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RF EME ANALYSIS REPORT
TELSTRA CORPORATION LIMITED
WIFI BASE CUBE



October2014

Prepared by

James Ward
RF EME Manager

PO Box 680
CLAREMONT WA 6910
08 9381 7199 (telephone)
08 9381 7166 (facsimile)
www.t-r-s.com.au

RF EME ANALYSIS REPORT

For

**Telstra Corporation Limited
242 Exhibition Street
Melbourne VIC 3000**

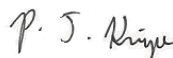
on

**WIFI BASE CUBE
Cisco ANT-10**

Assessment Date 7 October 2014

Reference No. 1370-4212

Authorised Signatory



Dr Phillip Knipe
Consultant Physicist
Total Radiation Solutions



NATA Accredited Inspection Body - Number: 15096

This document is issued in accordance with NATA's accreditation requirements.

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1. Introduction

Telstra Corporation Limited (Telstra) requested Total Radiation Solutions Pty Ltd (TRS) to undertake a radio frequency (RF) electromagnetic energy (EME) assessment of the Wifi Base Cube that contains a number of Cisco ANT-10 omni antennas.

The purpose of this assessment was to establish if the non-occupational boundaries for the antennas extend outside the cube shroud.

This report is based on information provided by Telstra and the manufacturer’s technical sheet for the Cisco ANT-10 omni antennas.

2. Regulatory Exposure Limits

ARPANSA, an agency of the Commonwealth Department of Health has established a Radiation Protection Standard (ARPANSA 2002) specifying limits for continuous exposure of the general public to RF EME transmissions (Table 1). Further information can be gained from the ARPANSA web site.

The Australian Communications and Media Authority (ACMA) mandates exposure limits for continuous exposure of the general public to RF EME. Further information can be found at the ACMA website at <http://www.acma.gov.au>

Table 1 Reference Levels for Time Averaged Exposure to RMS Electric and Magnetic Fields (Unperturbed) (ARPANSA 2002)

Exposure Category	Frequency Range	E-field (V/m)	H-field (A/m)	Power Flux Density (W/m ²)
Occupational (RF Worker)	100 kHz – 1 MHz	614	163/ <i>f</i>	–
	1 MHz – 10 MHz	614/ <i>f</i>	163/ <i>f</i>	1000/ <i>f</i> ²
	10MHz – 400 MHz	61.4	163	10
	400 MHz – 2 GHz	3.07 x <i>f</i> ^{0.5}	0.00814 x <i>f</i> ^{0.5}	<i>f</i> /40
	2 GHz – 300 GHz	137	0.364	50
Non-Occupational (General Public)	100 kHz – 150 kHz	86.8	4.86	–
	150 kHz – 1 MHz	86.8	0.729/ <i>f</i>	–
	1 MHz – 10 MHz	86.8/ <i>f</i> ^{0.5}	0.729/ <i>f</i>	–
	10MHz – 400 MHz	27.4	0.729	2
	400 MHz – 2 GHz	1.37 x <i>f</i> ^{0.5}	0.00364 x <i>f</i> ^{0.5}	<i>f</i> /200
	2 GHz – 300 GHz	61.4	0.163	10

f is frequency in MHz

3. Modelling Methodology

Using the IXUS modelling software in conjunction with the NATA accredited inspection body process, the occupational and non-occupation exclusion zones for the antennas listed in Table 2 were calculated.

Table 2 Wifi Base Cube Antenna Configuration – All Versions

Number of Antennas	Manufacturer	Model	Frequency	Type
2	Cisco	ANT-10	2.4 GHz	Omni
2	Cisco	ANT-10	5 GHz	Omni

Cube Design - Version 1

Cube Dimensions W (30cm) x D (30cm) x H (30cm)
 Antenna Base Plate Height 4cm
 Distance Between Antenna Midpoints 23cm

Table 3 Cube Design - Version 1 LMR400 Cable

Diagram Ref	Mech. Tilt (°)	Elec. Tilt (°)	Pol	LMR400 Cable Loss (dB)	System/Function/Sector	Port Power (dBm)
A01, A02	0	0	V	0.78	2.4 GHz	26
A03, A04	0	0	V	1.44	5 GHz	26

Table 4 Cube Design Version 1 RBK300 Cable

Diagram Ref	Mech. Tilt (°)	Elec. Tilt (°)	Pol	RBK300 Cable Loss (dB)	System/Function/Sector	Port Power (dBm)
A01, A02	0	0	V	1.04	2.4 GHz	26
A03, A04	0	0	V	1.95	5 GHz	26

Cube Design - Version 2

Cube Dimensions W (30cm) x D (30cm) x H (30cm)
 Antenna Base Plate Height 10cm
 Distance Between Antenna Midpoints 23cm

Table 5 Cube Design Version 2 - LMR400 Cable

Diagram Ref	Mech. Tilt (°)	Elec. Tilt (°)	Pol	LMR400 Cable Loss (dB)	System/Function/Sector	Port Power (dBm)
A01, A02	0	0	V	0.55	2.4 GHz	26
A03, A04	0	0	V	1.27	5 GHz	26

Cube Design - Version 3

Cube Dimensions W (30cm) x D (30cm) x H (31cm)
 Antenna Base Plate Height 10cm
 Distance Between Antenna Midpoints 18cm

Table 6 Cube Design Version 3 - LMR400 Cable

Diagram Ref	Mech. Tilt (°)	Elec. Tilt (°)	Pol	LMR400 Cable Loss (dB)	System/Function/Sector	Port Power (dBm)
A01, A02	0	0	V	0.55	2.4 GHz	26
A03, A04	0	0	V	1.27	5 GHz	26

4. Calculation Results

Table 7 Exclusion Zones Distance Outside Cube



Design Version	Exclusion Zone Distance Outside Cube (cm)	
	Non-Occupational	Occupational
1 (LMR400 Cable)	<1	0
1 (RBK300 Cable)	<1	0
2 (LMR400 Cable)	<1	0
3 (LMR400 Cable)	<1	0

Notes:

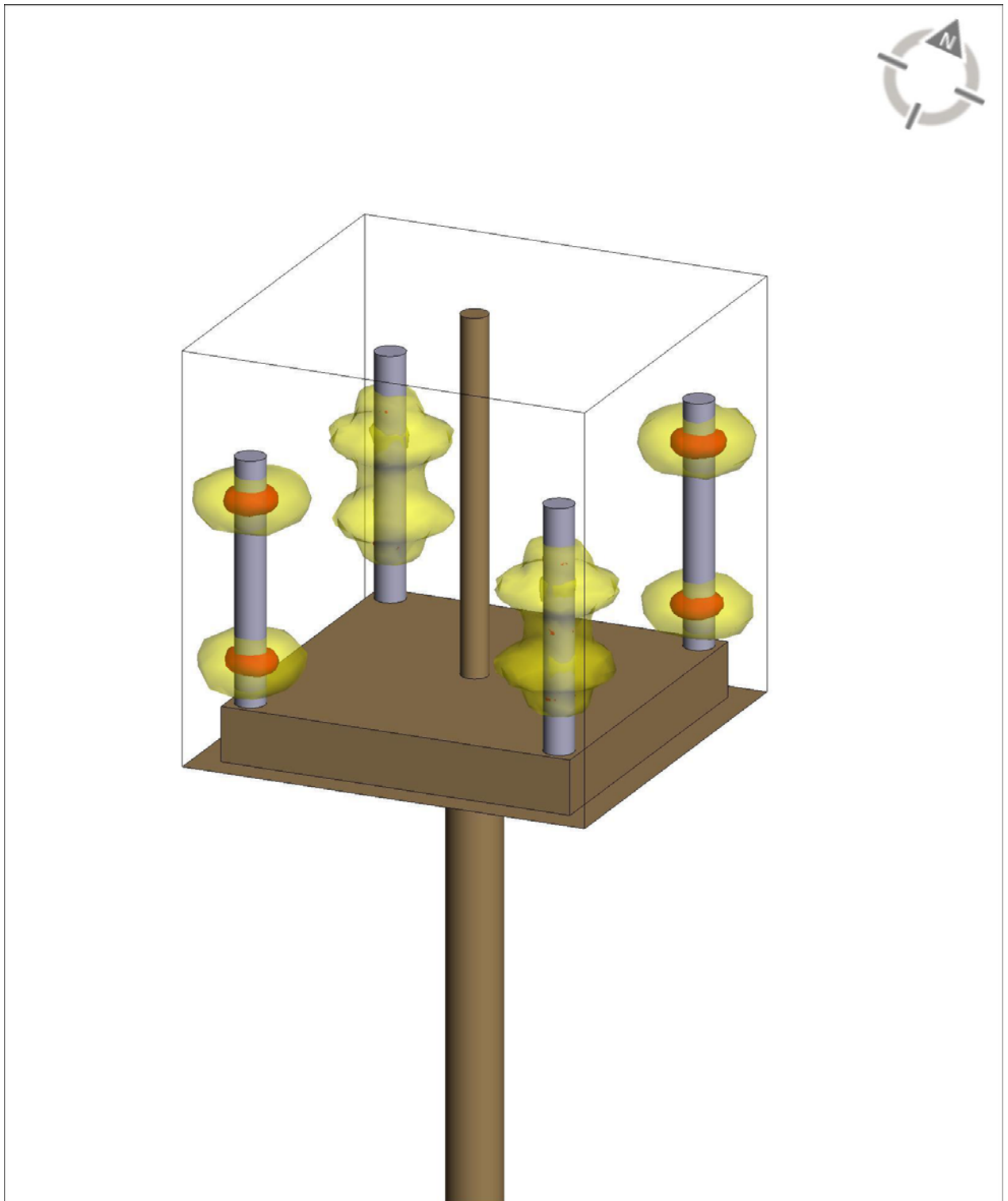
1. RF EME exclusion zones have been calculated based on the formulae specified in AS2772.2 using the specified parameters for the system by the IXUS software.
2. Assessment was conducted within the specified limits of the IXUS software.
3. For the purpose of this analysis it was assumed that the shrouding material did not attenuate the RF signals.
4. Wifi Base Cube Design Version 1 Reference 1370-4175.
5. Wifi Base Cube Design Version 3 Reference 1370-4205.

APPENDIX A – Antenna RF EME Exclusion Zones

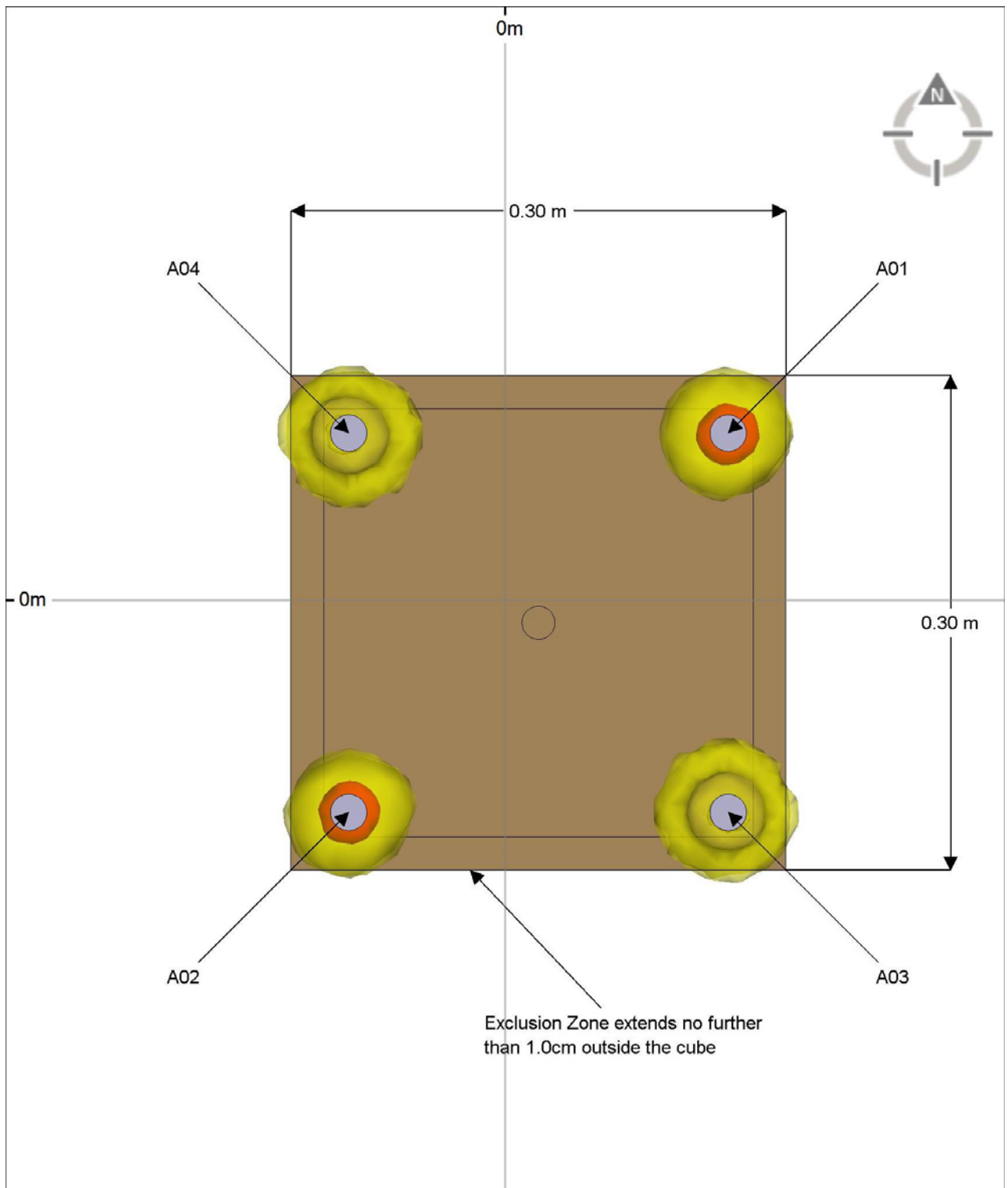
RF EME Exclusion Zone Legend

-  Areas above RPS3 public limits
-  Areas above RPS3 occupational limits

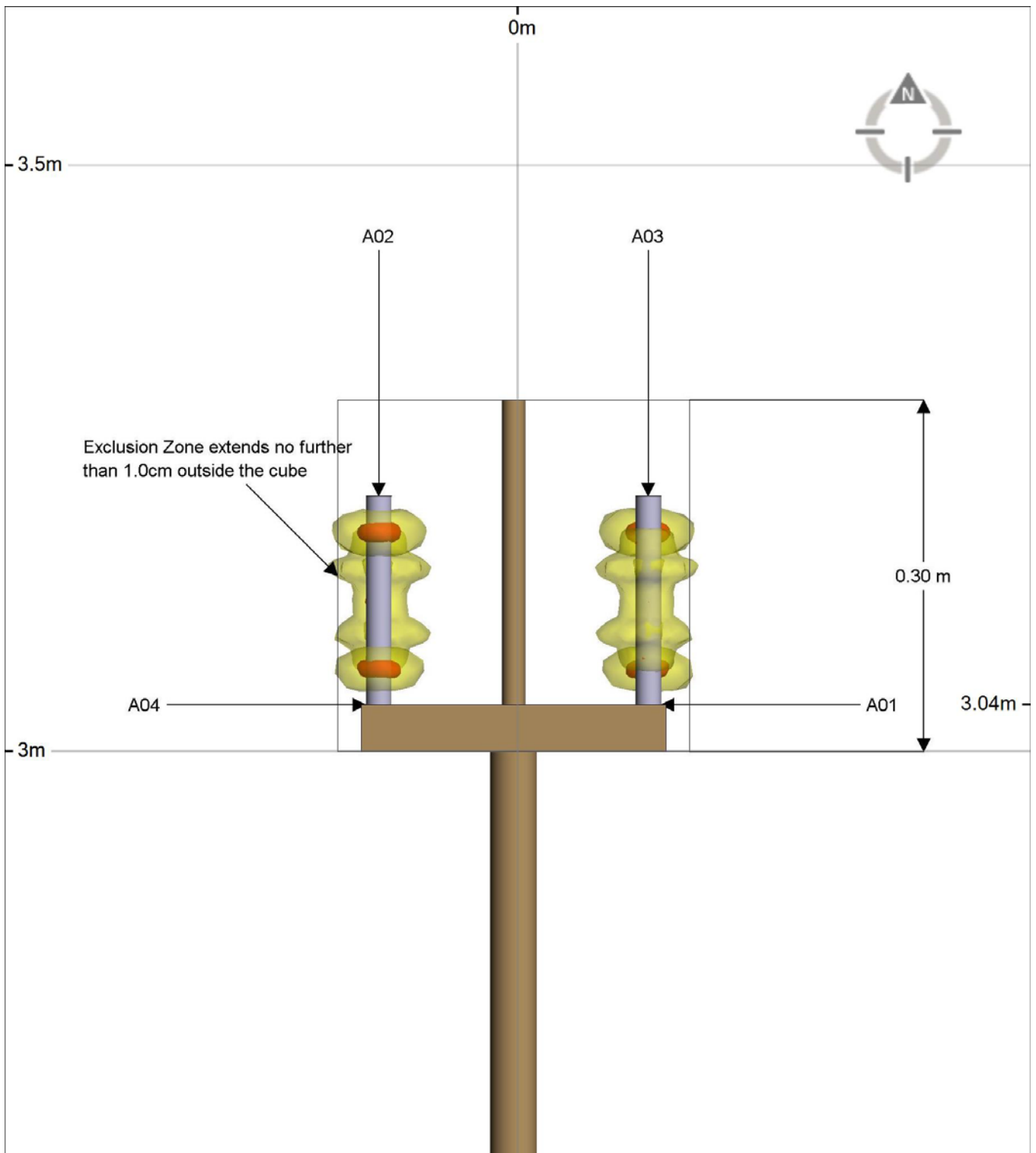
Wifi Base Cube – Design 1 - LMR400 Cable - Perspective View



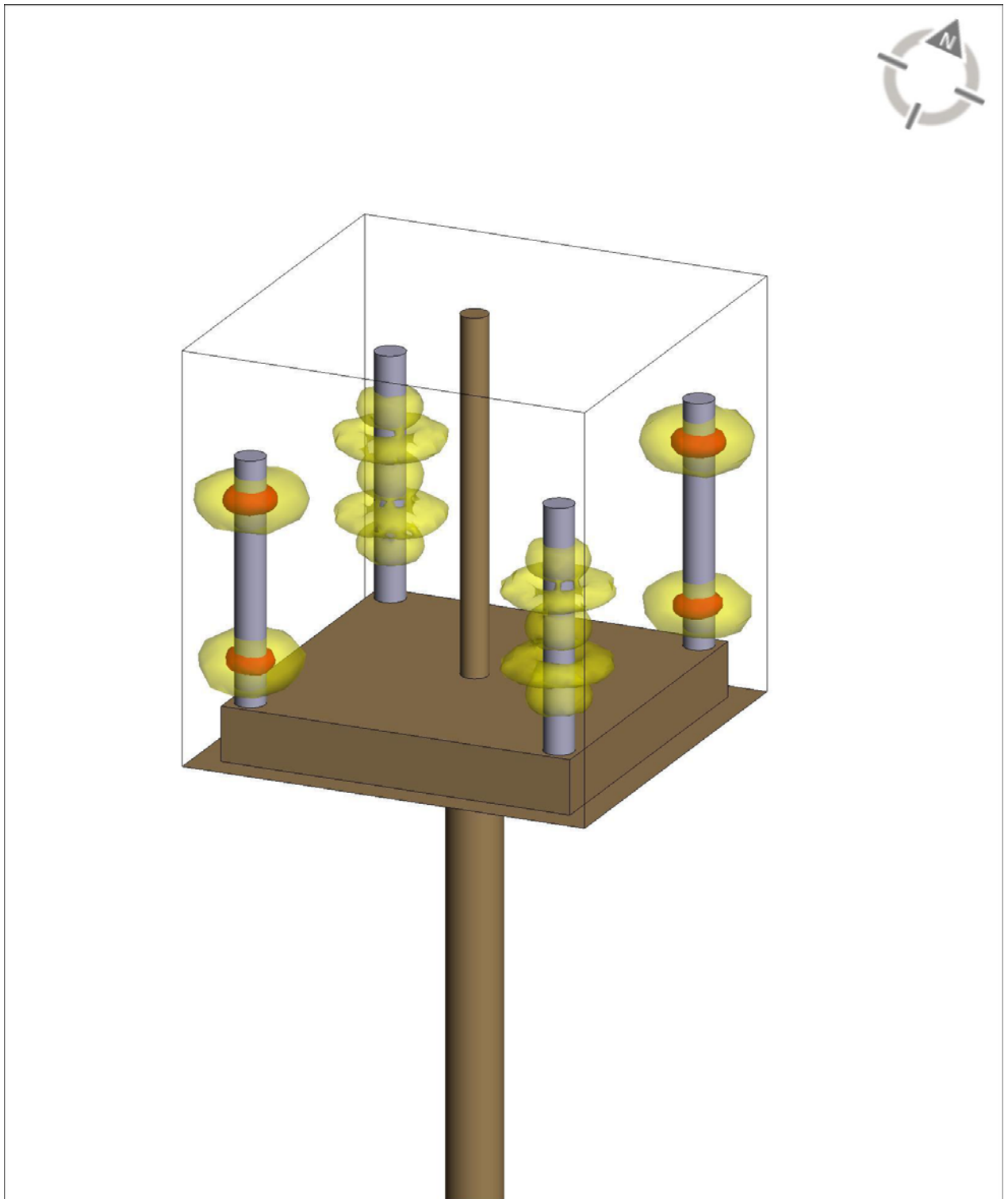
Wifi Base Cube – Design 1 - LMR400 Cable - Plan View



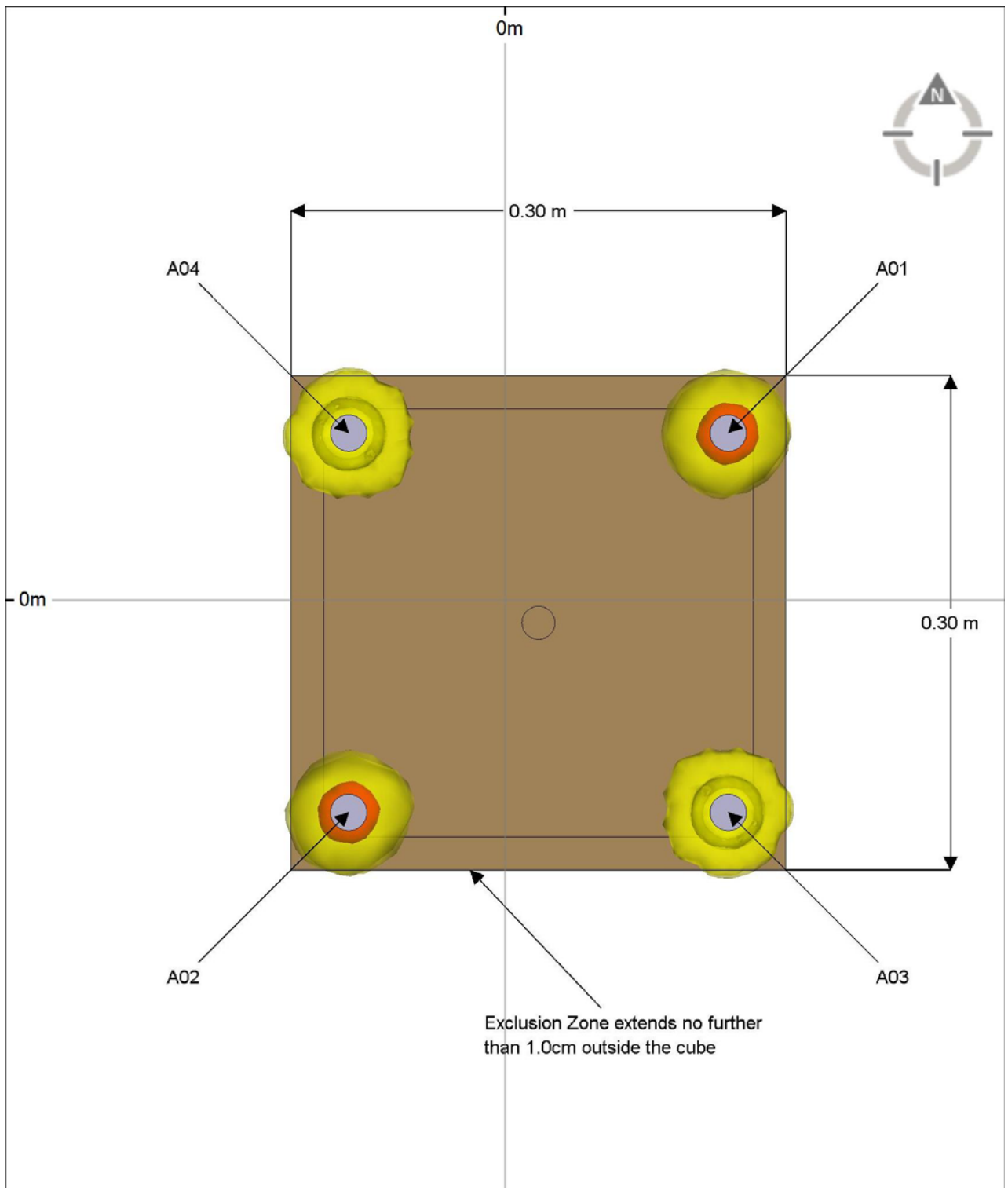
Wifi Base Cube – Design 1 - LMR400 Cable - Elevation View



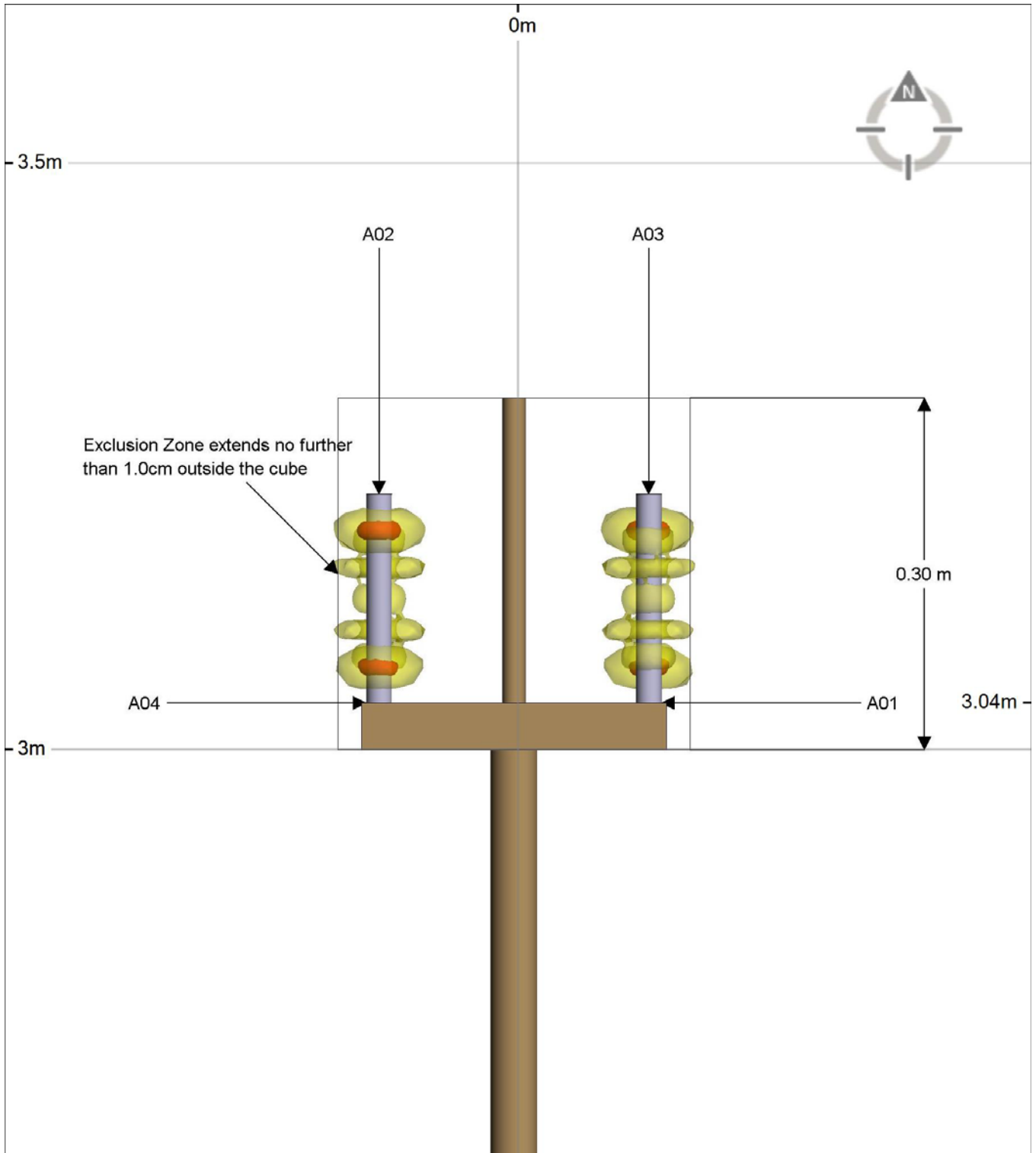
Wifi Base Cube – Design 1 – RBK300 Cable - Perspective View



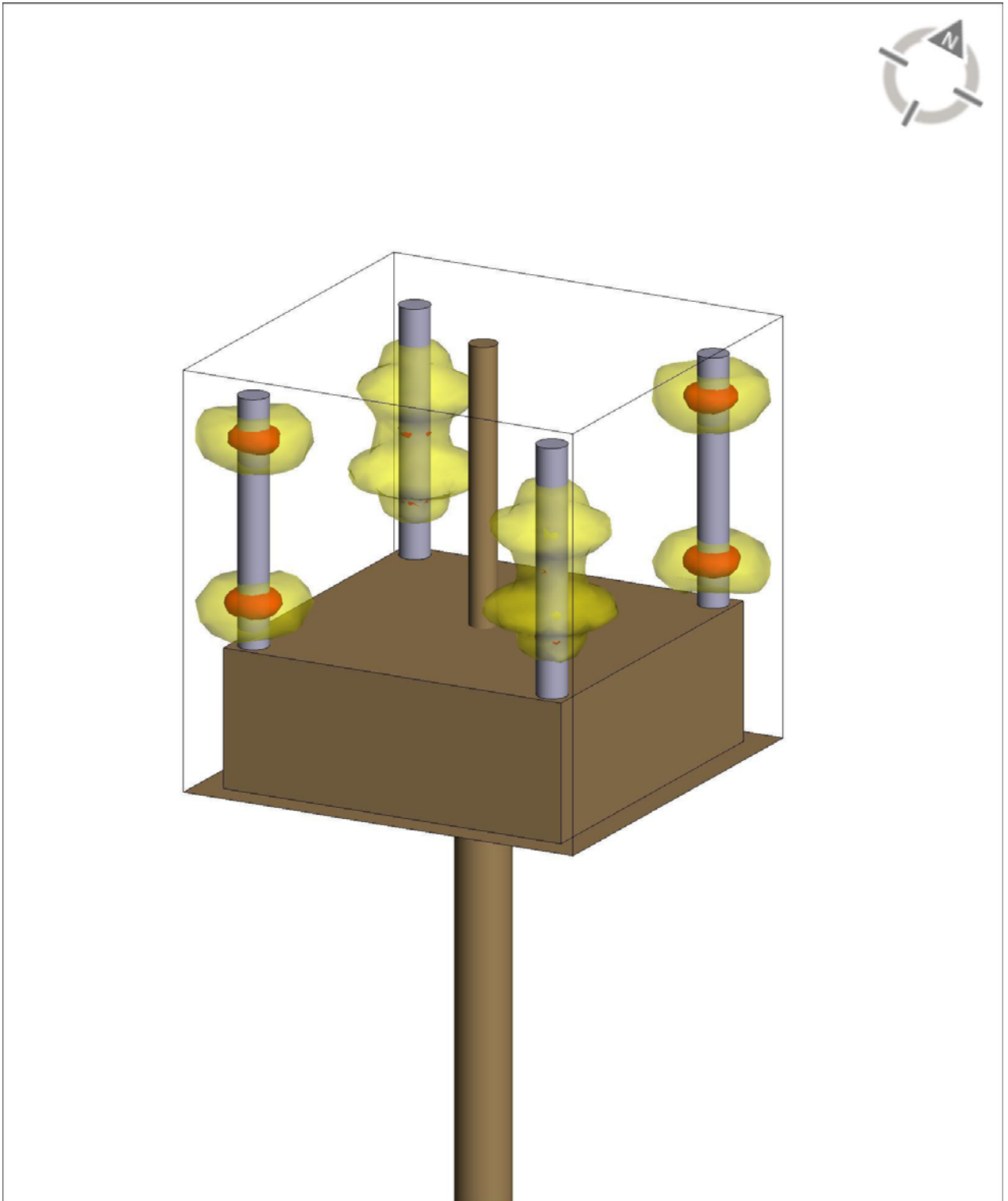
Wifi Base Cube – Design 1 - RBK300 Cable - Plan View



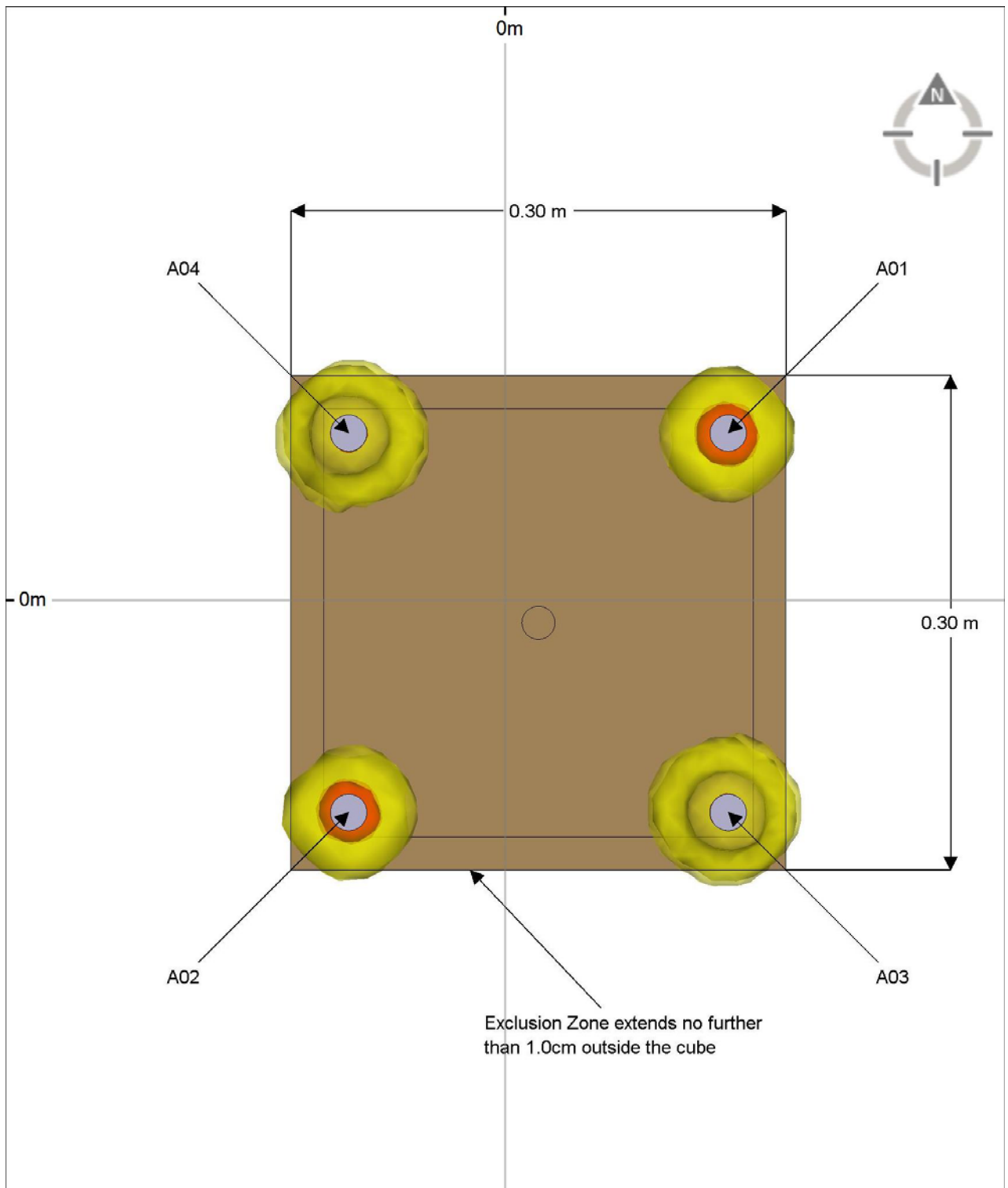
Wifi Base Cube – Design 1 - RBK300 Cable - Elevation View



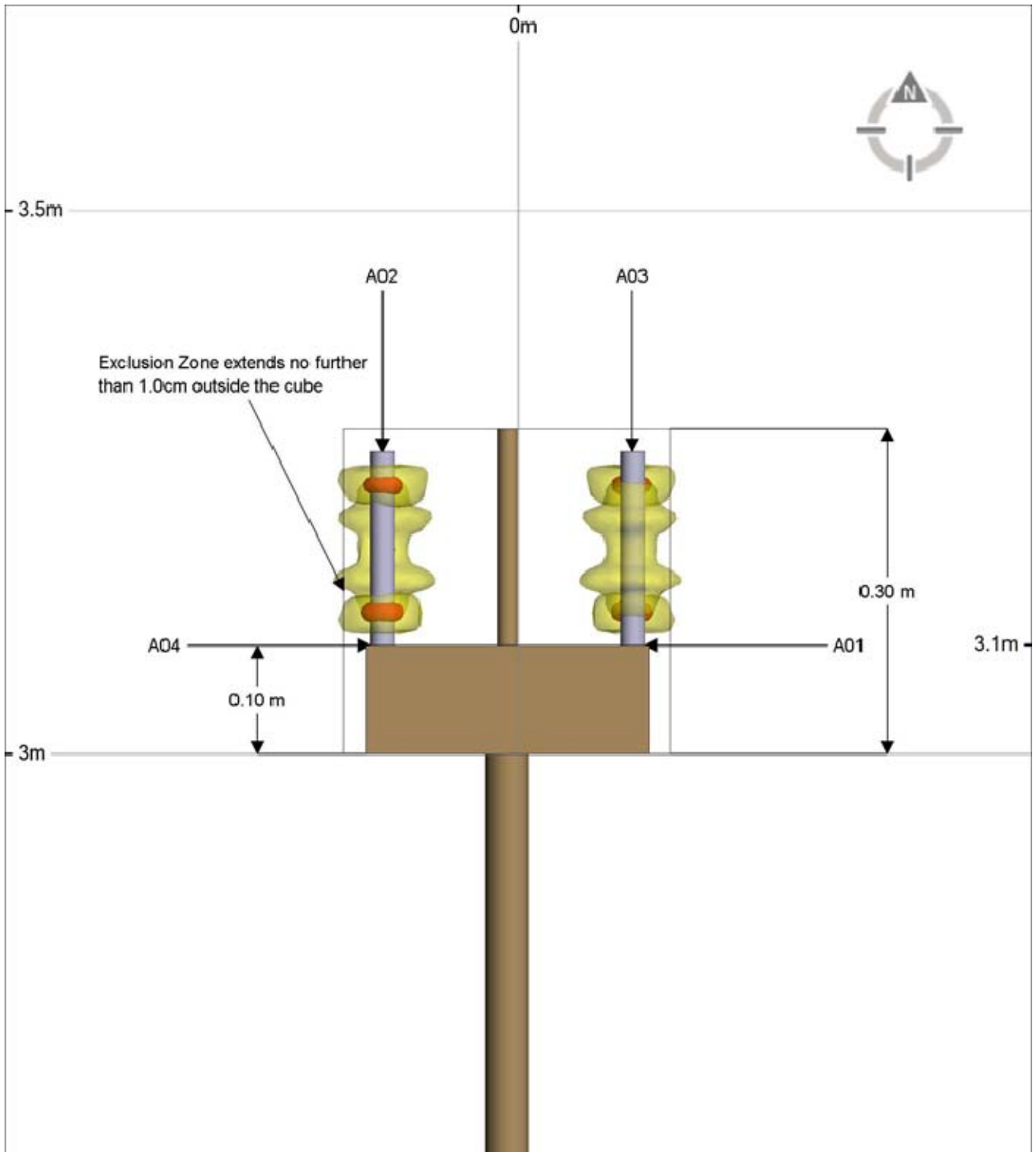
Wifi Base Cube – Design 2 - Perspective View



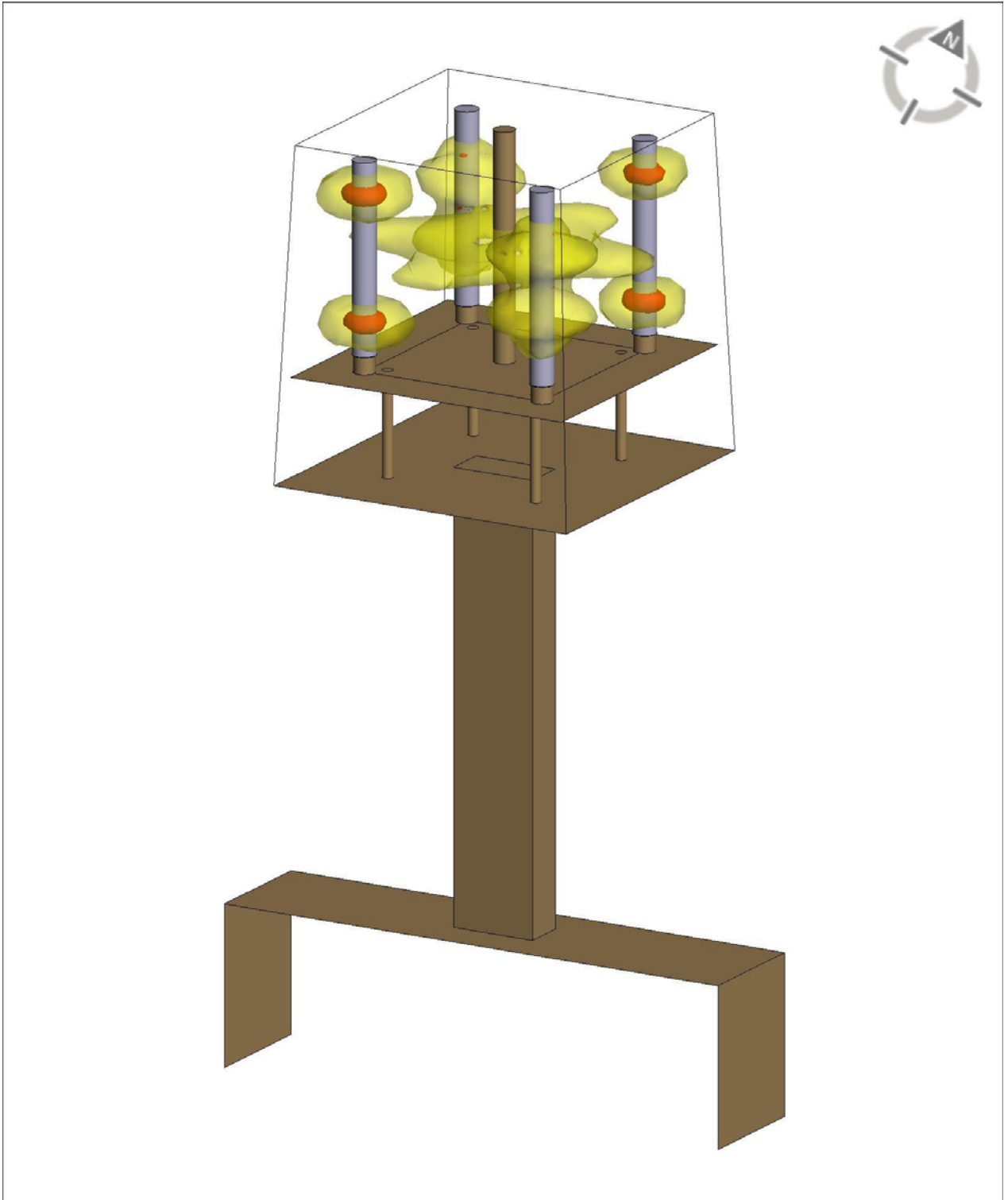
Wifi Base Cube – Design 2 - Plan View



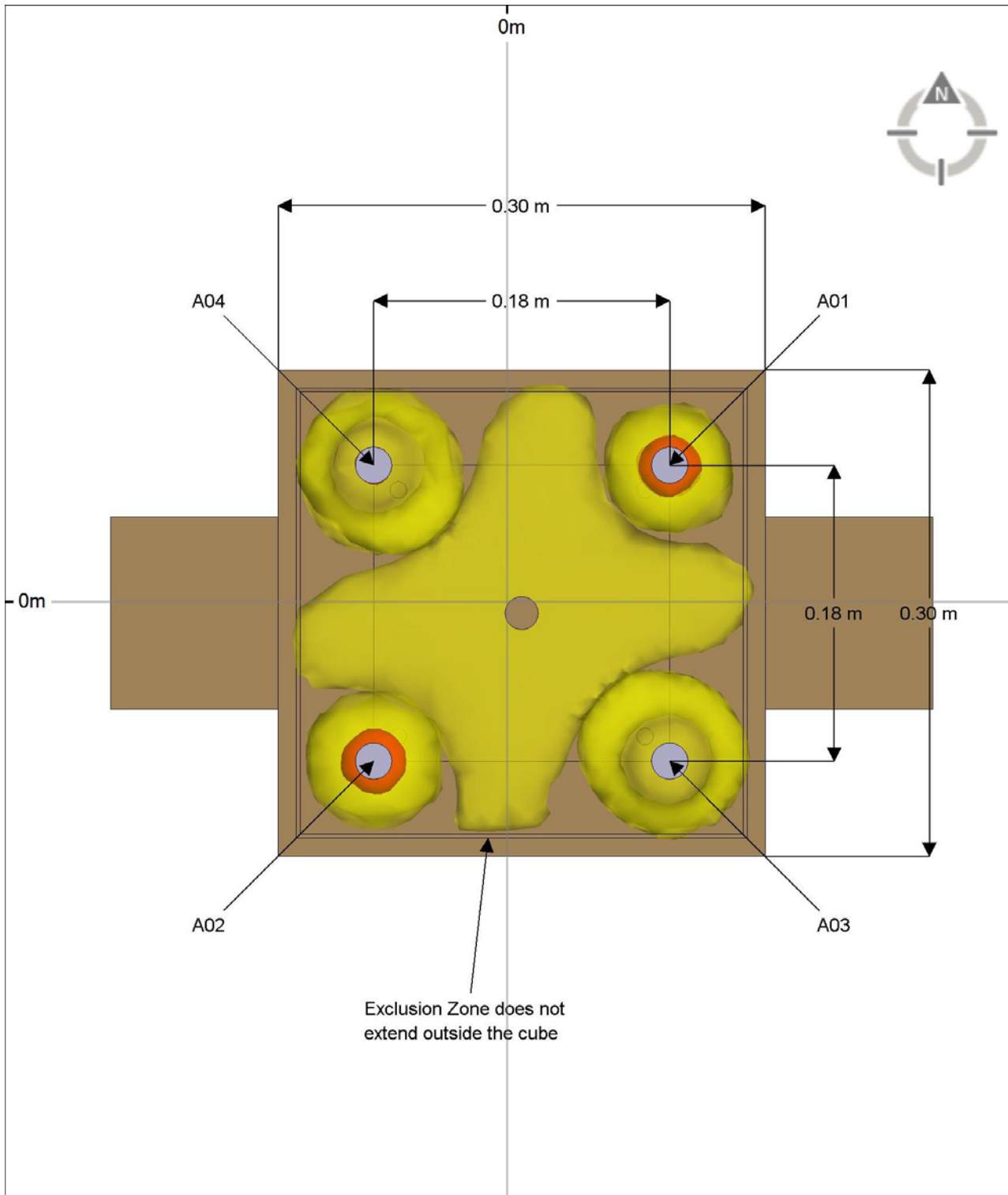
Wifi Base Cube – Design 2 - Elevation View



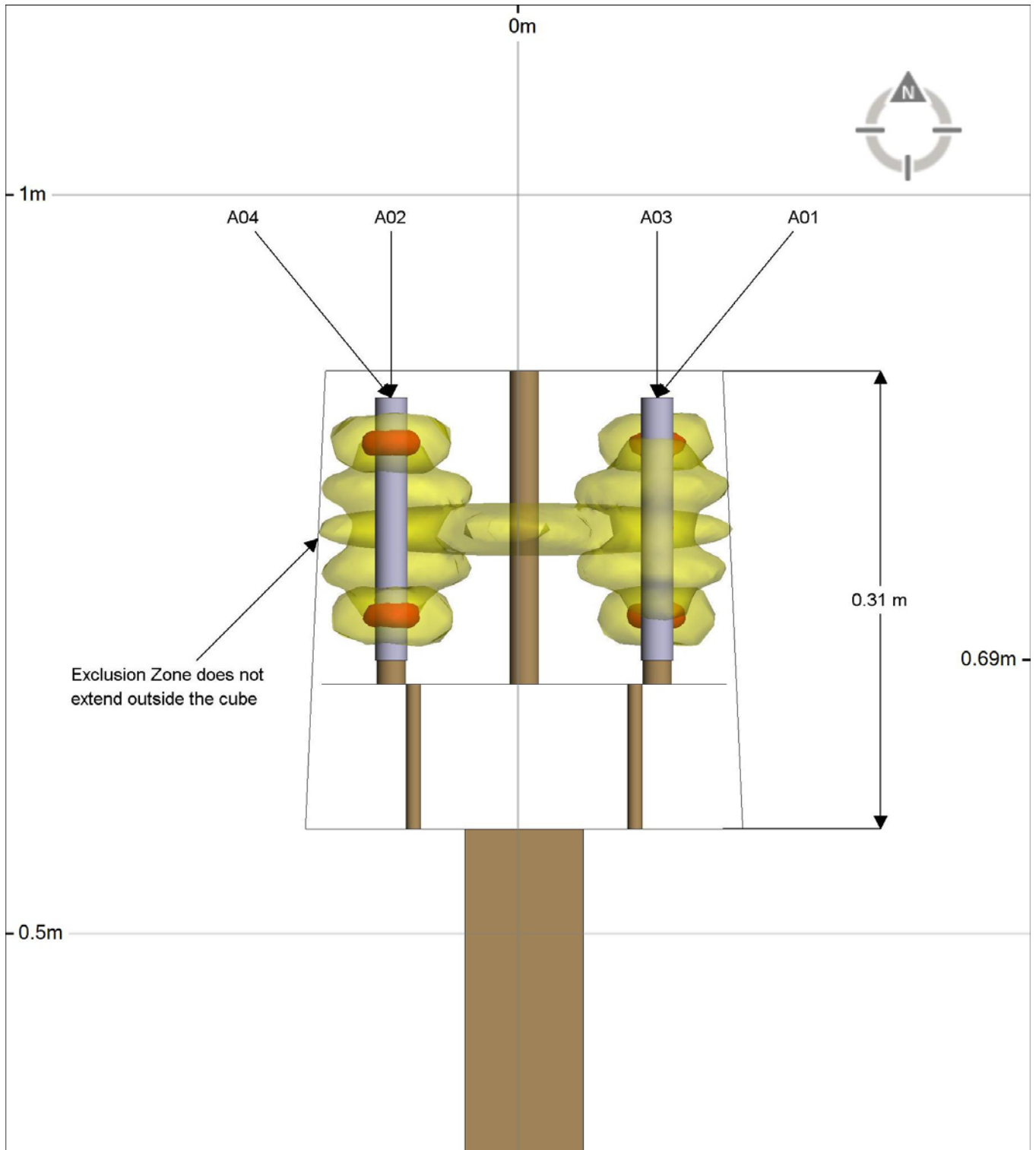
Wifi Base Cube – Design 3 - Perspective View



Wifi Base Cube – Design 3 - Plan View



Wifi Base Cube – Design 3 - Elevation View



APPENDIX B – References

ARPANSA (2002). Radiation Protection Standard - Maximum Exposure Levels to Radiofrequency Fields - 3 kHz to 300 GHz, Chief Executive Officer of ARPANSA.

AS/NZS (2011). Radiofrequency fields Part 2: Principles and methods of measurement and computation - 3 kHz to 300 GHz. AS/NZS 2772.2:2011. Australia, Standards Australia.