CELLULAR

Ethertronics 1001013 Antenna

RPMA product series

Application Note

Abstract

This document briefly describes a few guidelines for design and layout with the Ethertronics 1001013 FR4-based surface mount antenna.

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UBX-17000088 - R02

Document Information		
Title	**Ethertronics 1001013 Antenna**	
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This document applies to the following products:

Product name
NANO-S100

Contents

1 Introduction

The purpose of this document is to set some guidelines for design and layout with the Ethertronics 1001013 FR4-based surface mount antenna. Due to the nature of antennas, metals and dielectrics in close proximity to the antenna may cause de-tuning. Therefore it is necessary to follow several design concepts for proper implementation of this antenna.

The following symbols are used to highlight important information within the document:

☞ An index finger points out key information pertaining to integration and performance.

⚠ **A warning symbol indicates actions that could negatively impact or damage the module.**

2 Schematics

Figure 1 shows a typical application schematic for the Ethertronics 1001013 antenna.

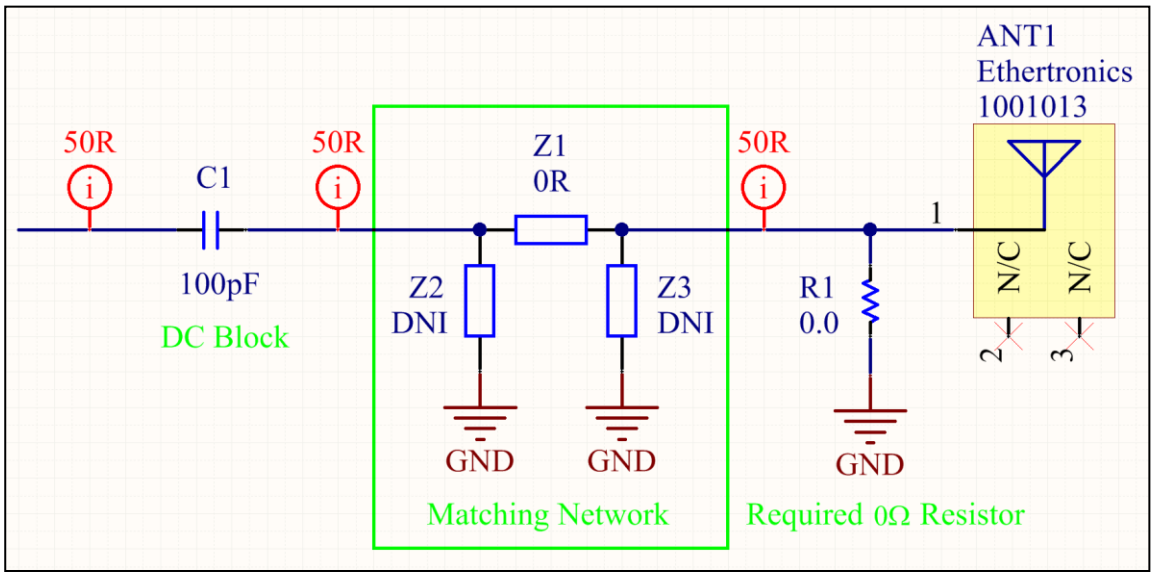

Figure 1: Typical application schematics for the Ethertronics 1001013 antenna

2.1 RF tracks

The RF tracks should be impedance controlled 50 Ω tracks.

2.2 DC blocking capacitors

A variety of applications for this antenna require the use of an antenna diversity switch to the left of C1. It is very common for these switches to require DC blocking. The location of this DC block can be placed anywhere along the track between the switch and the matching network.

2.3 Matching network

The matching network is required to allow for compensation of antenna de-tuning. These three components should be placed close together and near the antenna. For initial design, do not install (DNI) the shunt components (Z2 and Z3) and use a zero (0) Ω resistor for the series component (Z1). The final values for these components are determined when matching is performed on the antenna.

2.4 Shunt zero (0) Ω resistor

A zero (0) Ω resistor shorting the RF trace to ground is required for this antenna to properly form a dipole. The location of this resistor is very important. See section 3 for layout location of this resistor.

2.5 Antenna element

The antenna has three pins: one for RF and two for mechanical support. Pads for pins 2 and 3 should not be attached to any electrical net (i.e. they are no-connect [NC] pins).

3 Layout

3.1 Typical layout

Figure 2 shows a typical layout with the Ethertronics 1001013 antenna and the associated components.

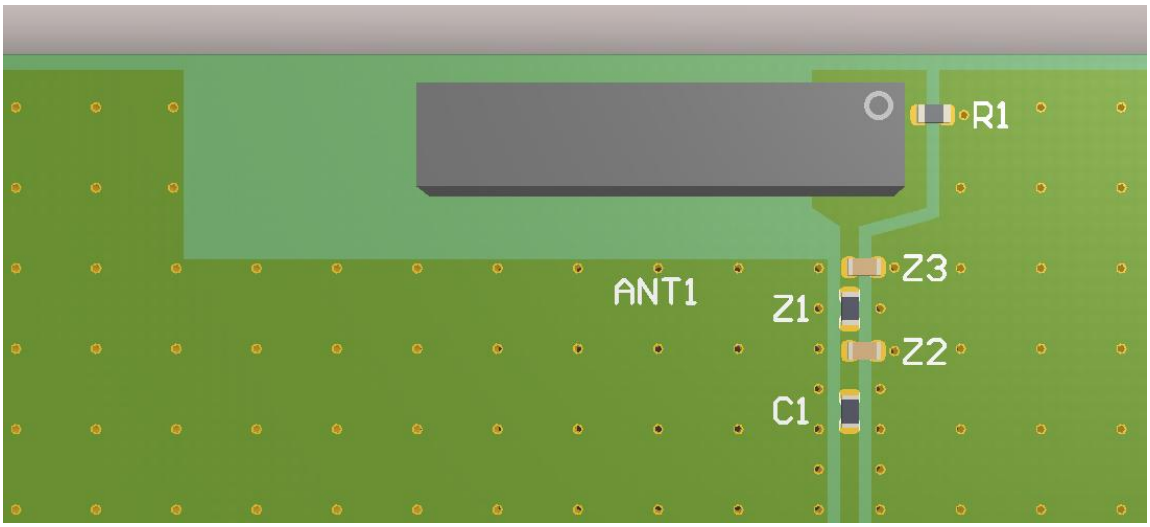

Figure 2: 3D PCB top view of a typical layout of the Ethertronics 1001013 antenna

Figure 3 is the same region as above with the components removed showing the component pads and added labels.

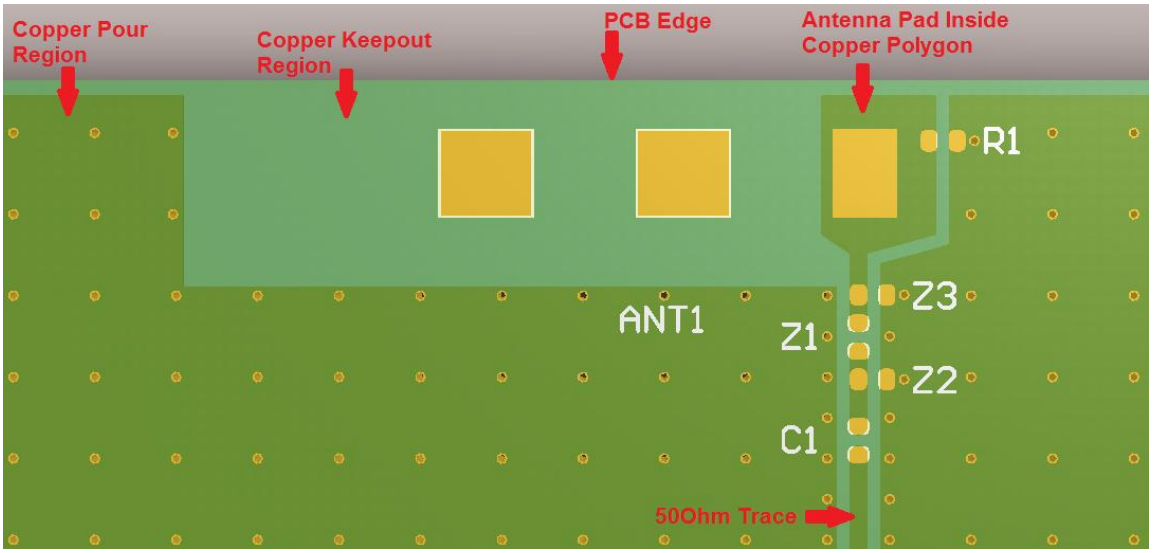

Figure 3: Layout of the Ethertronics 1001013 antenna with components removed (PCB top view)

Figure 4 shows the bottom view of the layout. The copper keep-out on the bottom layer (and all internal layers) mimics that of the top layer.

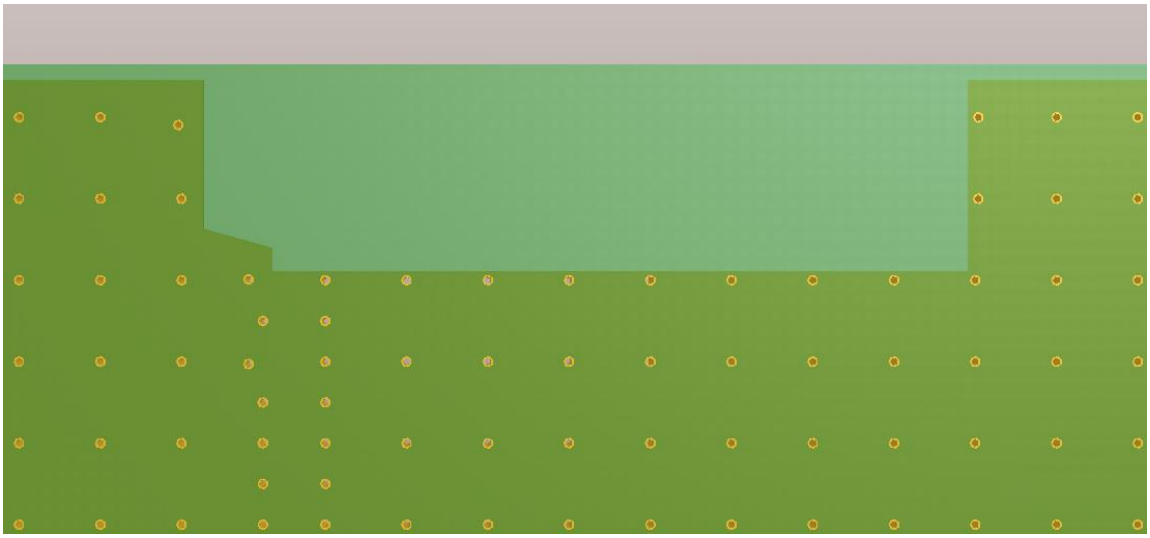

Figure 4: Layout of the Ethertronics 1001013 antenna (PCB bottom view)

Figure 5 is the CAD top view of the footprint with the solid copper pours.

☞ Only pin 1 of the antenna is connected to RF while the other two pins are no connects (NC) and serve as mechanical attachment for the antenna.

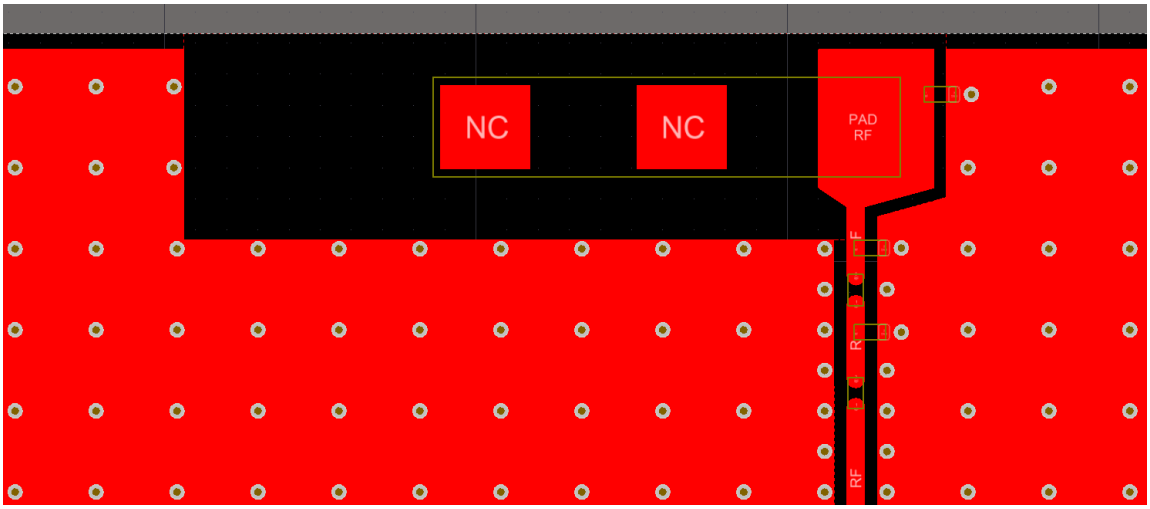

Figure 5: 2D CAD solid top view of the layout of the Ethertronics 1001013 antenna

3.2 Layout dimensions

Figure 6 and Figure 7 are outline top-view drawings showing the objects that makeup the footprint. Note at the right side of the antenna, there should be approximately 15 mm or more of solid ground plane. The copper keep-out on the left and bottom sides of the antenna are 8 mm and 2 mm respectively.

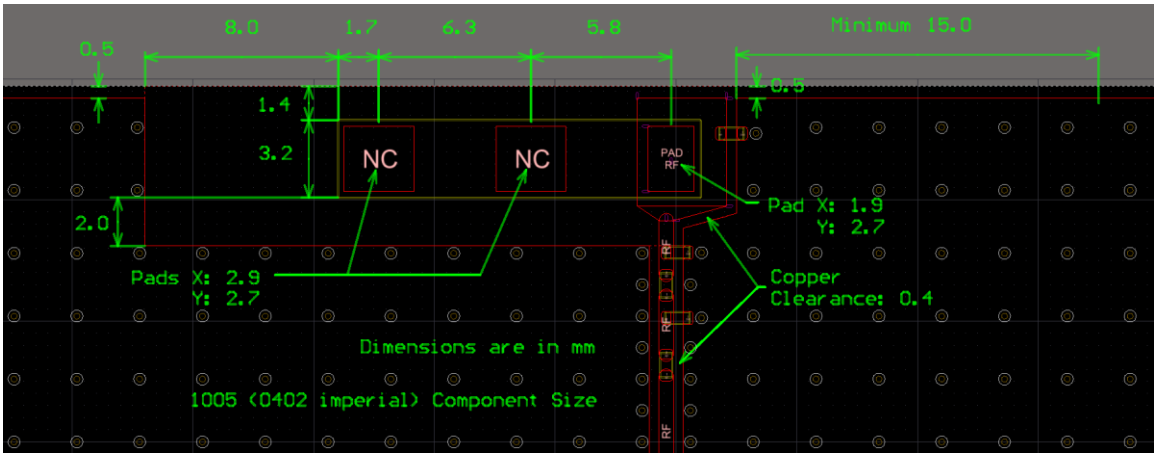

Figure 6: 2D CAD outline top view drawing of the pads and copper pours that make up the Ethertronics 1001013 antenna footprint

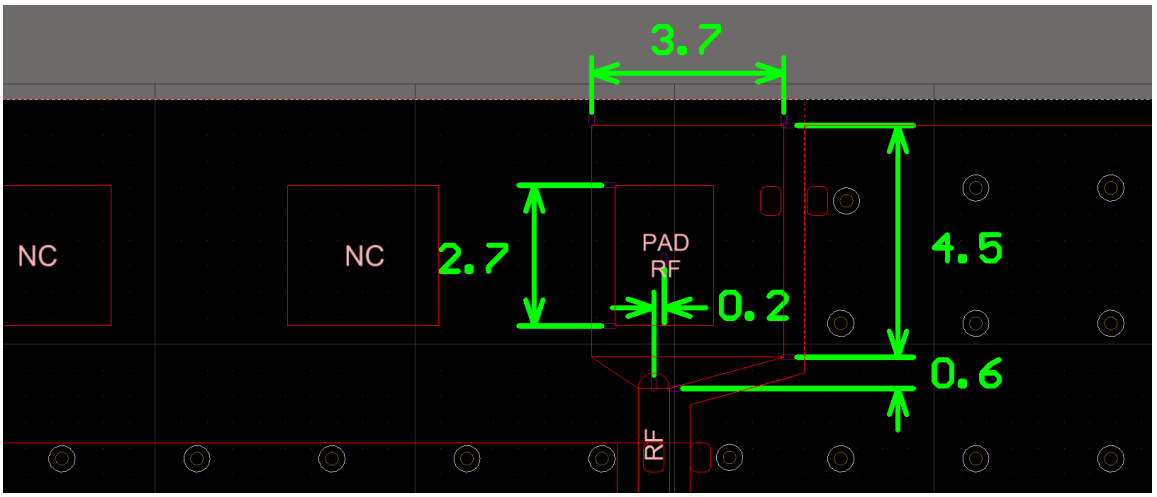

Figure 7: 2D CAD outline top view drawing of the RF pad

4 Layout variations

Due mechanical constraints, variations to the layout may be necessary. For example, if the antenna is near the corner of a PCB, it is acceptable to have the edge of the PCB at the copper cutout region (see Figure 8). Note that external conductors (mechanical or other PCBs) in this region may cause additional antenna shadowing.

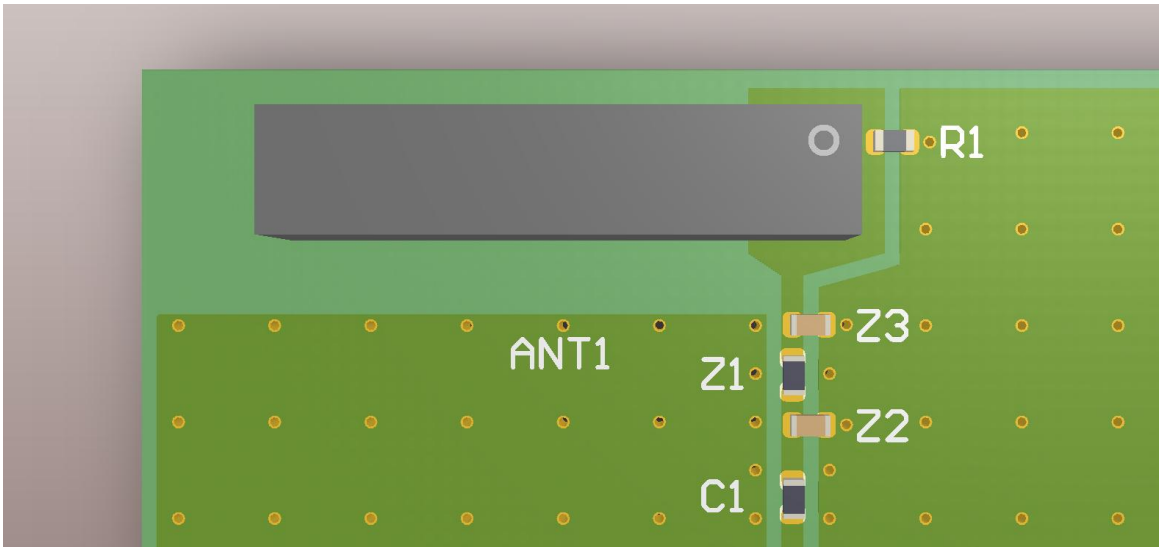

Figure 8: Antenna placed near corner of PCB. PCB edge cutting into keep-out zone on the left is acceptable.

Sometimes, the matching components need to be placed on the opposite side of the PCB. This is acceptable as long as the via on the RF trace is a good 50 Ω transition (see Figure 9). It is recommended to have RF signal via between the matching components and the antenna.

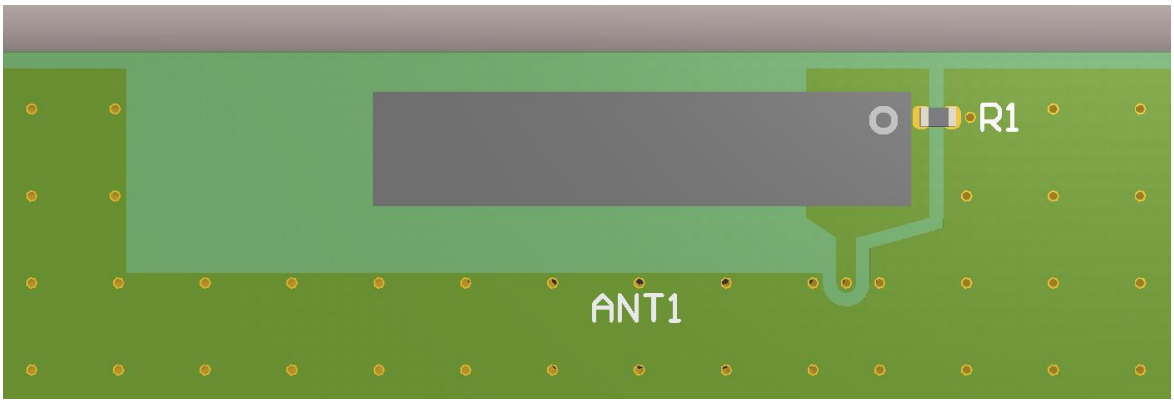

Figure 9: Antenna goes to a via and the matching components are placed on the backside. The via should be designed such that it makes a good 50 Ω transition to the backside.

5 What not to do

Due to the asymmetry of the antenna element, it should not be rotated 180 degrees (see Figure 10). This causes additional coupling between the antenna and the ground.

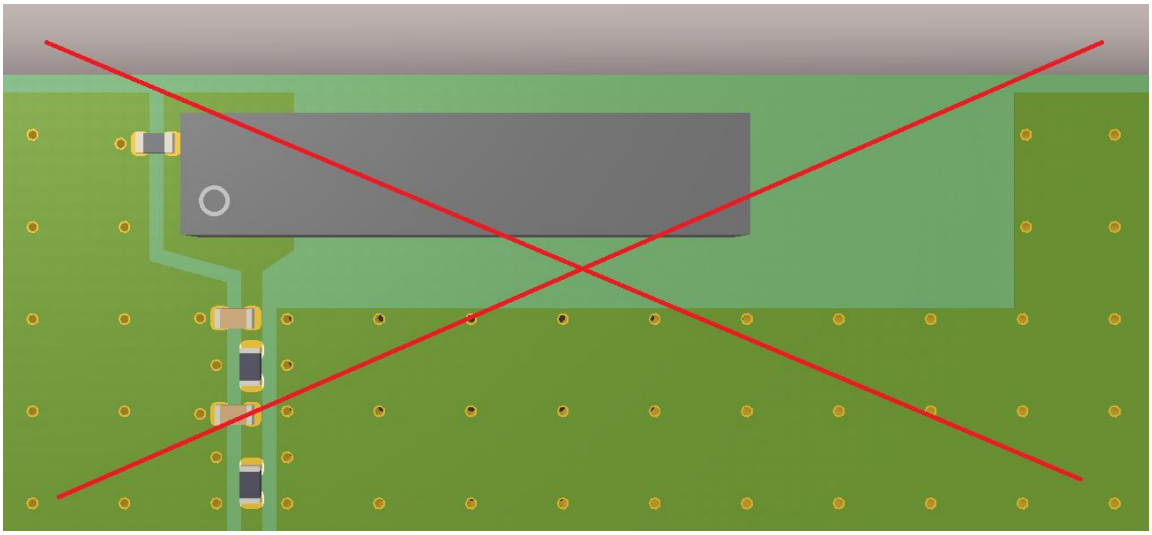

Figure 10: Do not rotate antenna 180 degrees and flip PCB land pattern

Avoid placing conductive objects close to the antenna (see Figure 11). This includes electrical components as well as mechanical components such as large mounting screws, shields, or enclosures. This causes excess shadowing effect as well as coupling between the antenna and these conductive components.

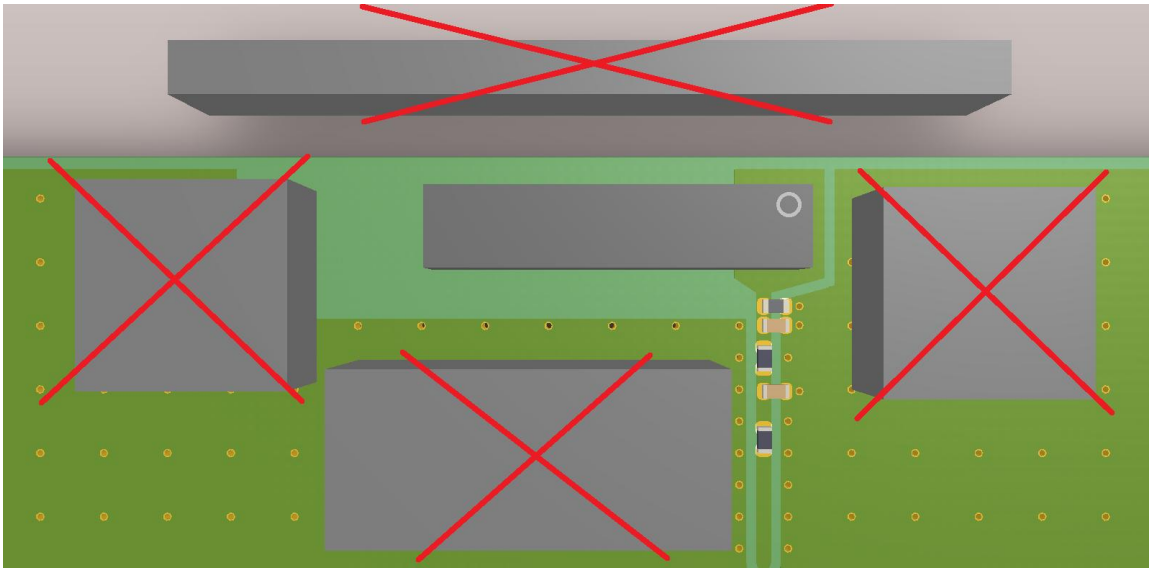

Figure 11: Avoid placing conductive objects close to the antenna. This includes electrical or mechanical components.

Do not move the 0R resistor next to the shunt matching component (see Figure 12).

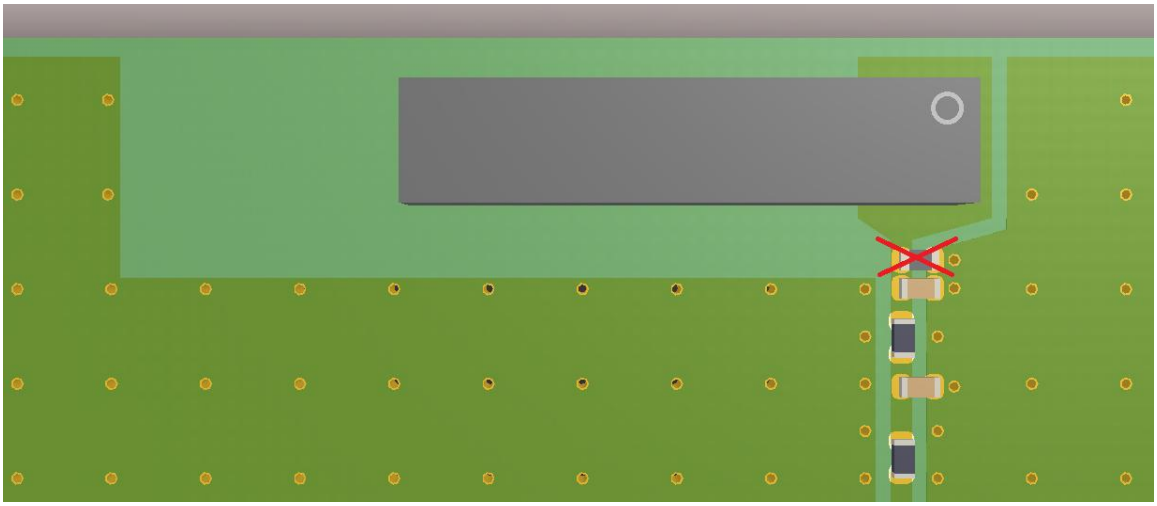

Figure 12: Do not move the 0R resistor next to the matching network

Antenna orientation is determined by the via on the top side of the antenna. The via indicates antenna pin 1 (see Figure 13).

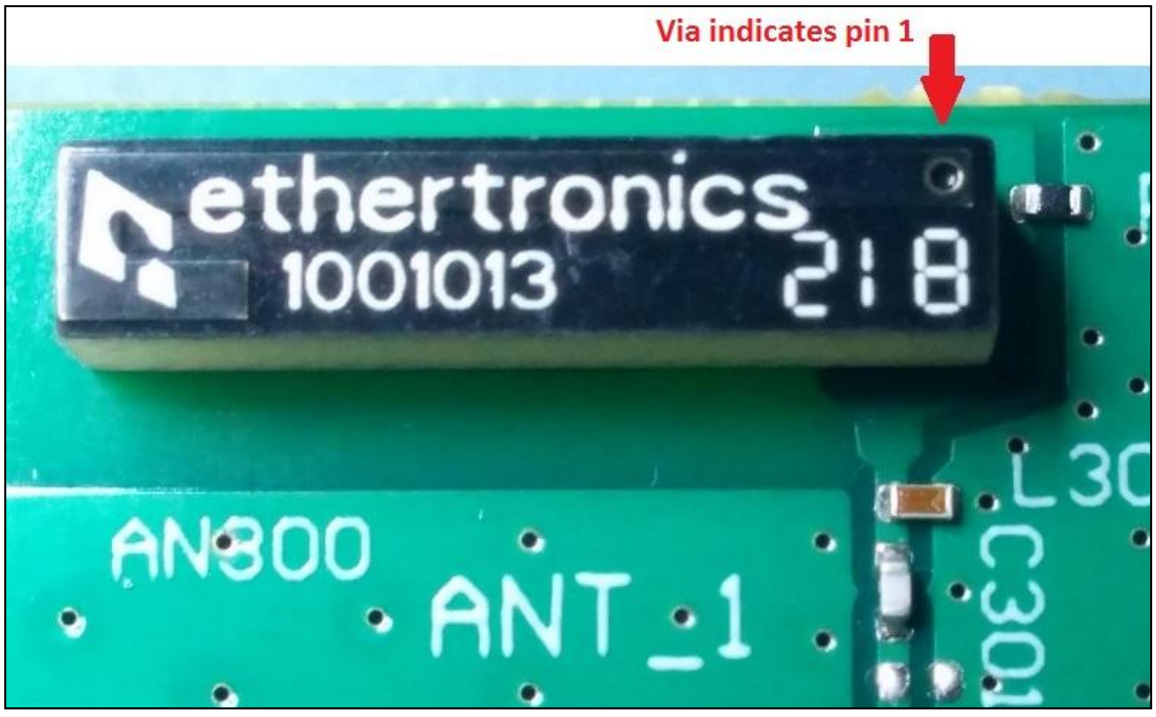

Figure 13: Photo of antenna showing via that indicates pin 1 location

Related documents

[1] u-blox NANO-S100 series Data Sheet, Docu No UBX-16025707

[2] u-blox NANO-S100 series System Integration Manual, Docu No UBX-16026400

Revision history

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R01	09-Mar-2017	clee	Initial release
R02	19-Oct-2017	clee	"Disclosure restriction" replaces "Document status" on page 2 and document footer.

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