connector type



Figure 2: ANN-MB2 SMA (plug)

## 4 Absolute maximum ratings

-  CAUTION. Risk of device damage. Exceeding the absolute maximum ratings may affect the lifetime and reliability of the device or permanently damage it. Do not exceed the absolute maximum ratings.
-  This product is not protected against overvoltage or reversed voltages. Use appropriate protection to avoid device damage from voltage spikes exceeding the specified boundaries.

| Parameter             | Symbol | Condition | Min | Max  | Units |
|-----------------------|--------|-----------|-----|------|-------|
| Power supply voltage  | VCC    |           | 0.0 | 10.0 | V     |
| Operating temperature | TGP    |           | −40 | +85  | °C    |
| Storage temperature   | TSTG   |           | −40 | +85  | °C    |

**Table 4: Absolute maximum ratings**



## 5 Antenna characteristics

### 5.1 Block diagram

A simplified block diagram for ANN-MB2 all-band antenna is shown in [Figure 3](#). The block diagram is divided into patch antenna element and amplifier sections. The patch antenna element section is specified in [Patch antenna specification](#) and the amplifier section in [RF front-end specification](#). The 5-meter coaxial cable is connected to the amplifier section output.

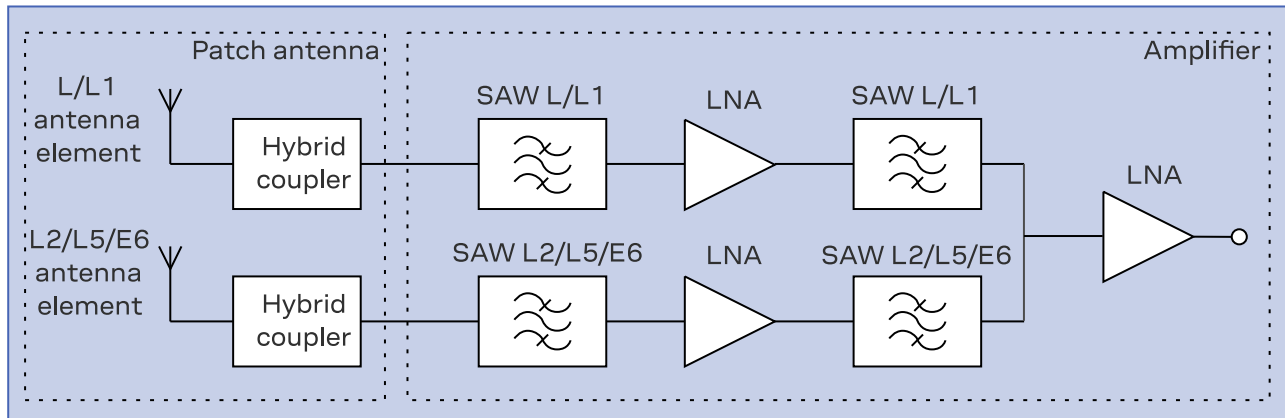


Figure 3: Simplified ANN-MB2 block diagram

### 5.2 Phase center

Typical values for the absolute antenna phase center offset in L1, L2, L5, E6 and B3 bands are given in [Table 5](#). The phase center offset is given in millimeters with respect to the antenna reference point defined in [Mechanical drawing](#). The “North” direction is toward the cable connector. The “Up” direction is normal to the antenna ground plane, toward the patch element.



The phase center offset is measured on a circular ground plane with a 120-millimeter diameter. Any change in ground plane size or shape may affect the phase center offset.

| GNSS signal | Frequency (MHz) | Phase center offset horizontal plane (mm) | Up (mm) | Phase center variation over azimuth/elevation (mm) |
|-------------|-----------------|-------------------------------------------|---------|----------------------------------------------------|
| GPS L1 C/A  | 1575.42         | < 6 in all directions                     | 9.10    | < 10 in all directions                             |
| GPS L5      | 1176.45         | < 6 in all directions                     | 6.37    | < 10 in all directions                             |
| GPS L2      | 1227.60         | < 6 in all directions                     | 6.99    | < 10 in all directions                             |
| Galileo E6  | 1278.75         | < 6 in all directions                     | 7.66    | < 10 in all directions                             |
| BeiDou B3   | 1268.52         | < 6 in all directions                     | 7.52    | < 10 in all directions                             |

Table 5: Typical values for phase center offset and variation relative to antenna reference point (ARP) at all bands. Measured on a circular 120-millimeter ground plane.

### 5.3 Radiation pattern

The radiation patterns at the L/L1 and L5/L2/E6 bands are shown in [Figure 5](#) and [Figure 6](#), respectively. The RHCP gain value is the total gain including the passive antenna element, the amplifier section, and the RG174 cable. The planes for the 2-D cuts are H (xy plane), E1 (xz plane), and E2 (yz plane). The coordinate axes are defined in [Figure 4](#).

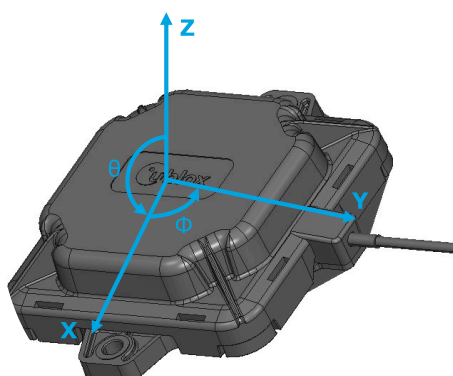


Figure 4: Definition of coordinate axes for radiation pattern plots.

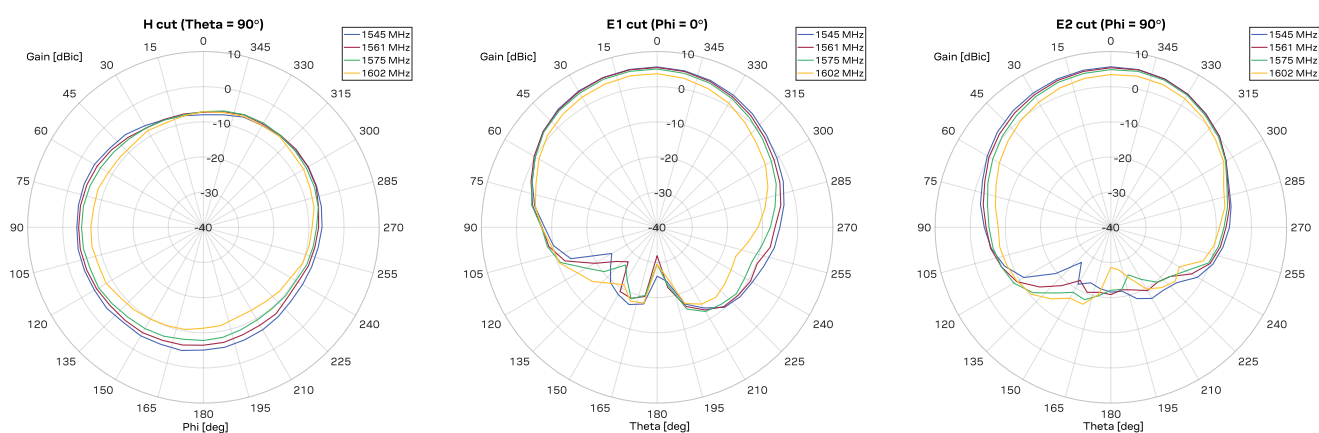


Figure 5: Radiation pattern at the L/L1 band. The 2-D cuts are measured at 1545 - 1602 MHz (four frequencies).

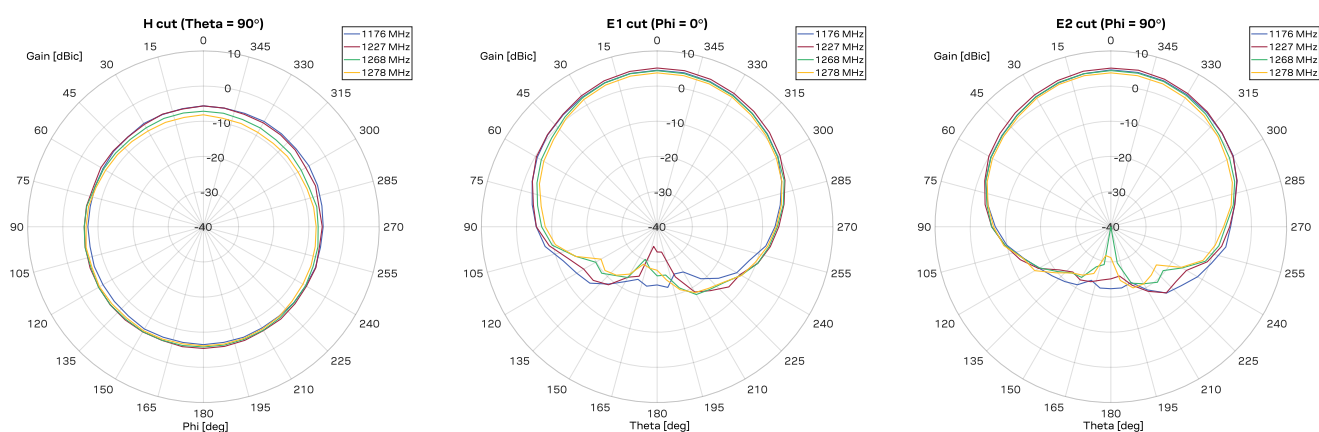


Figure 6: Radiation pattern at the L5/L2/E6 band. The 2-D cuts are measured at 1176 - 1278 MHz (four frequencies).

## 6 Labeling and ordering information

This section provides information about product labeling and ordering.

### 6.1 Product label

The product information label is found on the underside of the GNSS antenna. The label includes the type number, which provides important information on the product.

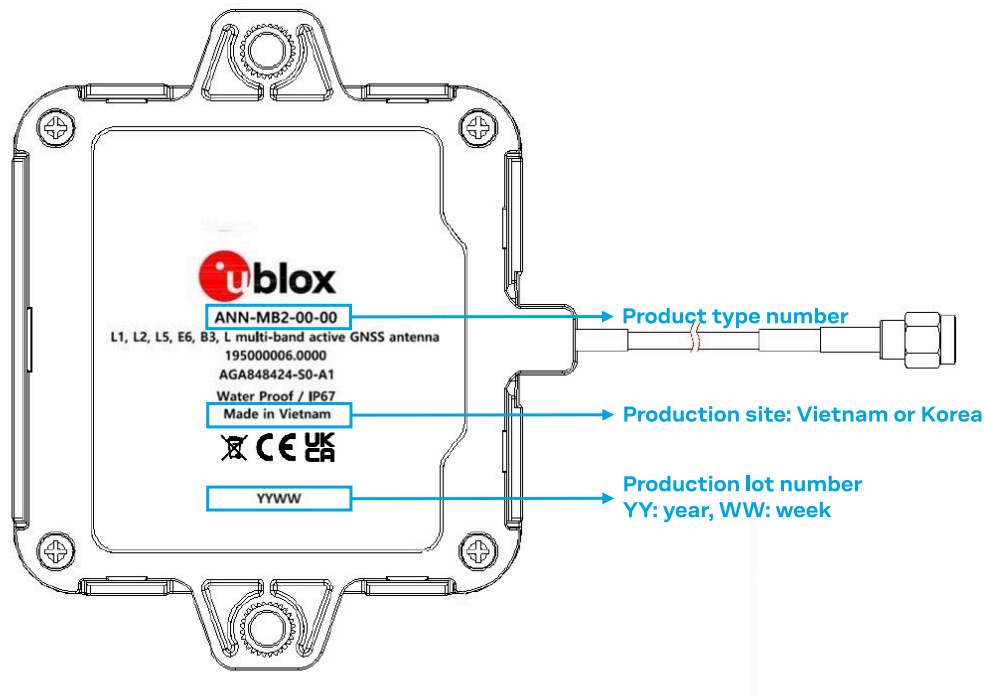


Figure 7: ANN-MB2 all-band GNSS antenna product label.

### 6.2 Product identifiers

The ANN-MB2 labels feature three identifiers for the product: product name, ordering code and type number. The product name is used across all u-blox products in documentation such as this Data sheet and is independent of packaging and product grade. The ordering code specifies the major product version and product grade and the type number additionally includes the hardware and firmware versions.

Table 6 provides product code formats

| Format        | Structure     | Product code  |
|---------------|---------------|---------------|
| Product name  | PPP-GVY       | ANN-MB2       |
| Ordering code | PPP-GVY-NN    | ANN-MB2-00    |
| Type number   | PPP-GVY-NN-XX | ANN-MB2-00-00 |

Table 6: Product code formats

### 6.3 Part identification

The parts of the product code are explained in Table 7.

| Identifier | Format                | Example                               |
|------------|-----------------------|---------------------------------------|
| PPP        | Product family        | ANN                                   |
| GV         | Product generation    | MB: Multi-band                        |
| Y          | Product variant       | 2: L1/L2/L5/E6/B3/L high precision    |
| NN         | Major product version | Connector type:<br>00 = SMA connector |
| XX         | Revision              | Hardware and firmware versions        |

**Table 7: Description of product label**

## 6.4 Ordering codes

| Ordering code | Product                                                                                        |
|---------------|------------------------------------------------------------------------------------------------|
| ANN-MB2-00    | L1/L2/L5/E6/B3/L all band active GNSS antenna, 5 m cable, SMA (plug) connector<br>Single units |

**Table 8: Product ordering codes**

## 7 Qualifications and approvals

| Type                                         | Description                                                                          |
|----------------------------------------------|--------------------------------------------------------------------------------------|
| <b>Environmental</b>                         |                                                                                      |
| RoHS compliance                              | Yes                                                                                  |
| ESD circuit protection                       | ±15 kV (IEC61000-4-2)                                                                |
| Ingress protection (IP) rating               | IP67 (dustproof and protected from temporary water immersion to 1 meter)             |
| Humidity                                     | 95%RH, 60 °C, 96 hours                                                               |
| Vibration                                    | MIL-STD-810G, Method 514.7 Vibration                                                 |
| <b>Type approvals</b>                        |                                                                                      |
| European RED certification (CE) <sup>6</sup> | Declaration of Conformity (DoC) is available on the <a href="#">u-blox website</a> . |
| UK conformity assessment (UKCA)              | Yes                                                                                  |

**Table 9: Qualifications and approvals**

### 7.1 Safety

ANN-MB2 shall be supplied by a power supply complying with the requirements of PS1 according to safety standard EN 62368-1 <https://webstore.iec.ch/publication/27412>.

<sup>6</sup> For more information regarding labeling, storage, and drying, see the Product packaging reference guide [1].

## Related documents

[1] Product packaging reference guide [UBX-14001652](#)

For product change notifications and regular updates of u-blox documentation, register on our website, <https://www.u-blox.com>.

## Revision history

| Revision | Date        | Comments                                                                                                                                                                                                                                              |
|----------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R01      | 02-Sep-2024 | Initial release                                                                                                                                                                                                                                       |
| R02      | 30-Oct-2024 | Initial production release<br>Added Phase center section<br>Added CE approval information and revised product label figure<br>Updated RF front-end specifications table to include group delay variation<br>Editorial changes throughout the document |
| R03      | 27-Feb-2025 | Updated product status to Mass Production                                                                                                                                                                                                             |

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