AN 1900

Far Field Reference Design for G2iL / G2iL+ (FarField9510-iL)

Rev. 1.0 — 2 April 2010 Application note

Document information

Info	Content
Keywords	UCODE EPC G2, G2iL, G2iL+, Reference Design, Antenna Design, Far Field, Broadband, Aluminum, FarField9510-iL
Abstract	This application note is a reference antenna design description for the UCODE G2iL / G2iL+ IC.

Revision history

Rev	Date	Description
1.0	02.04.2010	First initial release; Author: BFl

Contact information

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1. Far Field Reference Antenna Design

1.1 Geometry

- Dimensions of the design: 95 mm x 10 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;

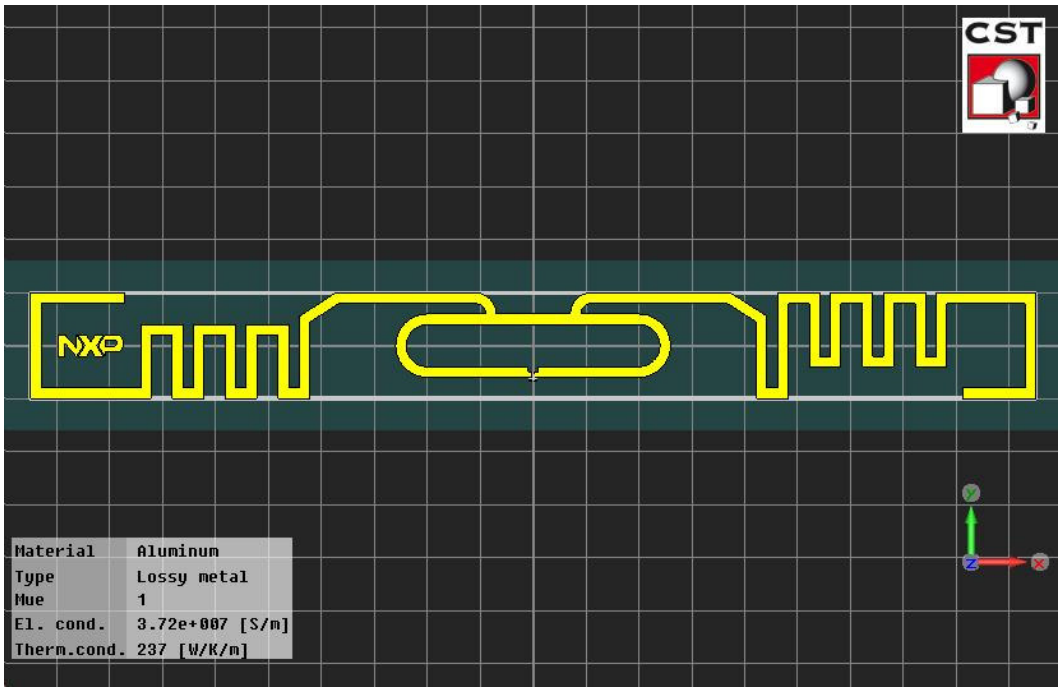

Fig 1. Far Field Reference Design

2. CST 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**. The marker is on the position of the resonance frequency from the S11 curve. This shows the matching between the antenna and the assembled IC impedance.

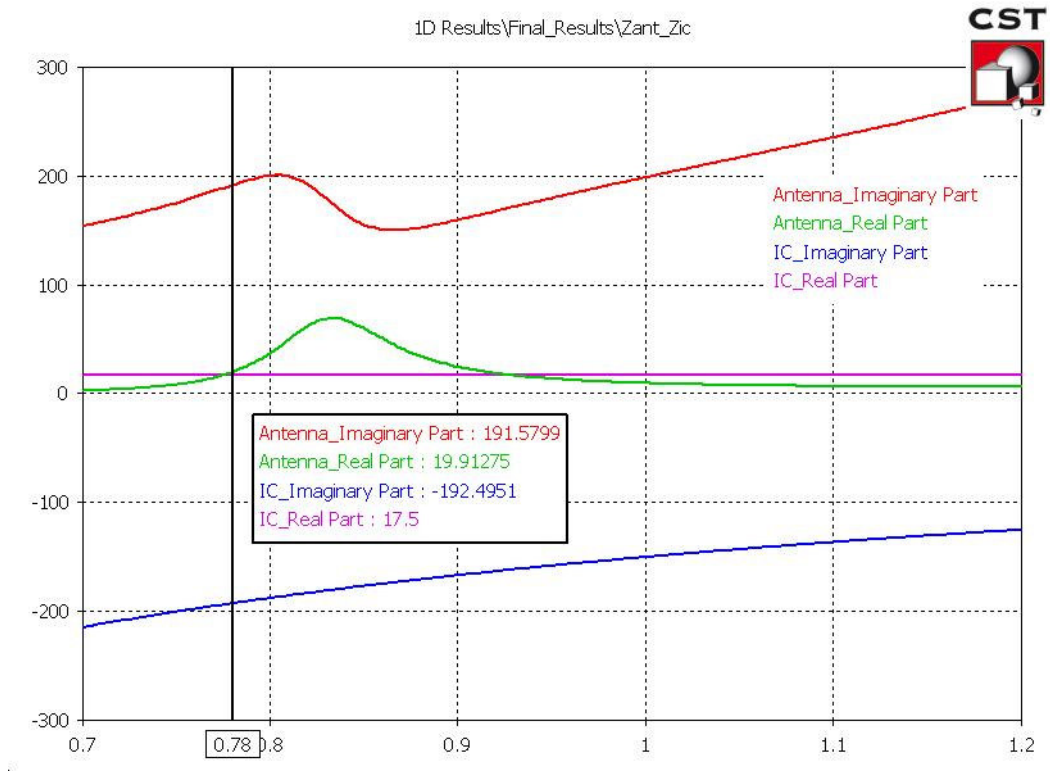

Fig 2. Far Field design: Impedance (Marker position 1)

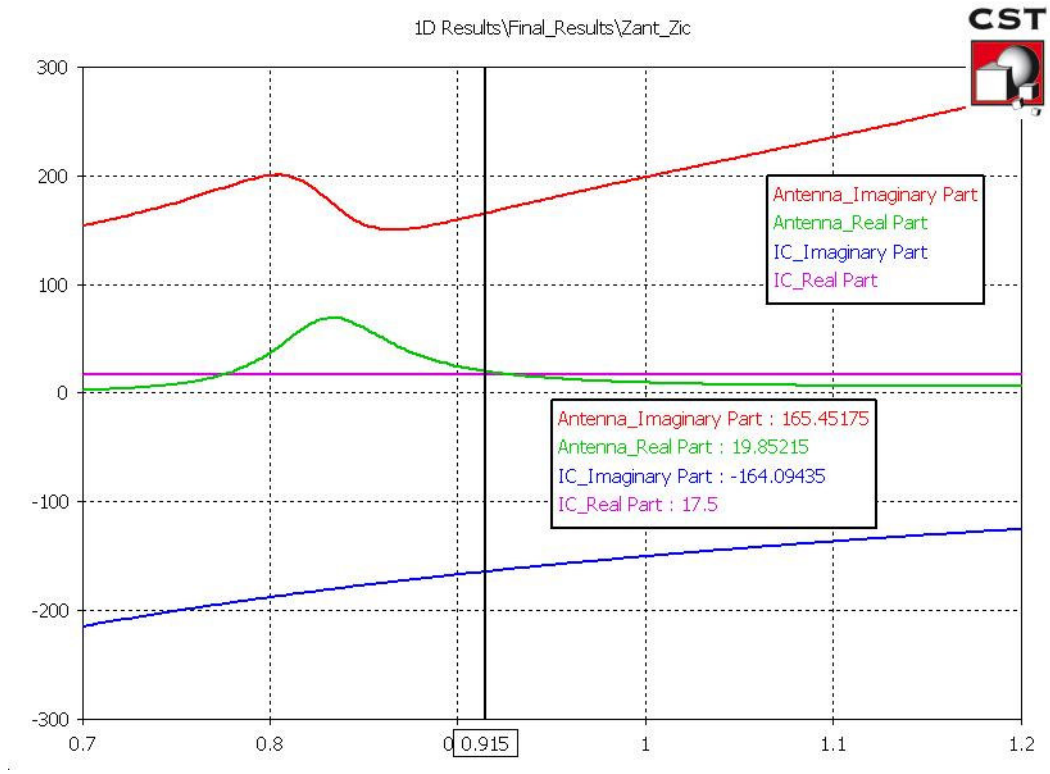

Fig 3. Far Field design: Impedance (Marker position 2)

2.2 Return Loss

The antenna impedance on one side and the assembled IC impedance on the other let calculate the return loss, Γ, which show a degree of matching between them (**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 for all frequencies and corresponds to those, measured at 915MHz by $P_{IC} = P_{min\ IC} + 0.5$ dB.

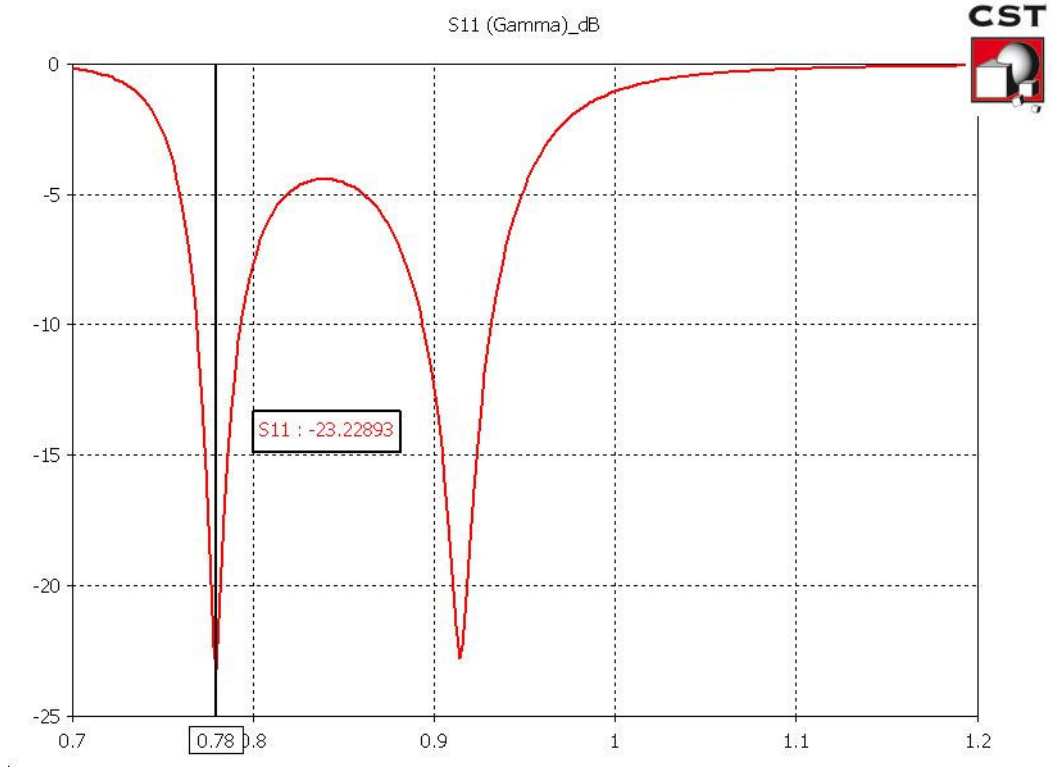

Fig 4. Far Field design: Return Loss (Marker position 1)

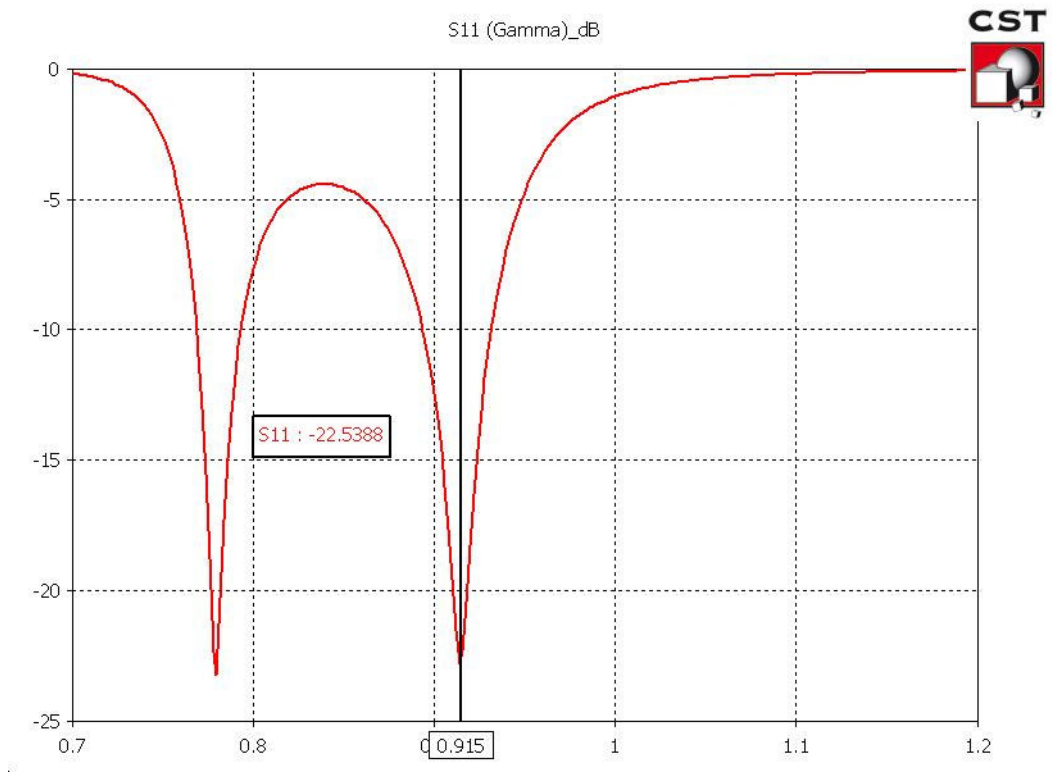

Fig 5. Far Field design: Return Loss (Marker position 2)

The matched frequency area covers the whole UHF RFID frequency band (860-960 MHz) if the label is placed on a material with an epsilon R value around 2 (e.g. Teflon).

2.3 Antenna Gain

The label radiation properties are shown in Fig 6 - Fig 9. The maximal Gain is 2.1 dBi.

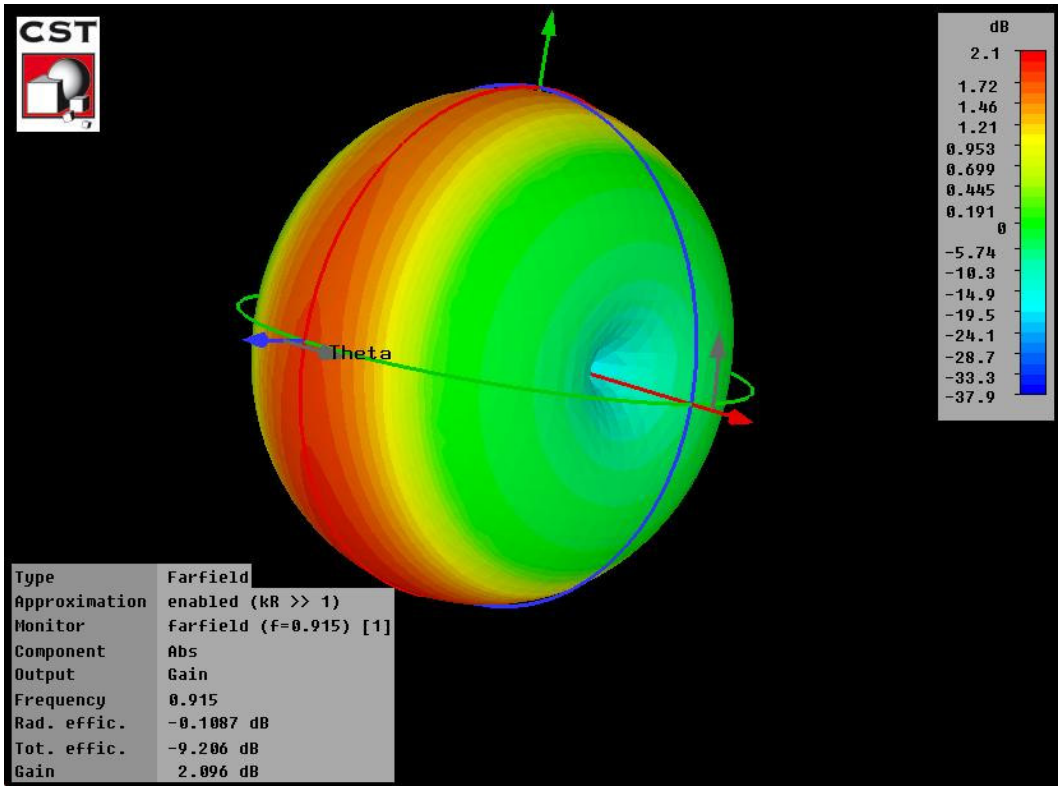

Fig 6. Far Field design: 3D Antenna Gain @ 915MHz

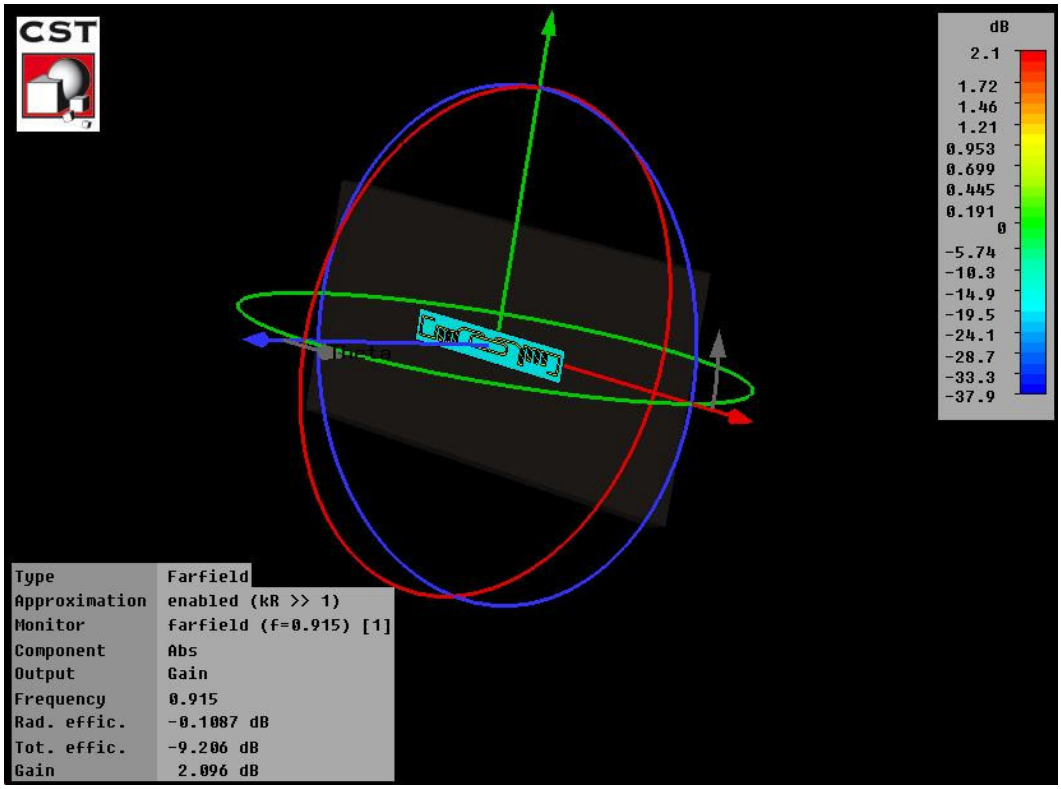

Fig 7. Far Field design: 3D Antenna Gain @ 915MHz – label position

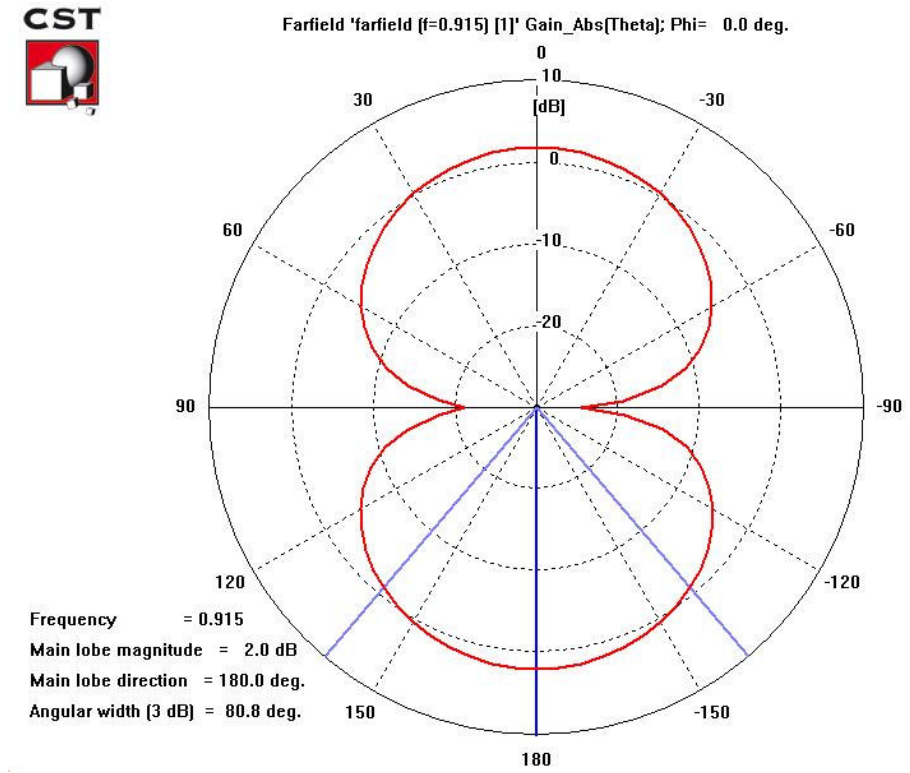

Fig 8. Far Field design: 2D Antenna Radiation Pattern @ 915MHz. E-Plane

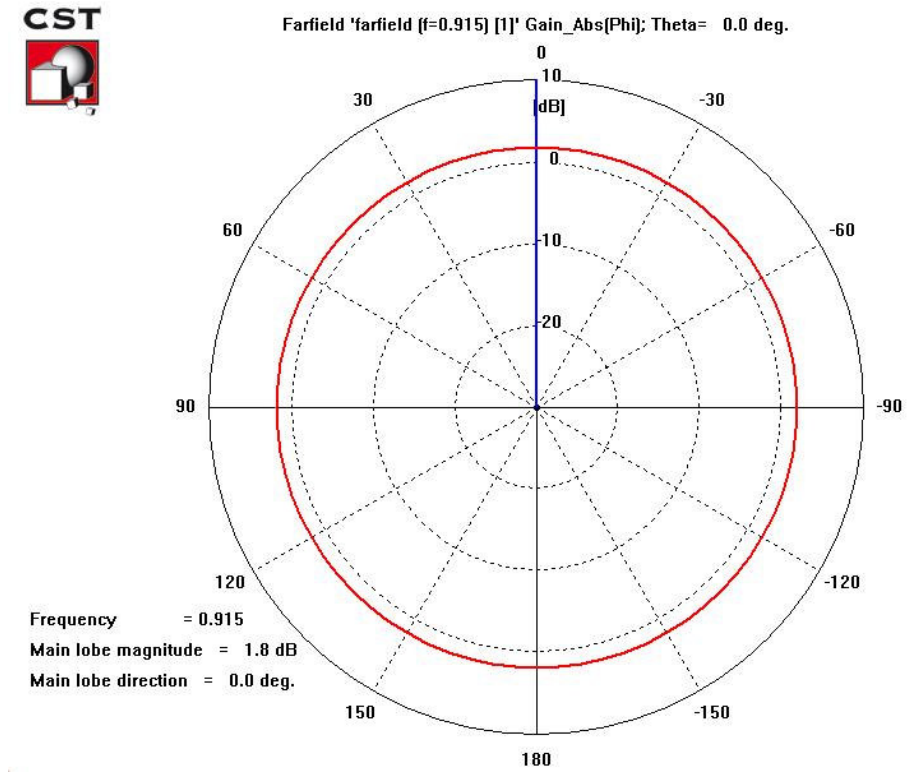

Fig 9. Far Field design: 2D Antenna Radiation Pattern @ 915MHz. H-Plane

3. Assembly process

3.1 Equipment

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

3.2 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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