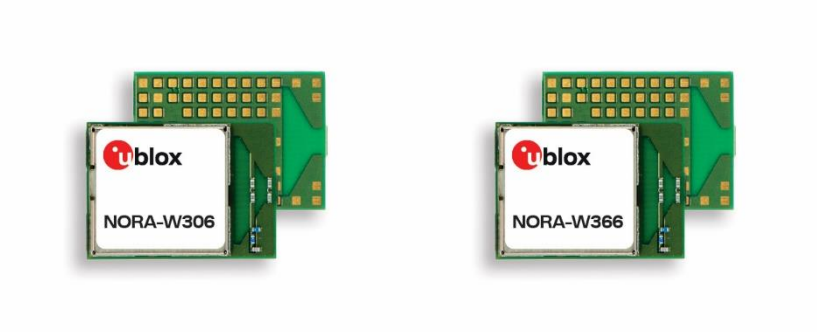
# NORA-W3x6 PCB trace antenna

## Lab measurements

Technical report

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# Document information

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| Title | **NORA-W3x6 PCB trace antenna** | |
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This document applies to the following products:

| Product name | Type number |
|---|---|
| NORA-W306 | NORA-W306-00B |
| NORA-W366 | NORA-W366-01B |

# Contents

# 1 Functional description

## 1.1 Overview

NORA-W306 and NORA-W366 incorporate a dual-band PCB trace antenna for the 2.4 GHz and 5 GHz ISM bands for Bluetooth LE and Wi-Fi operation. The antenna technology is licensed from Abracon and integrated into the module PCB.

## 1.2 Antenna layout

The trace antenna is incorporated onto the top side of the module, as shown in Figure 1. NORA-W306 and NORA-W366 are identical, with the exception of the label contents and loaded firmware.

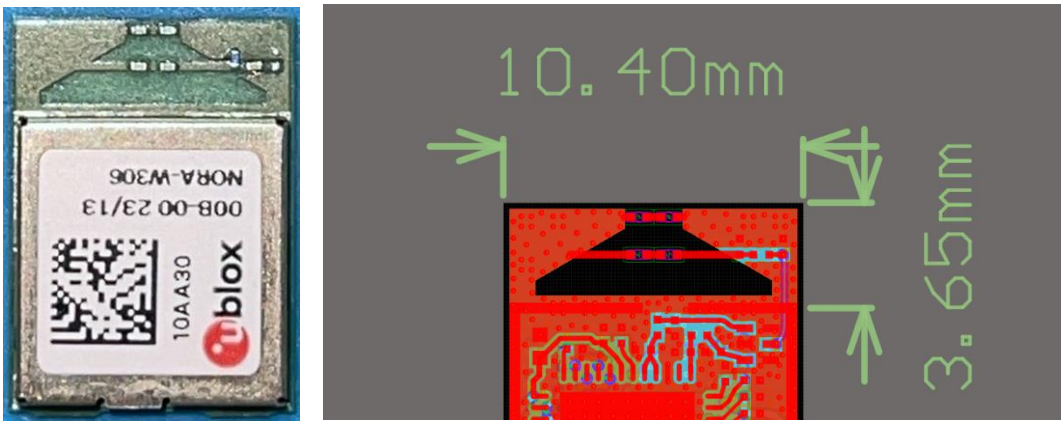


**Figure 1: NORA-W3x6 antenna layout**

## 1.3 Antenna specifications

Table 1 shows the antenna specifications.

| Feature | Details |
|---|---|
| Manufacturer | u-blox, licensed from Abracon |
| Module models | NORA-W306, NORA-W366 |
| Type | PCB trace antenna |
| Antenna element dimensions | 10.40 mm x 3.65 mm x 0.5 mm |
| Frequencies | 2400 MHz to 2483.5 MHz, 5100 MHz to 5850 MHz |
| Nominal impedance | 50 Ω |

**Table 1: NORA-W3x6 PCB trace antenna specifications**

# 2 Measurements

The NORA-W306 module is used for measurements. It is soldered to its evaluation board.

As the antenna is integrated into the module PCB, the antenna performance is verified with the specific module into which the PCB trace antenna is integrated, with the module mounted on its evaluation board. The evaluation board is then mounted into a positioning apparatus inside the anechoic chamber. Figure 2 shows the antenna orientation in X-Y-Z cartesian coordinate system. In the anechoic chamber, the initial DUT orientation is such that the Z-axis initially points toward the receive antenna at the far end of the chamber.

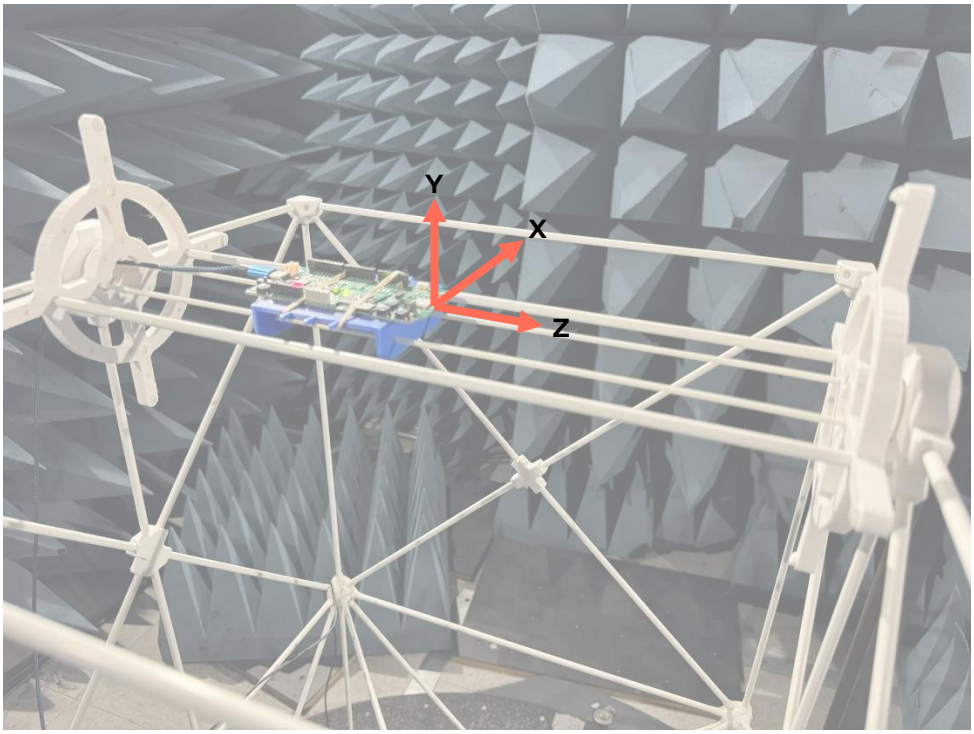


**Figure 2: NORA-W3x6 patch antenna on EVK mounted in test chamber**

Radiation patterns are measured in a far-field anechoic chamber with a measurement distance of 3 m. The device under test (DUT) is positioned using a 2-axis positioning apparatus, allowing rotation along azimuth (phi φ) and elevation (theta θ). The intensity of the received (*r*) signal is plotted as the distance from the origin at the azimuth and elevation angles. Measurements are taken at 15° angular increments for azimuth and elevation. Horizontal and vertical polarizations are measured.

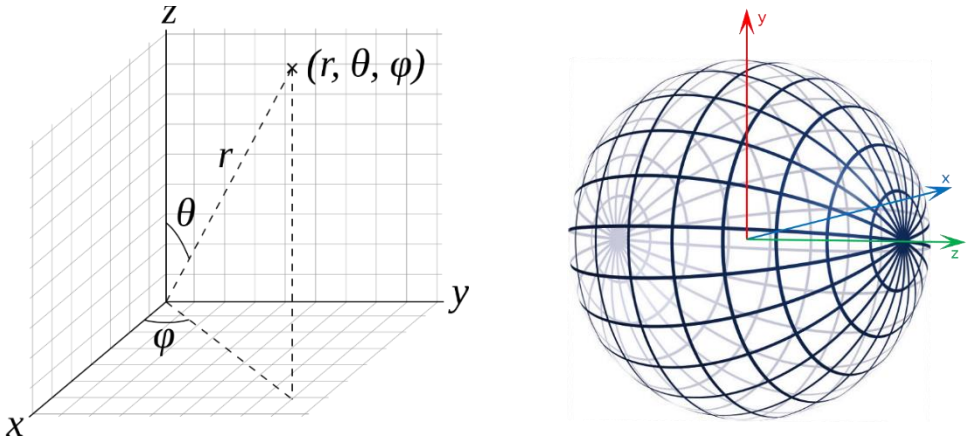


**Figure 3: Spherical coordinate system and rotated sphere showing test point orientation**

# 3 Antenna performance

## 3.1 Maximum gain

Table 2 shows the measured performance. Maximum gain is 0.5 dBi for the 2.4 GHz band and 2.4 dBi for the 5 GHz band.

| Frequency | Maximum gain (dBi) | Efficiency (%) | Orientation at maximum gain |
|---|---|---|---|
| 2412 | **0.5** | 67.6 | 180° azimuth, 180° elevation |
| 2442 | –0.1 | 56.7 | 270° azimuth, 45° elevation |
| 2472 | –0.7 | 48.3 | 0° azimuth, 180° elevation |
| 5180 | –1.5 | 20.9 | 255° azimuth, 0° elevation |
| 5260 | –2.7 | 20.8 | 180° azimuth, 180° elevation |
| 5540 | **2.4** | 51.1 | 180° azimuth, 180° elevation |
| 5825 | –1.8 | 25.9 | 180° azimuth, 45° elevation |

**Table 2: Maximum antenna gain per band**

## 3.2 Radiation patterns

Figure 4 shows the 2.4 GHz, 2D, X-Y plane antenna gain plot as a function of direction.

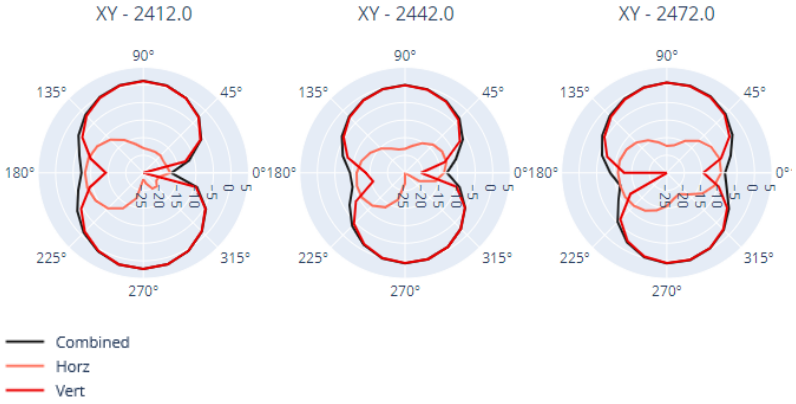


**Figure 4: NORA-W3x6 antenna – 2.4 GHz, 2D X-Y plane radiation pattern**

Figure 5 shows the 5 GHz, 2D, X-Y plane antenna gain plot as a function of direction.

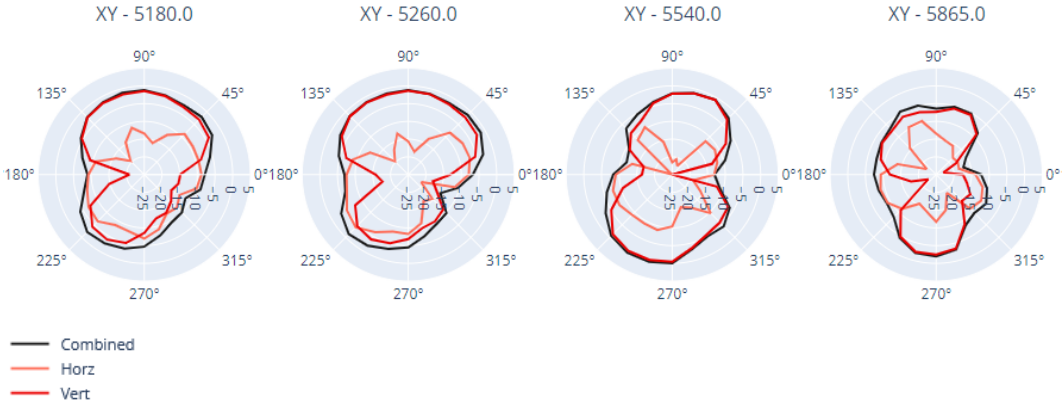


**Figure 5: NORA-W3x6 antenna – 5 GHz, 2D X-Y plane radiation pattern**

Figure 6 shows the 2.4 GHz, 2D, X-Z plane antenna gain plot as a function of direction.

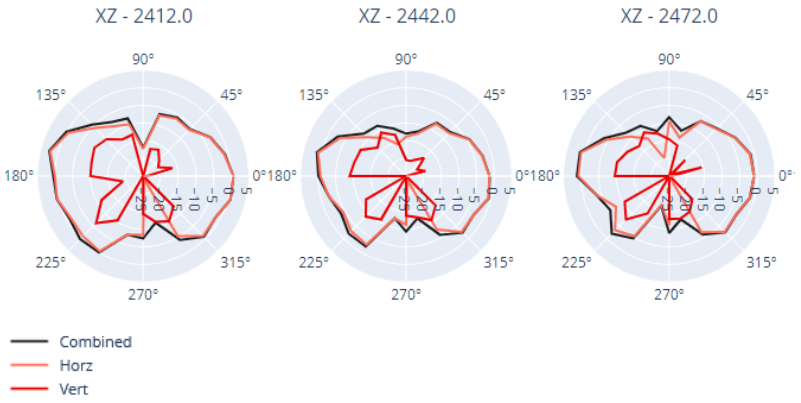


**Figure 6: NORA-W3x6 antenna – 2.4 GHz, 2D X-Z plane radiation pattern**

Figure 7 shows the 5 GHz, 2D, X-Z plane antenna gain plot as a function of direction.


**Figure 7: NORA-W3x6 antenna – 5 GHz, 2D X-Z plane radiation pattern**

Figure 8 shows the 2.4 GHz, 2D, Y-Z plane antenna gain plot as a function of direction.

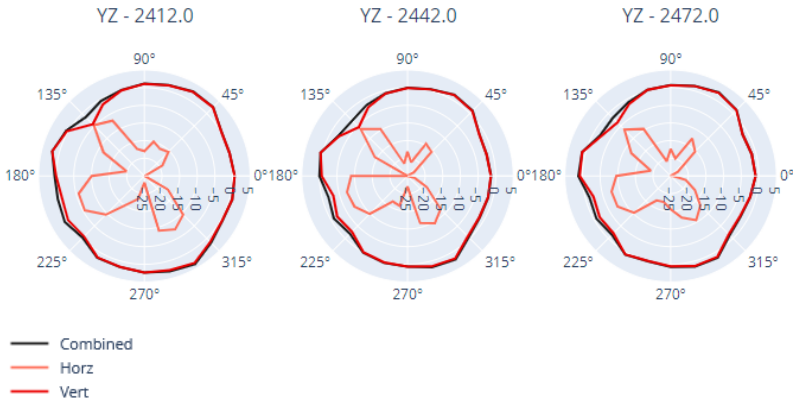


**Figure 8: NORA-W3x6 antenna –2.4 GHz, 2D Y-Z plane radiation pattern**

Figure 9 shows the 5 GHz, 2D, Y-Z plane antenna gain plot as a function of direction.

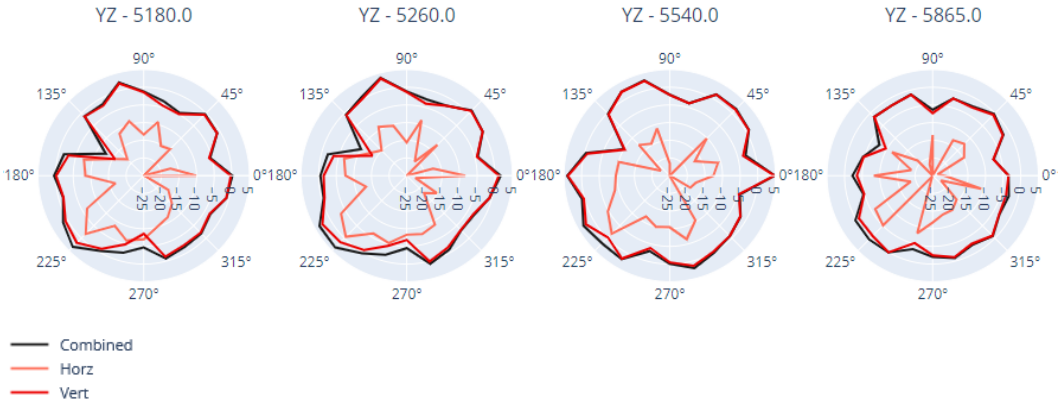


**Figure 9: NORA-W3x6 antenna – 5 GHz, 2D Y-Z plane radiation pattern**

# 4 Test equipment and dates

| Equipment name | Model number | Manufacturer | Serial Number | Date of last calibration |
|---|---|---|---|---|
| RF chamber | Space Saver PC | ETS Lindgren | AP563 | N/A |
| Spectrum analyzer | N9000B | Keysight | MY60251554 | 26-May-2022 |
| 300 MHz to 6 GHz Quad-ridged Horn Antenna | 3164-06 | ETS Lindgren | 00092216 | N/A |

**Table 3: Test equipment**

| Test date |
|---|
| 12-Oct-2023 |

**Table 4: Test date**

# Related documentation

[1] NORA-W30 series data sheet, UBX-22021117
[2] NORA-W36 series data sheet, UBX-22021118
[3] NORA-W30 series system integration manual, UBX-22021119
[4] NORA-W36 series system integration manual, UBX-22021120

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# Revision history

| Revision | Date | Author | Description |
|---|---|---|---|
| R01 | 12-Mar-2024 | brec | Initial release |

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