AN1903

NF12 Reference Design for G2iL / G2iL+

Rev. 1.0 — 10 May 2010 Application note

Document information

Info	Content
Keywords	UCODE EPC G2, G2iL, G2iL+, Reference Design, Antenna Design, Near Field, Aluminum, NF12-iL
Abstract	This application note is a reference antenna design description for the UCODE G2iL / G2iL+ IC.

Revision history

Rev	Date	Description
1.0	10.05.2010	First initial release; Author: BR

Contact information

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1. NF12 Reference Antenna Design

1.1 Geometry

- Dimensions of the design: 12 mm x 12 mm;
- Antenna material: Aluminium; thickness 10um;
- Substrate material: PET; thickness 50um;
- Antenna should be matched to following assembled IC impedance:

($Z_{ass.\ IC}$ = 17.3 – j 171.4 Ohm @ 915 MHz @ P_{IC} = $P_{IC\ min}$ +0.5dB);

C_{serial} = 1.02 pF;

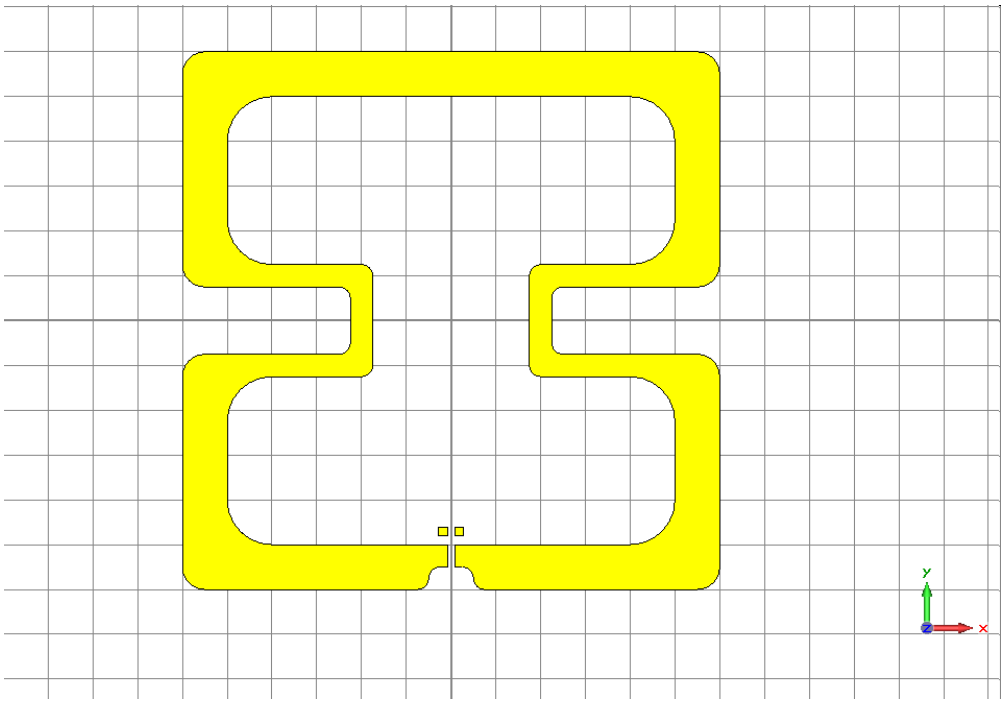

Fig 1. NF12 Reference Design

2. 3D EM Simulation Results

The following simulations are solved using CST with Transient Solver, a commercial 3-D solver for electromagnetic structures used for antenna design and the design of complex RF electronic circuit elements.

2.1 Antenna Impedance

One of the key characteristics of the label antenna is its complex input impedance as a function of frequency. The curves of Antenna_Real Part and Antenna_Imaginary Part of the optimized design are shown in **Fig 2** and **Fig 3** respectively.

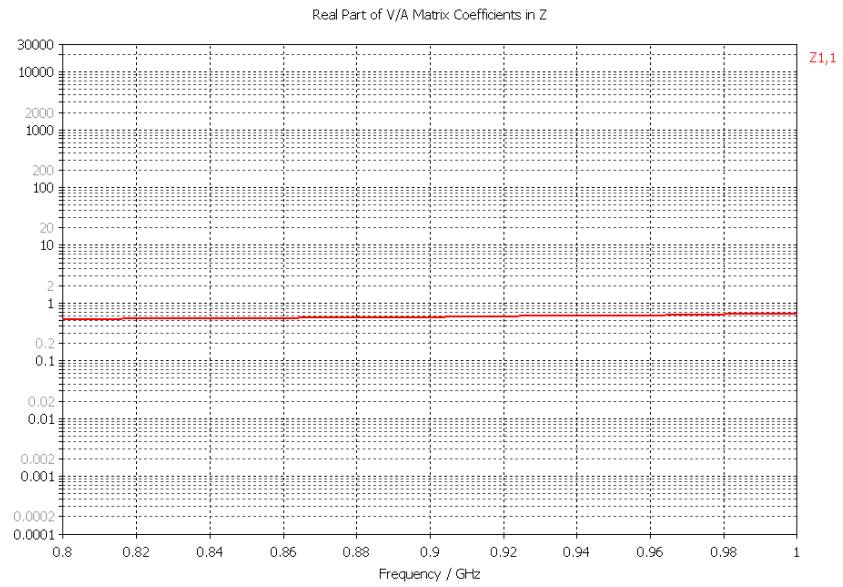

Fig 2. NF12 design: Impedance – Real Part

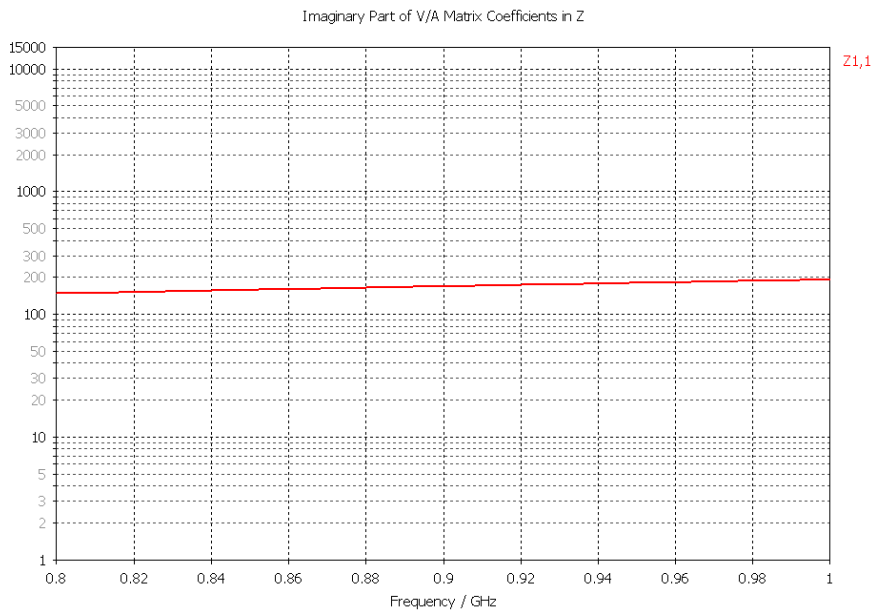

Fig 3. NF12 design: Impedance- Imaginary part

2.2 Return Loss

The return loss expresses the mismatch between the antenna impedance and the assembled IC impedance over frequency, and is calculated by following formula (**Equation 1**).

$$\Gamma = \frac{Z_A - Z_{IC}^*}{Z_A + Z_{IC}} \quad (1)$$

The corresponded curve is shown in **Fig 4**. The curve is based on the assumption that the IC impedance remains constant.

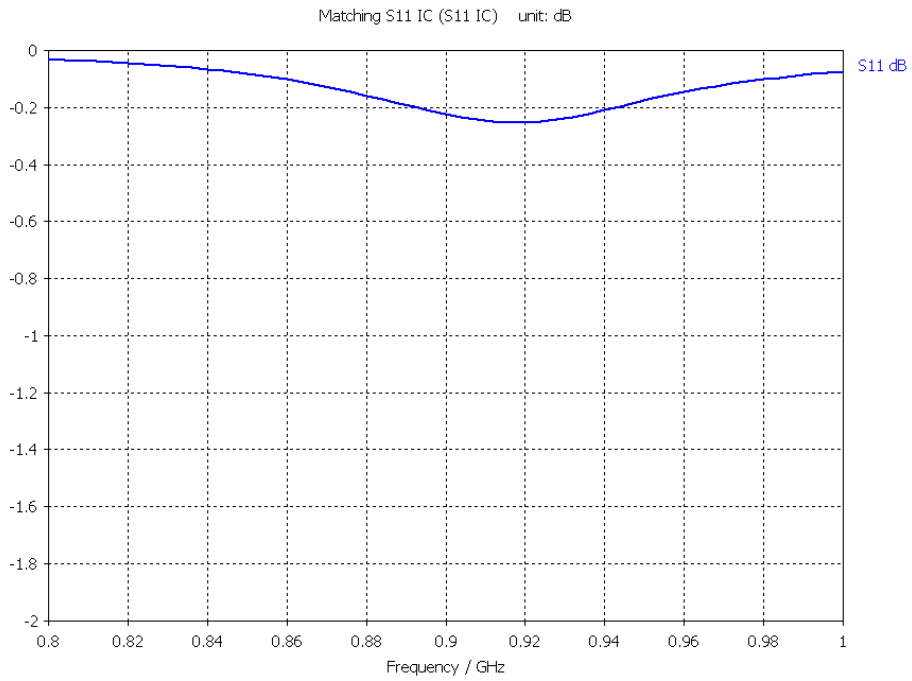

Fig 4. NF12 design: Return Loss

2.3 Antenna Gain

The label radiation properties are shown in Fig 5 - Fig 7. The maximal Gain is -10.1 dBi.

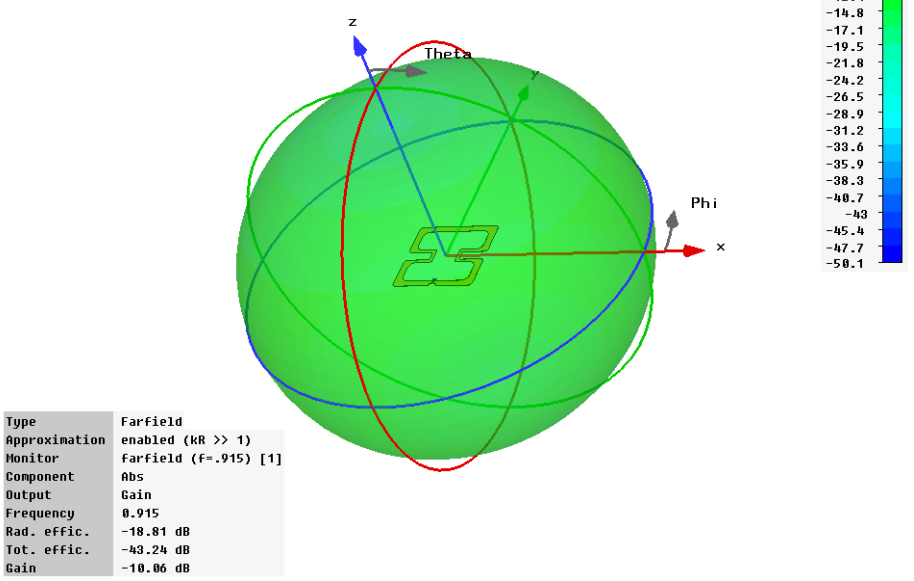

Fig 5. NF12 design: 3D Antenna Gain @ 915MHz

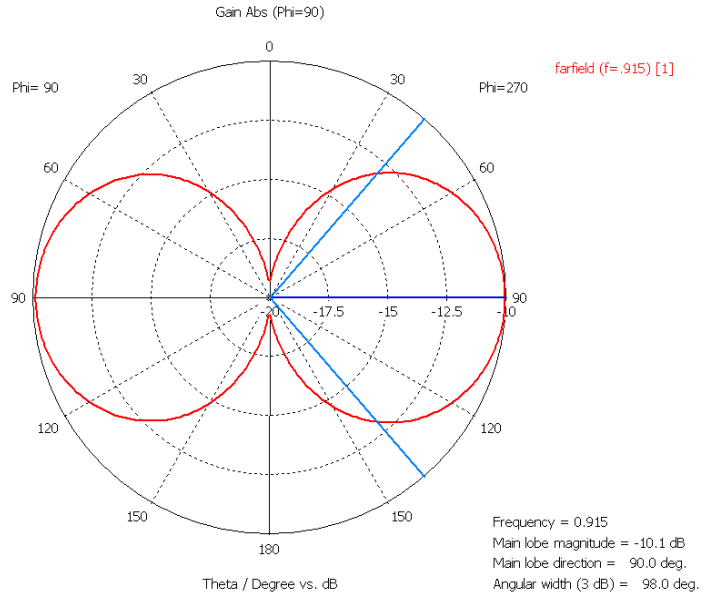

Fig 6. NF12 design: 2D Antenna Radiation Pattern @ 915MHz. Phi = 90° Plane

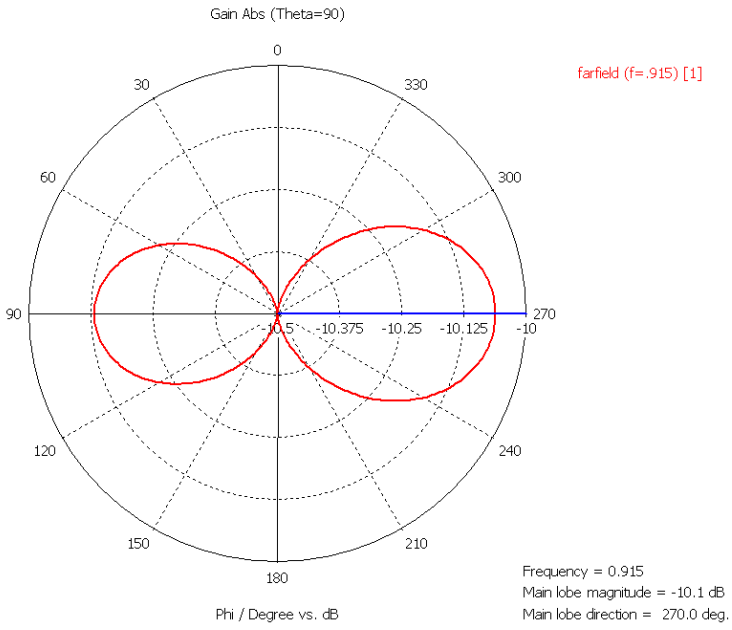

Fig 7. NF12 design: 2D Antenna Radiation Pattern @ 915MHz. Theta = 90° Plane

Assembly process

2.4 Equipment

- Thermode Test Station TTS 300 from Mühlbauer
- Low force thermode

2.5 Recommended assembly parameters

- Antenna: Alu 10um
- Substrate: PET 50um
- Glue: E&C 13975-11A
- Temperature
  - Upper thermode: 190°C
  - Lower thermode: 160°C
- Bonding time: 10 sec.
- Bonding pressure: 1,9 N

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4. List of figures

5. Contents

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