EMSS CONSULTING (PTY) LTD

Antenna Model Verification

Antenna manufacturer:	RF Industries
Antenna model:	YB806-82
Antenna kind:	yagi
Model date:	07-Jun-2011 13:42:00
Classification:	Confidential
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Document date:	June 7, 2011

1 Introduction

The *RF Industries YB806-82* is a 11.0 dBi yagi antenna that operates at 900 MHz. A representative antenna model was created in FEKO [1]. The model allows near-field calculations in a finite 3-D region around the antenna using the field assessment calculator (FAC) described in [2].

This document provides a comparison between the antenna properties specified by the manufacturer and the simulated model properties. A default vertical orientation is used for the antenna model. The horizontal beamwidth, vertical beamwidth and exclusion zone simulations use this orientation, unless indicated otherwise. Examples of exclusion zones are shown for a number of compliance simulations performed using the FAC. The results presented in this document can be used to verify the accuracy of the simulated model.

2 Antenna properties.

The frequency-independent properties for this antenna are listed in Table 1.

Table 1: Antenna Properties

Property	***Value***
Manufacturer	RF Industries
Manufacturer abbreviation	RFI
Model	YB806-82
Kind	yagi
Data source	TRS

The antenna properties are shown for a single operating frequency. Comparisons are shown between the simulated and calculated (1) power densities on a line in the antenna boresight.

$$S = \frac{PG}{4\pi R^2} \tag{1}$$

S is the power density in W/m^2, P is the power in $Watt$, G is the unit-less gain and R is the distance from the antenna in meters. The far-field power density is calculated using the specified antenna gain in the region between the far-field distance $max(2.5\lambda, 2L^2/\lambda)$ and twice the far-field distance. L is the length of the antenna.

2.1 900 MHz

Table 2: Antenna properties at 900 MHz.

Property	***Value***	
	Specified	***Simulated***
Frequency (MHz)	900	
Maximum simulation power (W)	100	
Gain (dBi)	11	10.6
F/B ratio (dB)	20	19
Horizontal 3dB beamwidth (°)	61	58.6
Vertical 3dB beamwidth (°)	49	48.6

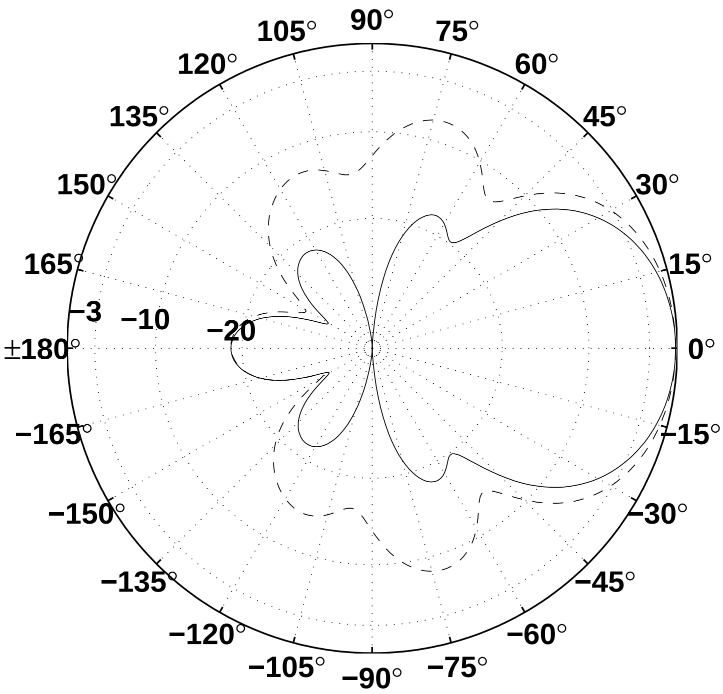


Figure 1: Horizontal (dotted) and vertical (solid) directivity patterns in dB, simulated in FEKO at 900 MHz.

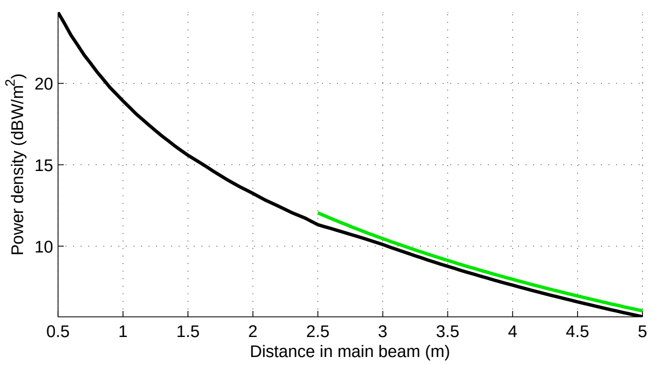


Figure 2: Comparison between simulated (black) and calculated using (1) (green) power densities for an input power of 100 W at 900 MHz.

3 Compliance Simulations

Exclusion zone simulations were performed using the FAC for input-powers of 0.15, 0.35, 0.75, 1.55, 3.1, 12.5, 25, 50, 100 (vertical) and 100 W (horizontal), and isosurfaces indicate in Figures 3 - 12 where the ICNIRP [3] public and occupational power density reference levels were exceeded. In the figure(s) where no public or occupational exclusion zones are indicated, it may still be possible that the ICNIRP reference levels are exceeded on the surface of the antenna. Refer to [2] for a detailed discussion and uncertainty analysis.

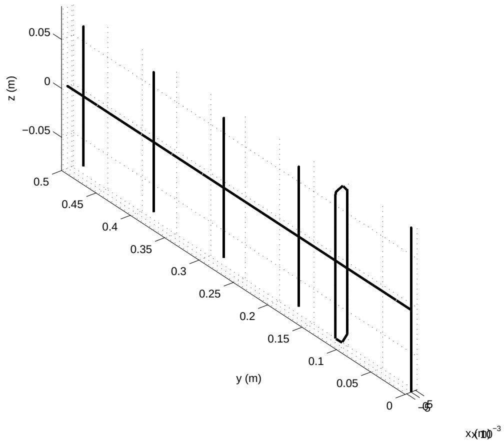


Figure 3: ICNIRP public (yellow) and occupational (red) exclusion zones for the vertically oriented model with 0.15 W input power at 900 MHz.

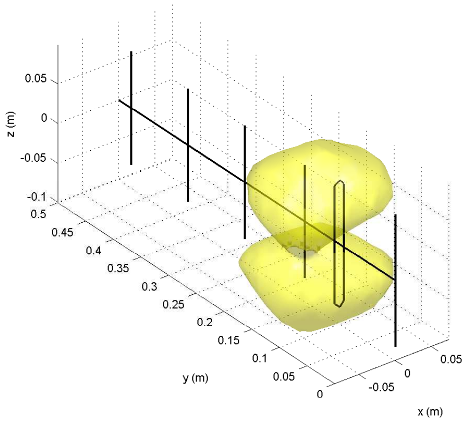


Figure 4: ICNIRP public (yellow) and occupational (red) exclusion zones for the vertically oriented model with 0.35 W input power at 900 MHz.

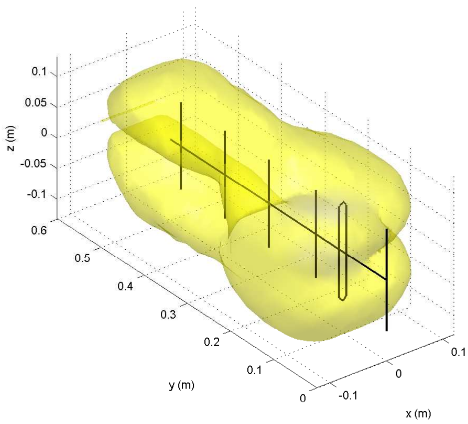


Figure 5: ICNIRP public (yellow) and occupational (red) exclusion zones for the vertically oriented model with 0.75 W input power at 900 MHz.

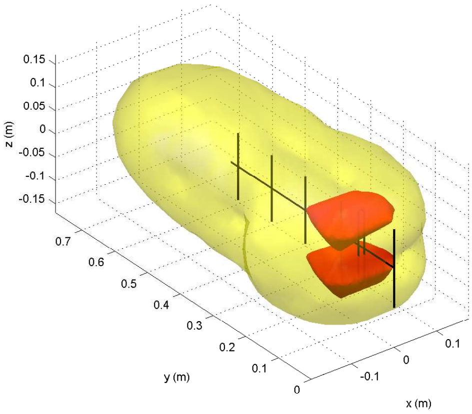


Figure 6: ICNIRP public (yellow) and occupational (red) exclusion zones for the vertically oriented model with 1.55 W input power at 900 MHz.

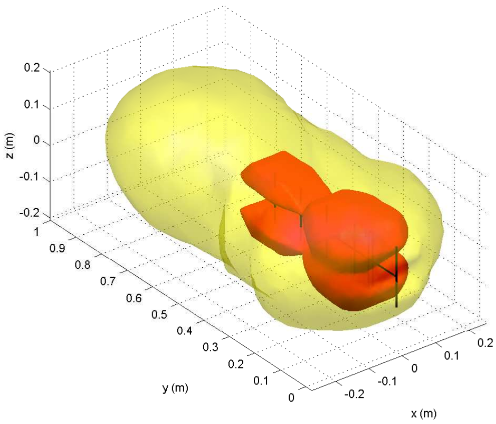


Figure 7: ICNIRP public (yellow) and occupational (red) exclusion zones for the vertically oriented model with 3.1 W input power at 900 MHz.

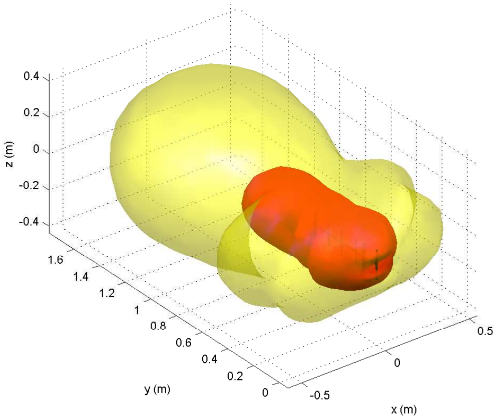


Figure 8: ICNIRP public (yellow) and occupational (red) exclusion zones for the vertically oriented model with 12.5 W input power at 900 MHz.

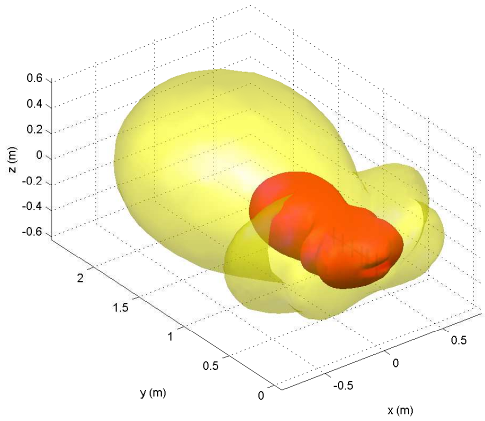


Figure 9: ICNIRP public (yellow) and occupational (red) exclusion zones for the vertically oriented model with 25 W input power at 900 MHz.

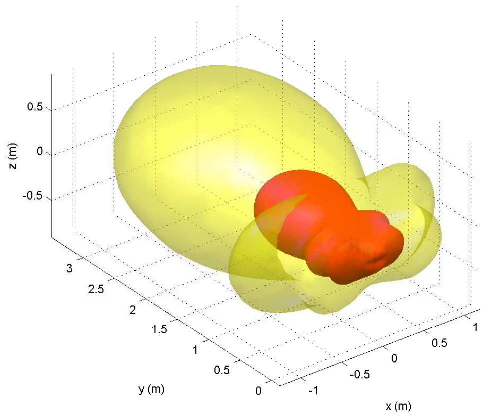


Figure 10: ICNIRP public (yellow) and occupational (red) exclusion zones for the vertically oriented model with 50 W input power at 900 MHz.

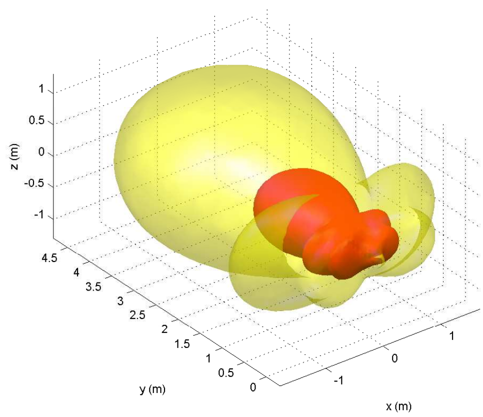


Figure 11: ICNIRP public (yellow) and occupational (red) exclusion zones for the vertically oriented model with 100 W input power at 900 MHz.

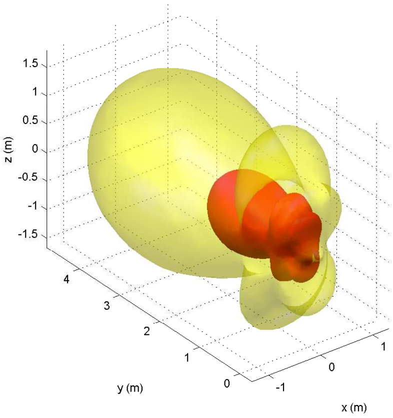
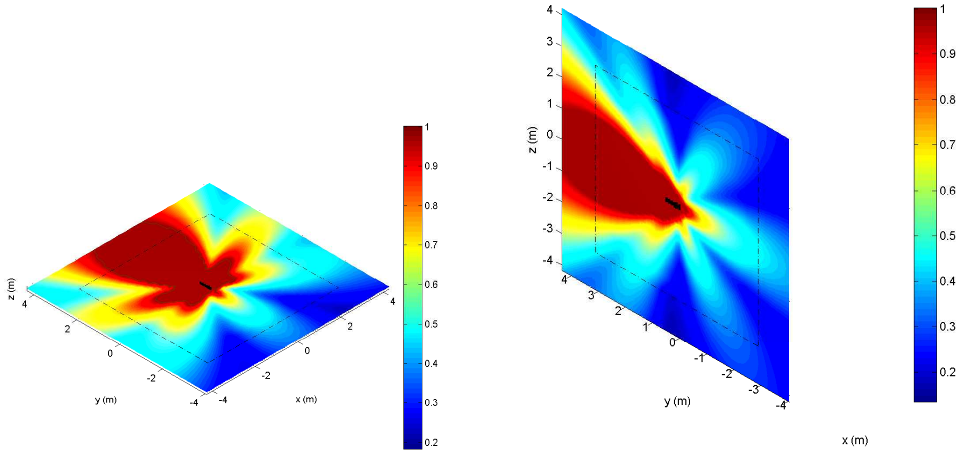


Figure 12: ICNIRP public (yellow) and occupational (red) exclusion zones for the horizontally oriented model with 100 W input power at 900 MHz.

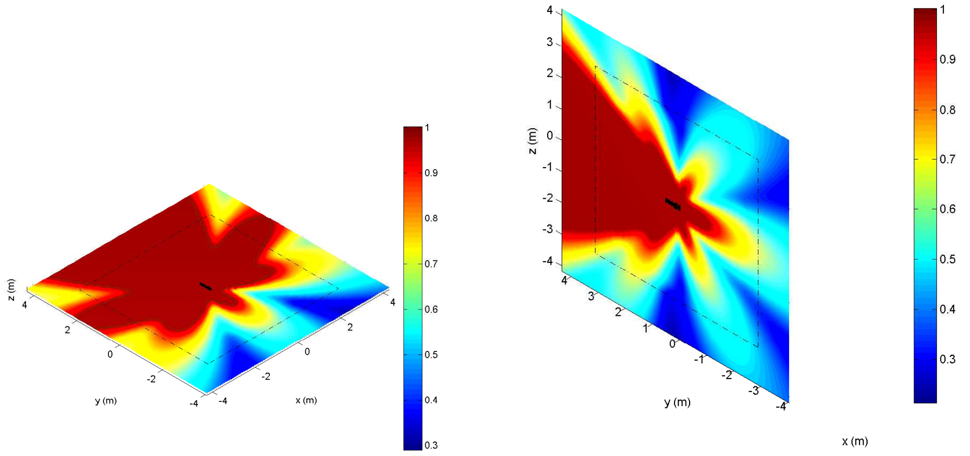
Horizontal and vertical orthogonal slices in Figures 13 and 14 indicate the extents of the near-field block.



(a) Horizontal slice

(b) Vertical slice

Figure 13: Horizontal and vertical orthogonal slices displaying the field intensity of the vertically oriented model as a fraction of ICNIRP public power density reference level for 100 W input power at 900 MHz. The solid, striped and dotted contour lines indicate fractions of 1, 0.1 and 0.01 respectively. The dot-striped block indicates the near-field block extents.



(a) Horizontal slice

(b) Vertical slice

Figure 14: Horizontal and vertical orthogonal slices displaying the field intensity of the vertically oriented model as a fraction of Serbian public E-field reference level for 100 W input power at 900 MHz. The solid, striped and dotted contour lines indicate fractions of 1, 0.1 and 0.01 respectively. The dot-striped block indicates the near-field block extents.

4 Conclusions

The simulated model properties were compared to properties specified by the manufacturer of the antenna. The properties were found to compare well. Compliance simulations were performed and exclusion zones plotted to illustrate the typical exclusion zones for this antenna.

References

[1] FEKO User's Manual Suite 5.4, July 2008. `http://www.feko.info`.

[2] F. D. du Plessis. Field assessment calculation and uncertainty estimation. P02-2008-IXUS-1, 2008. `http://www.emssixus.com`.

[3] International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz). *Health Phys 74: 494-522.2*, 1998.