Scottish & Southern Electricity Networks

EMF-OHL-003

Transmission - Engineering

Electric & Magnetic Field Study Report

for

Beauly to Blackhillock to New Deer to Peterhead 400 kV Overhead Line Project

Revision	Overview of Amendment & Text Affected	Previous Document	Revision Author	Date
1.0	N/A	-	-	-
2.0	Administrative Changes	1	CT	18/09/25

	Name	Title
Author	[redacted]	OHL Engineer
Checked by	[redacted]	Assistant Engineering Manager
Approved by	[redacted]	Principal Engineer

Summary

This report summarises the assessments of Electric and Magnetic Fields (EMF) associated with the proposed Beauly Blackhillock New Deer Peterhead 400kV Overhead Line Project (the 'Proposed Development'), focusing on its compliance with the exposure limits in the UK's Code of Practice 'Power Lines: Demonstrating compliance with EMF public exposure guidelines (DECC: 2012)', validation process and assessment of the more complex arrangements. It is proposed to use an AAAC Araucaria conductor which will be a triple-bundled configuration per phase, the conductor will be supported by lattice steel tower structures which are of an AS4 design.

SSEN Transmission undertook a comprehensive assessment of the EMF levels using PLS CADD software for two levels of current, 3370A (Amperes) and 5000A, for both transposed (optimal) and untransposed phasing scenarios. PLS CADD is an internationally recognised software for overhead line design. To validate the results, an independent consultant, WSP, was engaged, and they used an alternative software package for the assessment, known as SES CDEGS. Both analyses produced consistent results, ensuring the accuracy and reliability of the findings.

The assessed EMF levels comply fully with the exposure limits set out in the UK's Code of Practice. These guidelines are based on internationally recognised limits and form the basis of the framework for EMF safety in the UK. The results confirm that EMF levels remain within the permissible thresholds, demonstrating the Proposed Development's compliance with the Code of Practice.

Table of Contents

1 Introduction

This document presents an assessment, results and compliance statement of the proposed Beauly to Blackhillock to New Deer to Peterhead 400 kV Overhead Line (OHL) Project (the 'Proposed Development') in terms of Electric and Magnetic Fields (EMF). This report is applicable to the new build OHL and the specific complex OHL arrangements detailed in Section 5 only.

1.1 Objective of EMF Study

The objective of this study is to assess the Electric and Magnetic Field (EMF) levels generated by the Proposed Development and to determine compliance with the UK's Code of Practice 'Power Lines: Demonstrating compliance with EMF public exposure guidelines (DECC: 2012)[1]. This report summarises the studies carried out on EMF levels from the proposed OHLs to demonstrate a compliant design. The design calculations were done using PLS CADD software with the results being independently validated by Consultants using SES CDGES software.

1.2 Project Background

Scottish and Southern Electricity Networks Transmission ("SSEN Transmission") is proposing to construct and operate approximately 158 kilometres (km) of new double circuit 400 kilovolts (kV) OHL between the proposed Fanellan and Greens 400 kV substations and 28 km of new double circuit 400 kV OHL between the proposed Greens and Netherton 400 kV substations.

The proposed 400 kV OHL will consist of steel lattice towers using a new tower series known as the ASTI SSE400 or AS4 for short. These towers are expected to average 57 m in height across the routes. The conductor system is proposed to be 3 x 700 mm^2 AAAC Araucaria (also referred to as triple bundle) with 500 mm bundle spacing. The circuit is designed to function up to 90°C while maintaining a minimum ground clearance of 9 m under normal conditions. Although it is capable of operating at to 90°C, it is not currently intended to be used at this maximum rating.

[1] Power Lines: Demonstrating compliance with EMF public exposure guidelines (DECC: 2012) https://assets.publishing.service.gov.uk/media/5a796799ed915d07d35b5397/1256-code-practice-emf-public-exp-guidelines.pdf accessed: 18 September 2025

2 Electric and Magnetic Field

2.1 Introduction to Electric and Magnetic Field Study

OHLs are used to carry high voltage electricity across long distances and are a source of electric and magnetic fields. There are long established concerns around the potential health effects of exposure of these fields. As a result, OHLs have been subject to a large body of scientific research and regulatory initiatives. A summary of the known potential impacts is provided in this section.

2.2 Electric Fields

Electric fields are found wherever there is electricity. Electric fields are created by the presence of electric charges and are measured in volts per meter (V/m). An electric field is associated with any device or wire that is connected to a source of electricity, even when a current is not flowing. Electric fields are easily shielded by common objects such as trees, fences, and walls. It has been determined there is no body of evidence indicating a relationship between exposure to electric fields and human disease. However, strong electric fields can lead to micro-shocks from poorly earthed objects and sensory impacts (reversible on removal from the field and temporary in duration). Therefore, it is necessary to understand and control the electric field strength.

2.3 Magnetic Fields

Magnetic fields are created by charges (electrons) moving in a conductor, such as a wire. The number of electrons moving through a conductor at any given time is called the current (measured in amperes). As the powerflow increases, so does the magnetic field. The magnetic field decreases as the distance from the source increases. Scientific studies have identified that there is a statistical association between magnetic fields and childhood leukaemia, however the evidence of the association has weakened in recent years. No biological mechanism has been found for this relationship and since this potential relationship was identified in the 1960's, subsequent studies have shown a steady decline in the potentially elevated risk. This is despite powerflows, and thus the magnetic field strength from OHLs, increasing over the same period. There is insufficient evidence of magnetic fields being linked to other diseases or cancers. As the statistical association with childhood leukaemia remains, it is acknowledged as a potential impact and thus it is considered necessary to control the magnetic field strength to reduce the potential risk.

2.4 EMF Exposure limits

To ensure the safety of the public due to EMF emissions from OHLs, the UK Government issued, following consultation, a Code of Practice for the industry 'Power Lines: Demonstrating compliance with EMF public exposure guidelines' issued via the Department of Energy & Climate Change in 2011 and updated in 2012. This was based on levels set by 1998 guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). These levels are set to minimise any health risk posed by the OHL. Additionally, whilst being low risk, the statistical association with childhood leukaemia was recognised and the UK Government further introduced a precautionary measure requiring optimal phasing, where reasonably possible, in the Cc

The Code of Practice sets the maximum levels for long term public exposure as 360 µT for magnetic fields and 9 kV/m for electric fields. Long term exposure relates to places of residence or similar where people regularly

spend extended periods of time. The SSEN Transmission OHL design standard TG-NET-OHL-506 Rev 2.0 defines the exposure limits in accordance with the Code of Practice.

The following characteristics are defined by TG-NET-OHL-506 Rev 2.0 for calculation of the EMF fields from OHLs:

- Fields shall be measured directly below the line.
- Fields shall be calculated with maximum continuous current and voltage.
- The conductors shall be modelled at the design minimum clearance.
- Double circuit vertical transmission lines shall have optimum phase arrangement to reduce imbalance EMF and induced ground currents.

The UK Government have reconfirmed the principles and limits set out in the Code of Practice with their latest policy on EMF. National Policy Statement EN-5[2], (NPS EN-5) which was reissued in November 2023 and came into force on 17 January 2024. This policy confirmed the current UK Government guidance, informed by relevant international guidance, is therefore still considered appropriate.

[2] National Policy Statement EN-5
https://assets.publishing.service.gov.uk/media/65a78a5496a5ec000d731abb/nps-electricity-networks-infrastructure-en5.pdf accessed: 18 September 2025

3 EMF Calculations

This section summarises the SSEN Transmission calculations of EMF for the proposed OHLs.

3.1 Line Modelling Parameters

The Proposed Development is being designed with a triple bundled AAAC Araucaria conductor per phase on AS4 Towers (a modified version of the SSE400). The phase configurations are considered as optimal phasing i.e. a fully transposed phase arrangement.

The following conductor system design is proposed as shown in Table 3.1 below.

Table 3.1 – Conductor System

Conductor	Construction	Diameter (mm)	Resistivity (nΩm)	No. of Sub conductors	Bundle Distance (mm)	Max. Operating Temperature (°C)
Araucaria	AAAC 700mm^2	37.26	30.5	3	500	90

Two power flow scenarios were considered:

1. Intended maximum power flow; 3370 Amps (winter pre-fault continuous based on a summer pre-fault continuous power flow of 2090MVA),
2. Maximum possible power flow; 5000A (maximum winter pre-fault continuous considering substation limitations)

It should be noted that although analysis has been carried out up to a maximum current of 5000A, the OHL is only intended to operate up to 3370A but the full capability has been considered to be conservative.

The proposed structure design for the OHL is the AS4 series of lattice steel towers, specifically designed for the Proposed Development. The proposed tower outline drawing for the standard suspension tower (AS4-AD) is attached in Appendix-A.

3.2 Design Calculations

The EMF calculations were performed in-house by SSEN Transmission's Onshore Capital Delivery Project Engineering team using PLS-CADD Software, an internationally recognised tool by the transmission industry. The OHL was modelled on the basis of the parameters defined in Section 3.1 of this report. The calculations were performed for both transposed and untransposed (for reference only) phase arrangement and calculated at middle of the span where the conductor is nearest to the ground level; the worst-case scenario. These calculations were made for a range of different ground clearance options to determine the minimum ground clearance needed to ensure compliance with the Code of Practice. The smallest, minimum ground clearance which was found to be compliant is shown in green for each of the following scenarios:

- Transposed: Maximum possible power flow;

- Transposed: Required maximum power flow;
- Untransposed: Maximum possible power flow; and
- Untransposed: Required maximum power flow.

The below tables summarise the EMF level for the range of heights checked. The EMF reports, generated by the PLS-CADD software, used to populate these tables are enclosed in Appendix-B. Where cells are highlighted red, this indicates the value exceeds the exposure limits set by the Code of Practice. Where cells are highlighted green, this indicates the value is less than the exposure limits.

Table 3.2 - Transposed Phase Arrangement

Current: 5000 A			Current: 3370 A		
TRANSPOSED (RYB-BYR)					
Clearance (m)	**Electric Field (kV/m)**	**Magnetic Field (uT)**	**Clearance (m)**	**Electric Field (kV/m)**	**Magnetic Field (uT)**
7.3	11.20	111.20	**7.3**	11.20	74.90
7.6	10.6	108.30	7.6	10.60	72.96
8.0	9.86	104.36	8.0	9.86	70.34
8.5	9.05	96.47	8.5	9.05	65.02
8.7	8.63	93.12	**8.7**	8.63	62.76
9.0	8.30	89.36	9.0	8.30	60.22
9.5	7.54	83.24	9.5	7.54	44.65

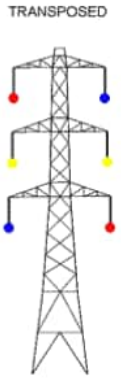
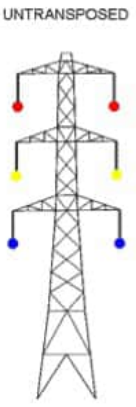


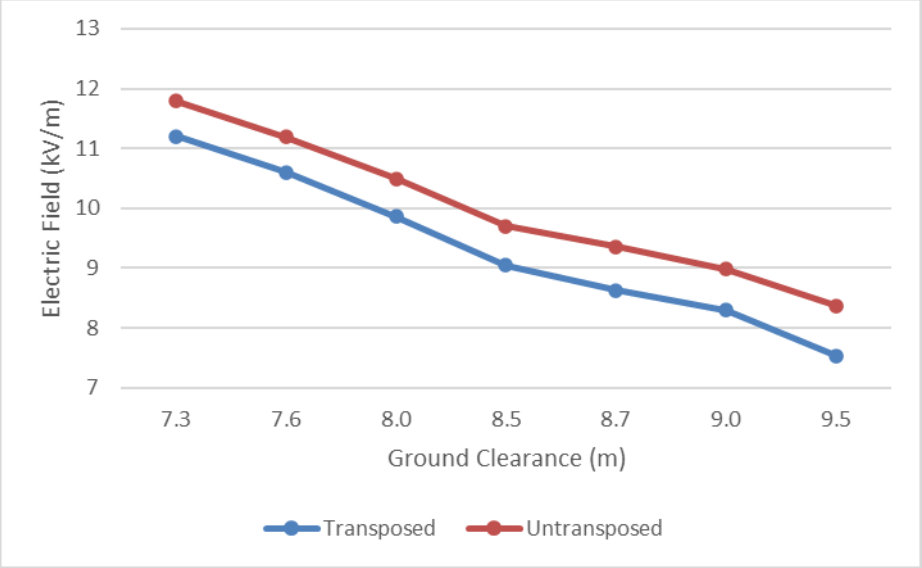
Table 3.3 - Un-Transposed Phase Arrangement

Current: 5000 A			Current: 3370 A		
UNTRANSPOSED (RYB-RYB)					
Clearance (m)	**Electric Field (kV/m)**	**Magnetic Field (uT)**	**Clearance (m)**	**Electric Field (kV/m)**	**Magnetic Field (uT)**
7.3	11.79	92.50	**7.3**	11.79	67.80
7.6	11.19	91.66	7.6	11.19	64.90
8.0	10.49	90.55	8.0	10.50	61.03
8.5	9.70	83.91	8.5	9.70	56.56
8.7	9.36	81.11	8.7	9.36	54.67
9.0	8.98	77.90	**9.0**	8.98	52.51
9.5	8.37	72.85	9.5	8.37	49.10



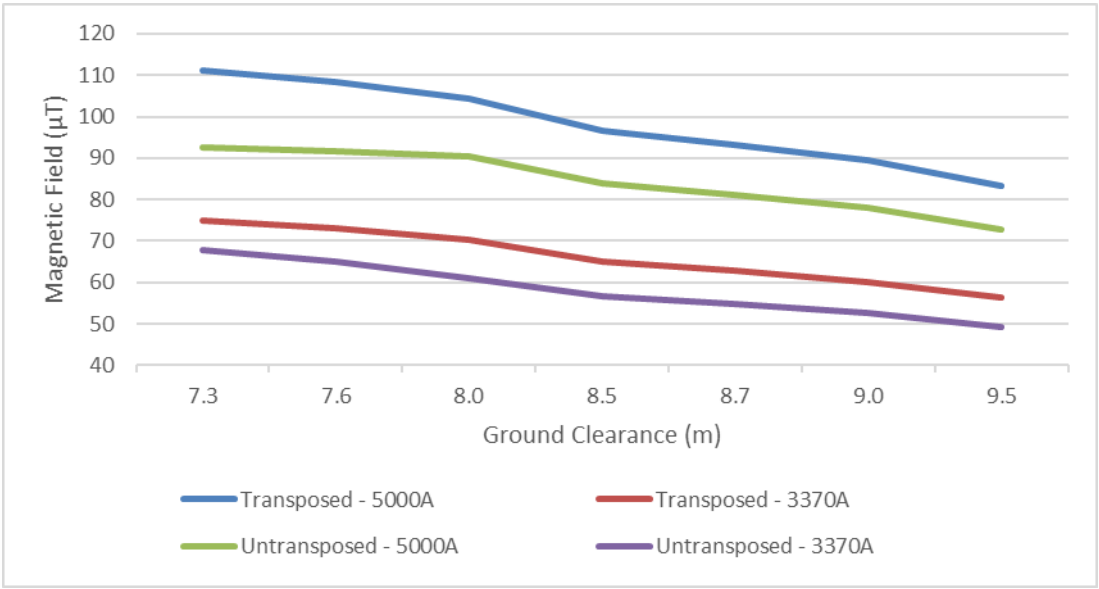
The calculated values for the electric field at the minimum statutory ground clearance (7.3m) are 11.20 kV/m and 11.79 kV/m for the transposed and untransposed scenarios respectively. These values are not within the acceptable limits (i.e. 9 kV/m). The acceptable electric field exposure levels are not achieved until a ground clearance of 8.7 m and 9.0 m is achieved for the transposed and untransposed scenarios respectively. The following figure shows a graphical representation of the electric field in transposed and untransposed phasing scenarios.

Figure 3.1 - Electric Field Arrangement



The calculated value for the magnetic field varies with the increase in the current/load. However, the statutory limit for the magnetic field is 360 uT which is achieved at the 7.3 m ground clearance for all scenarios. The following figure shows the graphical representation of the magnetic field at transposed and untransposed phasing scenarios and with two different power flows:

Figure 3.2 - Magnetic Field Arrangements



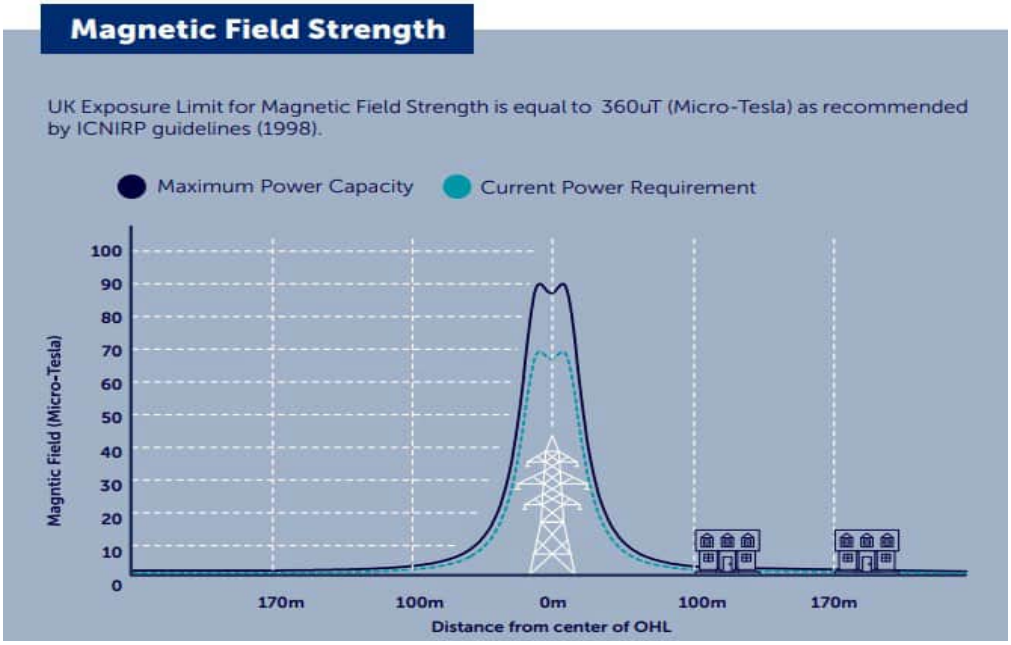
It was concluded from the above tables that the minimum compliant clearance to ground, 8.7 m-9.0 m, was relatively consistent for the four scenarios considered, including the conservative untransposed values. The overall tower height would not change whether an 8.7 m or 9.0 m clearance to ground was adopted. As such,

there would be no change to the landscape & visual, or other environmental impacts and therefore the more conservative value of 9.0 m clearance was adopted.

3.3 Summary of Assessment and Further Precautions

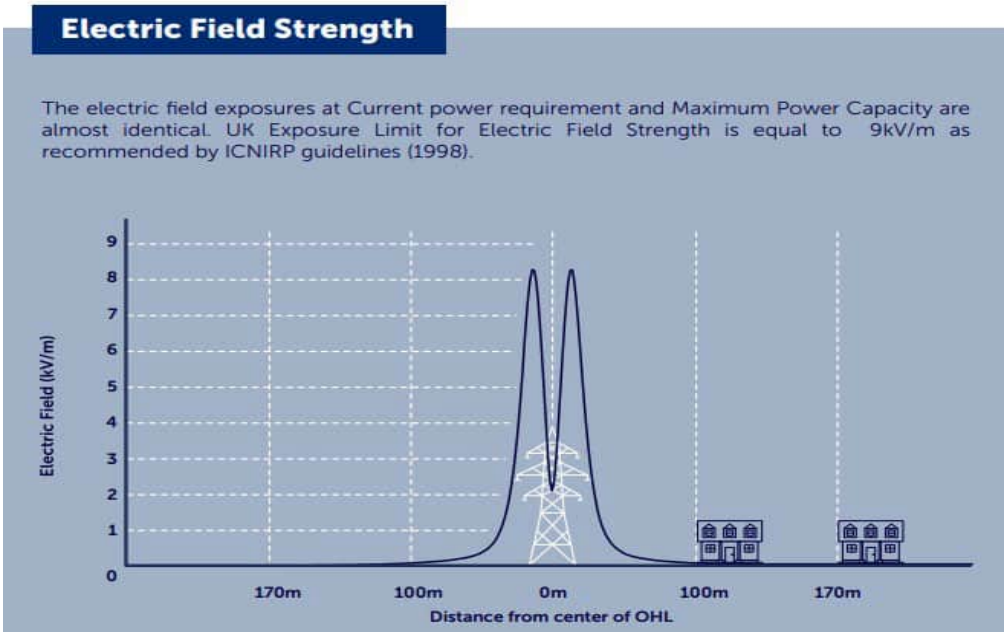
The assessment of electric and magnetic field levels for the Proposed Development confirms that with a minimum ground clearance of 9.0 m, all calculated values are within the statutory exposure limits. It should be noted that these values are for a 1 m height above ground, directly beneath the line and assume long term exposure that would be typical for a residence or similar. The routeing of the Proposed Development has avoided the oversail of residential (or similar) properties and looked to site the OHL away from the properties. Whilst this is not necessary under the Code of Practice, nor was the EMF levels the sole factor in these routing decisions, in practice this substantially reduces the EMF exposure levels compared to the values given in this report. This is illustrated in Figures 3.3 and 3.4, taken from the SSEN Transmission, Pathway to 2030 Projects EMF leaflet.[3]

Figure 3.3 - Magnetic Field Strength as per Pathway to 2030 Projects EMF leaflet



[3] SSEN Transmission, 'Electric and Magnetic Field's (EMF's)', https://www.ssen-transmission.co.uk/globalassets/projects/2030-projects/2030-project-documents/emf.pdf accessed: 24 August 2025

Figure 3.4 - Electric Field Strength as per Pathway to 2030 EMF leaflet



4 Validation of EMF Result

SSEN Transmission commissioned the consultancy group WSP to provide an independent validation of the EMF levels generated by the proposed OHL. WSP utilised another industry standard tool, SES CDEGS software, for this work. The EMF reports generated by WSP by using CDEGS software are enclosed in Appendix-C. The results from WSP's analysis were consistent with those calculated in Section 3, see Table 4.1, and confirmed that the EMF levels are well within the acceptable exposure limits set by the Code of Practice.

Table 4.1 - Comparison of WSP and SSEN-T EMF analysis

Power flow/ Current (3x Araucaria on AS4)	Clearance	Magnetic Field (under the line at mid span)		Electric Field (under the line at mid span)	
		SSEN Transmission (PLS-CADD)	WSP (CDEGS)	SSEN Transmission (PLS-CADD)	WSP (CDEGS)
5000 A	9.00 M	89.3 µT	92 µT	8.3 kV/m	7.9 kV/m
3370 A	9.00 M	60.2 µT	62 µT	8.3 kV/m	7.9 kV/m

5 Complex OHL Arrangements

5.1 Cumulative Assessment

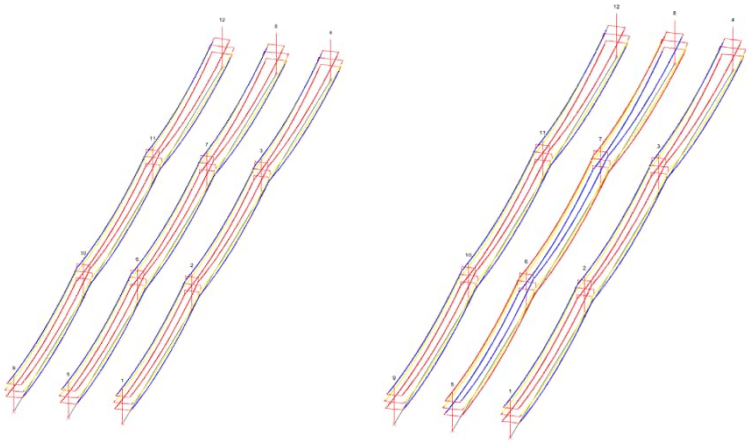
Where OHLs come into close proximity to each other, their electric and magnetic fields can interact with one another and therefore a cumulative assessment is required to demonstrate compliance. Due to the fact that electric and magnetic fields are vector quantities and have both magnitude and direction, the way in which they combine is complex and the values cannot simply be added together. Although combining the EMFs from different sources is complex, generally when the field from one source is larger than the other, the larger field dominates, with the smaller field making a minor impact to the overall field. This is why at substations the largest fields typically come from the OHLs entering the substation and the impact of the plant within the substation itself is considered to have minimal impact to the overall fields.

To demonstrate compliance, a conservative assessment has been carried out within PLS-CADD considering three 400 kV OHLs, in parallel, all operating at 5000 A using the parameters from Section 3 of this report. The three OHLs have been spaced at 72 m centre to centre which has been selected based on an 18 m substation bay spacing and is considered to be the closest the OHLs will operate at this voltage on approach to a substation.

The exact field that is produced by the OHLs in parallel depends on specifics of relative phasing and loads, however this assessment considers a number of scenarios that are considered to be representative of the cumulative effect.

Two phasing scenarios have been modelled. The first scenario (Case 1) considers all OHLs being optimally phased and the circuits between adjacent OHLs also being optimally phased. This is an ideal scenario as when circuits have optimal phasing the electric and magnetic fields can partially cancel each other out, reducing the resultant fields. However, while the Proposed Development is to be optimally phased, the phasing of future developments is not yet confirmed, therefore a precautionary assessment was undertaken. For the precautionary assessment, a second case (Case 2) was considered where the three individual OHLs were still optimally phased, but the circuits between the adjacent OHLs were not optimally phased. This second arrangement has the potential to increase the magnitude of the resultant fields. Figure 5.1 below depicts the two cases described above.

Figure 5.1 - Case 1 on left, Case 2 on right



The maximum fields for each scenario are presented in Table 5.1 below. The full PLS-CADD report can be seen in Appendix-D. Figures 5.2 and 5.3 show the two cases for both the cumulative electric field and magnetic field extracted from the PLS Report.

Table 5.1 - Summary of Electric and Magnetic Field Values for Cumulative Assessment

Cumulative Assessment Case	Maximum Magnetic Field (µT)	Maximum Electric Field (kV/m)
Case 1 – Optimal phasing of adjacent circuits	92.71	8.69
Case 2 – Non-Optimal phasing of adjacent circuits	94.71	8.67

Figure 5.2 - Cumulative Electric Field Results

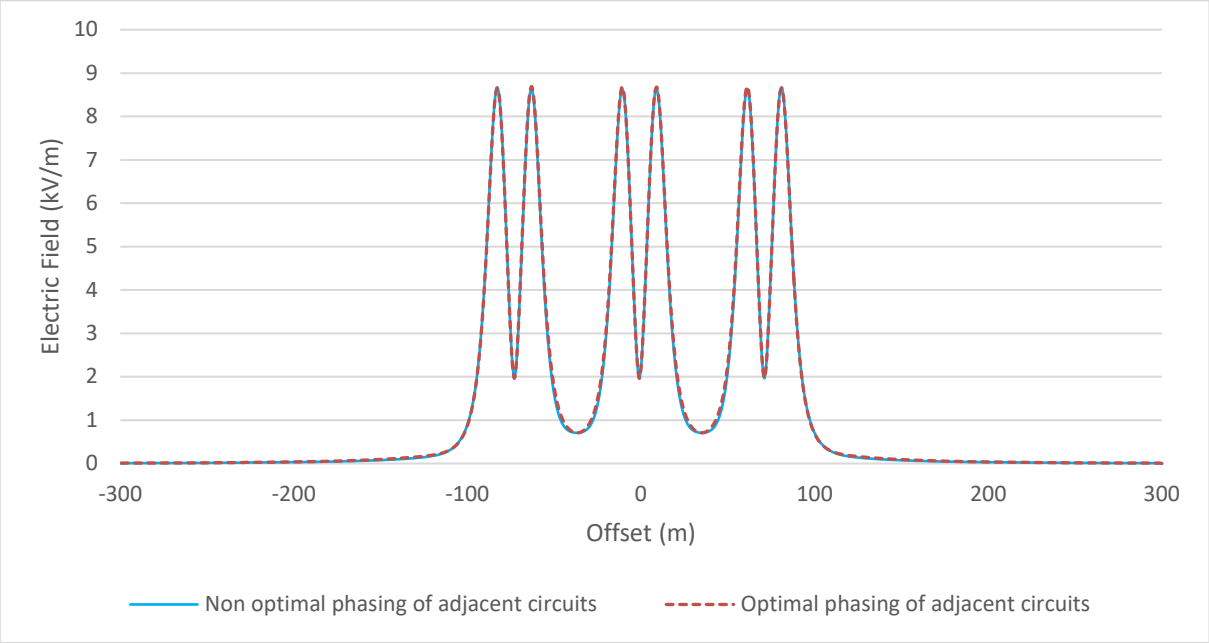
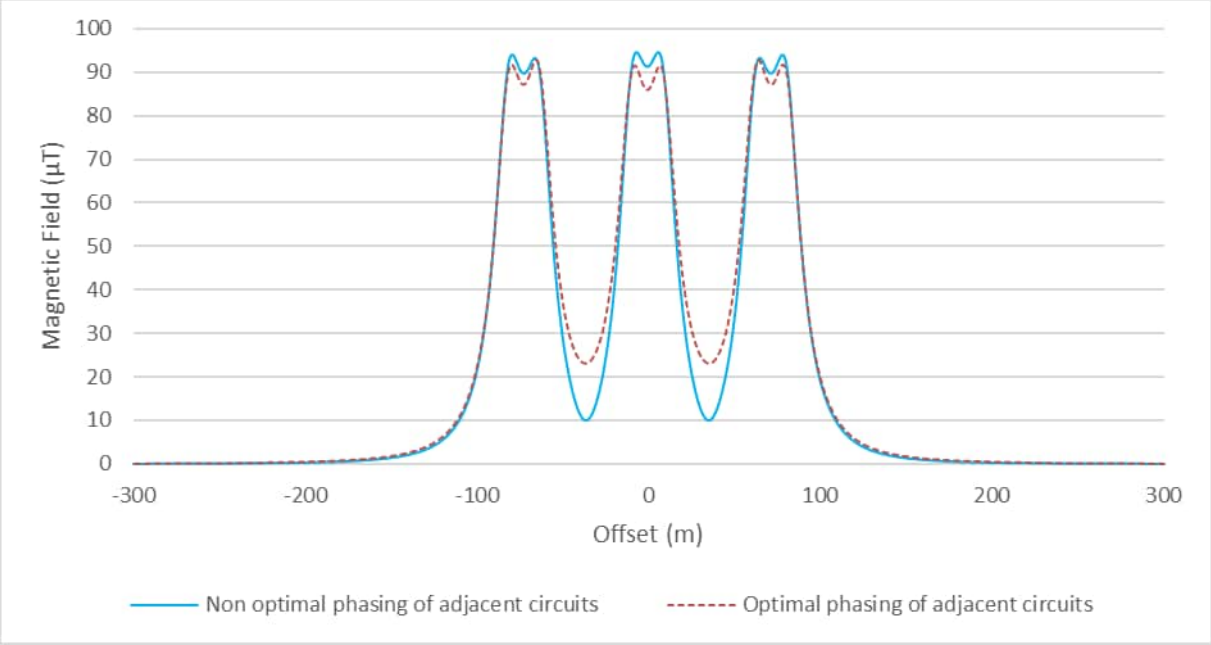


Figure 5.3 - Cumulative Magnetic Field Results



As stated above, this analysis depends on numerous factors such as phasing and load, however the cases carried out demonstrate the mechanisms in which fields combine and are considered representative for the Proposed Development. This assessment demonstrates that the combined impact of electric and magnetic fields from parallel OHLs does not affect the assessment of compliance for the proposed new OHL, with the maximum fields remaining within the acceptable exposure limits set by the Code of Practice.

5.2 Complex Crossings

Across the Proposed Development there are certain complex OHL arrangements that required further detailed analysis. These arrangements are a result of the proposed 400 kV OHL crossing an existing OHL. Where these crossings occur, the electric and magnetic fields of the respective OHLs can interact with one another and therefore the combined effects must be considered.

This analysis cannot be carried out in the same method as discussed in the previous sections and requires specialist software, SES CDEGS, due to the complexity of these crossings involving multiple circuits directly crossing each other. This type of analysis is best suited to the specialist software to accurately model the resultant electric and magnetic fields. A specialist consultant, Arcadis Consulting (UK) Limited, was commissioned to carry out this detailed analysis and the full study is included within Appendix-E of this report.

An overview of the results for the proposed crossing is provided within Table 5.2 below.

Table 5.2 - Summary of Electric and Magnetic Field Values for Complex Arrangements

Description of Crossing	Maximum Magnetic Field (µT)	Maximum Electric Field (kV/m)
OHL Crossing 1	60.16	6.98
OHL Crossing 2	65.97	7.44
OHL Crossing 3	46.99	4.11
OHL Crossing 4	34.03	3.70
OHL Crossing 5	78.42	9.52
OHL Crossing 6	78.89	7.50

Based on the results in Table 5.2 it can be observed that all complex arrangements except for OHL Crossing 5 remain below the UK public exposure limits. OHL Crossing 5 exceeds the UK public exposure limit for electric field which is 9 kV/m with a maximum value of 9.52 kV/m. Although this crossing exceeds this limit, it does however still comply with the EMF public exposure guidelines, as the location in which this crossing occurs is not deemed to be an area where members of the public spend significant time. As exposure can be deemed not to be for a significant period of time, the ICNIRP occupational guidelines apply in which this crossing remains in compliance with.

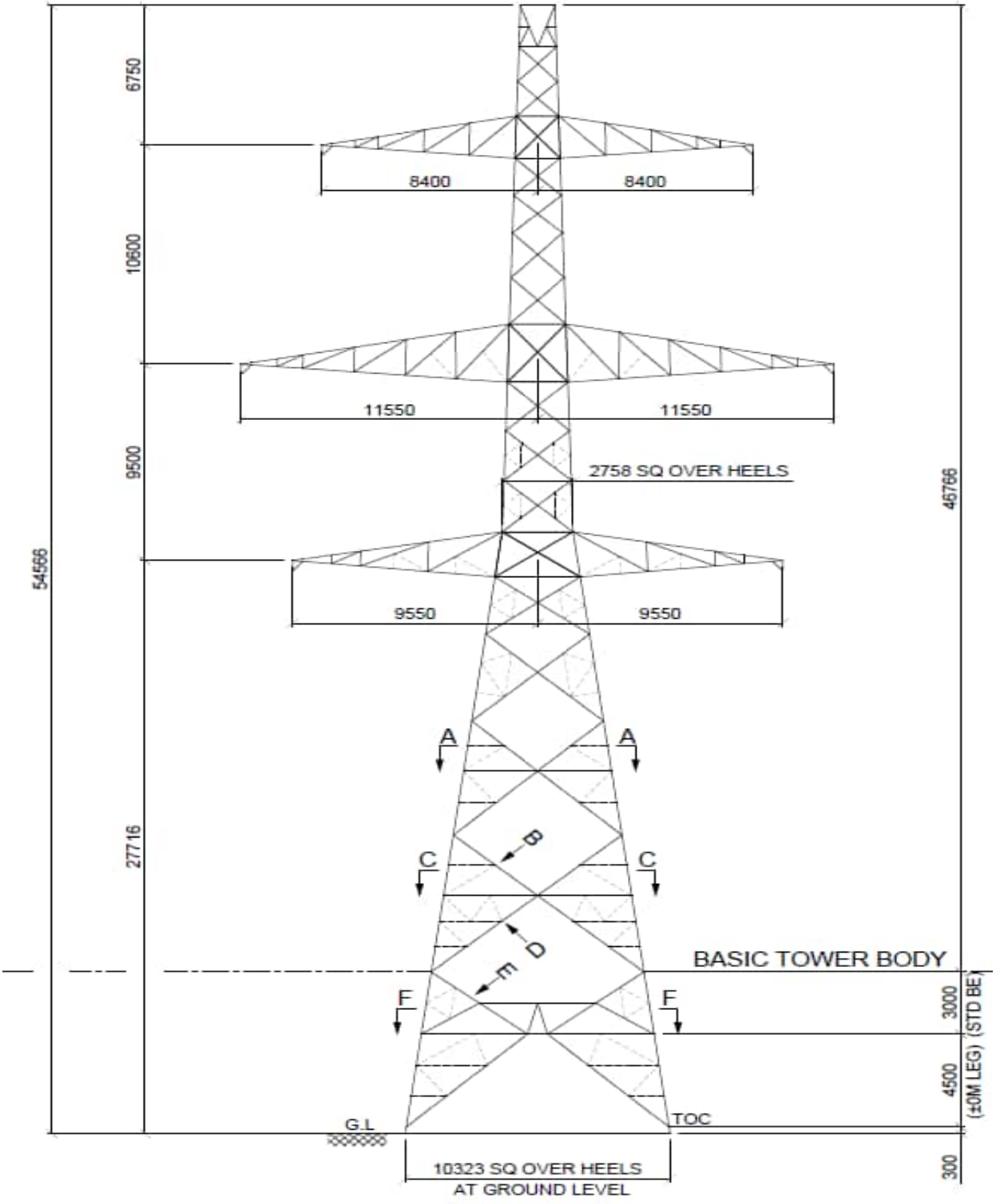
It should be noted that this analysis is considered conservative and further work shall be progressed within the detailed design stage to further reduce the electric field magnitude at this crossing as low as reasonably practicable however the current proposal remains compliant with the Code of Practice.

The full details of this analysis can be seen in Appendix-E.

6 Conclusion

In conclusion, as demonstrated by this report and its supporting documents, the Proposed Development is compliant with the industry's current Code of Practice 'Power Lines: Demonstrating compliance with EMF public exposure guidelines' developed by the Department of Energy & Climate Change.

Appendix A Tower Geometry



Appendix B PLS CADD Electric and Magnetic Field Calculations

TRIPLE Araucaria (7.6m ground clearance)

```
PLS-CADD Version 18.00x64    11:51:13 AM 06 July 2023
Scottish and Southern Energy
Project Name: 'C:\Users\AM25305\Desktop\CSR ASTI-\PLS Model ASTI\profile 637.don'

Criteria Notes:
  Design criteria developed for SSE Beauly Blackhillock Line reconductoring
  Global wind notes: wind directions are annotated NNW-330, E-90, etc as `wind from` - angles in GLB wind are `wind to` or wind azumuth
  delete - survey and maps confirm angle as per XYZ 19/08/08.Terrain 289: angle has been corrected in pfl. CHECK xyz
  delete?20/08/08.PFL 180 and 181 points edited
  tower 229 is a D10 with extended crossarms. It should be modeled???Erection loads??CHECK.

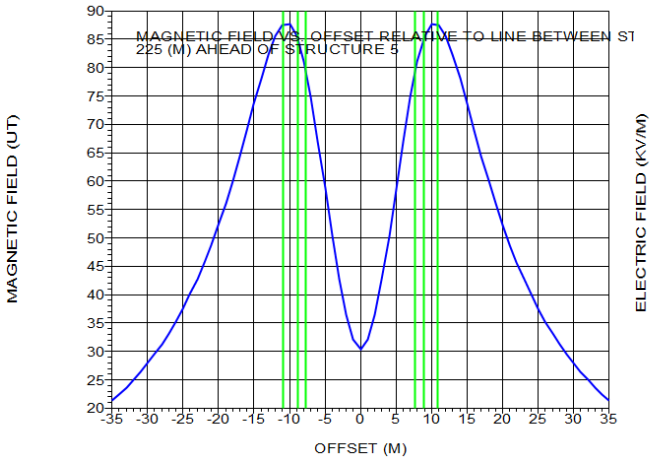

3D EMF Calculation Notes:
  1) Calculations based on the EPRI Red Book methods (3rd Edition, 2005 - 7.4 Calculation of Magnetic Fields and Appendices 7.1 Calculation
of Field Ellipse Parameters and 7.6 Electric Field Calculations for 3D Geometry).
  2) All wire positions are modeled at the specified weather case and wind direction. Height above ground determined by the modeled ground
TIN.
  3) Only the effects of wires are being analyzed. The effects of structures are not included unless enabled as noted below.
  4) Ground return is being ignored for magnetic field calculations.

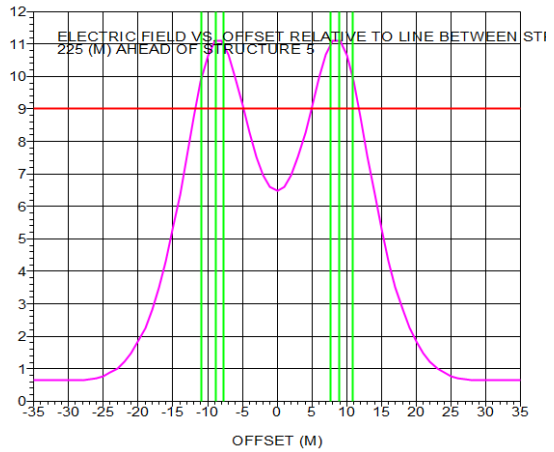

Meter height above ground:                  1.00 (m)
Maximum wire distance:                    150.00 (m)
Maximum cable segment size:                 3.00 (m)
Cross section offset +/-:                  35.00 (m)
Result interval:                            1.00 (m)
Electric field limit:                       9.00 (kV/m)
Magnetic field limit:                     360.00 (uT)
Space potential limit:                      0.00 (kV)
Contour Map Spacing:                           3 (m)
Analyzing spans between these structures:  1 - 6

One or more sections have wind from both directions which is not supported. A wind direction of left is being used for those sections.

Section Data for 3D EMF Results:
```

Section Number	Section Note	Voltage Ph-Ph (kV)	Current (Amps)	Cable Filename	Cable Description	Conductors Per Phase	Bundle Diameter (cm)	Cable Radius (cm)	Weather Case	Condition	Wind Dir.	WC Temperature (deg C)	Effective Radius (cm)
1		400.0	4570.0	araucaria lumpi - 30.5.wir 700mm² AAAC - Araucaria		3	57.735	1.863	90°C	Creep RS	Left	90.000	16.700
2		400.0	4570.0	araucaria lumpi - 30.5.wir 700mm² AAAC - Araucaria		3	57.735	1.863	90°C	Creep RS	Left	90.000	16.700





TRIPLE Araucaria (7.6m ground clearance)

3D EMF Point Results Span from 5 to 6:

Measurement			B					H	EF					Space Potential			
X (m)	Y (m)	Z (m)	Real (uT)	Imaginary (uT)	Angle (deg)	Magnitude (uT)	Polarization Axial Ratio %	Magnitude (A/m)	Real (kV/m)	Imaginary (kV/m)	Angle (deg)	Magnitude (kV/m)	Polarization Axial Ratio %	Real (kV)	Imaginary (kV)	Angle (deg)	Magnitude (kV)
275807.9	3098063.4	1.9	17.279	12.506	35.9	21.330	20.2	16.974	0.273	0.582	64.8	0.643	6.0	0.269	0.581	65.1	0.640
275808.2	3098064.4	1.9	18.101	13.284	36.3	22.452	20.4	17.867	0.238	0.599	68.3	0.645	6.9	0.232	0.599	68.8	0.642
275808.5	3098065.3	1.9	18.975	14.132	36.7	23.659	20.7	18.827	0.197	0.616	72.3	0.646	7.9	0.188	0.615	73.0	0.643
275808.8	3098066.3	1.9	19.906	15.057	37.1	24.960	21.0	19.862	0.151	0.629	76.5	0.647	9.1	0.136	0.628	77.8	0.643
275809.1	3098067.2	1.9	20.898	16.069	37.6	26.362	21.2	20.978	0.103	0.640	80.8	0.648	10.5	0.075	0.638	83.3	0.642
275809.4	3098068.2	1.9	21.955	17.178	38.0	27.877	21.4	22.184	0.079	0.645	83.0	0.650	12.2	0.003	0.642	89.7	0.642
275809.7	3098069.1	1.9	23.083	18.393	38.5	29.515	21.5	23.487	0.119	0.643	79.5	0.654	14.2	-0.081	0.640	-82.8	0.645
275810.1	3098070.1	1.9	24.286	19.729	39.1	31.290	21.7	24.899	0.203	0.633	72.2	0.665	16.4	-0.178	0.628	-74.2	0.653
275810.4	3098071.0	1.9	25.571	21.197	39.7	33.214	21.7	26.431	0.311	0.610	63.0	0.685	18.6	-0.291	0.604	-64.3	0.671
275810.7	3098072.0	1.9	26.943	22.814	40.3	35.304	21.7	28.094	0.440	0.573	52.5	0.722	20.5	-0.422	0.564	-53.2	0.704
275811.0	3098072.9	1.9	28.409	24.595	40.9	37.576	21.6	29.902	0.590	0.517	41.2	0.784	21.6	-0.574	0.502	-41.2	0.762
275811.3	3098073.9	1.9	29.978	26.557	41.5	40.049	21.4	31.870	0.763	0.438	29.8	0.880	21.5	-0.748	0.413	-28.9	0.854
275811.6	3098074.8	1.9	31.655	28.718	42.2	42.741	21.2	34.012	0.964	0.338	19.3	1.021	20.4	-0.948	0.290	-17.0	0.991
275811.9	3098075.8	1.9	33.450	31.098	42.9	45.673	20.8	36.345	1.193	0.242	11.4	1.218	18.5	-1.177	0.122	-5.9	1.183
275812.3	3098076.7	1.9	35.371	33.712	43.6	48.863	20.2	38.884	1.456	0.272	10.6	1.482	16.3	-1.439	-0.102	4.0	1.443
275812.6	3098077.7	1.9	37.425	36.574	44.3	52.329	19.6	41.642	1.757	0.500	15.9	1.827	14.2	-1.739	-0.394	12.8	1.783
275812.9	3098078.6	1.9	39.617	39.693	45.1	56.081	18.7	44.628	2.099	0.857	22.2	2.267	12.3	-2.079	-0.770	20.3	2.217
275813.2	3098079.6	1.9	41.947	43.066	45.8	60.119	17.7	47.841	2.486	1.328	28.1	2.819	10.6	-2.464	-1.246	26.8	2.761
275813.5	3098080.5	1.9	44.408	46.673	46.4	64.424	16.6	51.267	2.923	1.923	33.3	3.498	9.1	-2.897	-1.837	32.4	3.430
275813.8	3098081.5	1.9	46.972	50.461	47.1	68.940	15.3	54.861	3.409	2.650	37.9	4.318	7.8	-3.378	-2.557	37.1	4.237
275814.1	3098082.4	1.9	49.585	54.336	47.6	73.560	13.8	58.537	3.944	3.514	41.7	5.282	6.6	-3.906	-3.407	41.1	5.183
275814.5	3098083.4	1.9	52.147	58.133	48.1	78.095	12.2	62.146	4.516	4.502	44.9	6.377	5.5	-4.469	-4.377	44.4	6.256
275814.8	3098084.3	1.9	54.492	61.603	48.5	82.246	10.5	65.449	5.106	5.576	47.5	7.560	4.6	-5.047	-5.429	47.1	7.412
275815.1	3098085.3	1.9	56.380	64.393	48.8	85.587	8.7	68.108	5.675	6.664	49.6	8.753	3.7	-5.602	-6.490	49.2	8.573
275815.4	3098086.2	1.9	57.501	66.075	49.0	87.591	6.9	69.703	6.173	7.655	51.1	9.834	3.0	-6.084	-7.455	50.8	9.623
275815.7	3098087.2	1.9	57.534	66.217	49.0	87.720	4.9	69.806	6.537	8.417	52.2	10.657	2.4	-6.436	-8.199	51.9	10.424
275816.0	3098088.1	1.9	56.246	64.522	48.9	85.596	3.0	68.115	6.713	8.834	52.8	11.095	2.0	-6.609	-8.612	52.5	10.855
275816.3	3098089.1	1.9	53.598	60.960	48.7	81.172	1.0	64.594	6.679	8.848	53.0	11.086	1.8	-6.582	-8.641	52.7	10.862
275816.7	3098090.0	1.9	49.784	55.810	48.3	74.788	1.0	59.514	6.456	8.492	52.8	10.668	1.8	-6.375	-8.317	52.5	10.479
275817.0	3098090.9	1.9	45.180	49.566	47.7	67.067	3.0	53.370	6.098	7.871	52.2	9.957	2.0	-6.039	-7.738	52.0	9.816
275817.3	3098091.9	1.9	40.224	42.787	46.8	58.726	4.9	46.732	5.677	7.122	51.4	9.107	2.1	-5.641	-7.034	51.3	9.017
275817.6	3098092.8	1.9	35.337	35.982	45.5	50.432	6.7	40.133	5.258	6.370	50.5	8.260	2.2	-5.244	-6.326	50.3	8.217
275817.9	3098093.8	1.9	30.904	29.595	43.8	42.789	7.9	34.051	4.891	5.711	49.4	7.519	2.1	-4.895	-5.705	49.4	7.517
275818.2	3098094.7	1.9	27.294	24.103	41.4	36.413	7.9	28.976	4.610	5.206	48.5	6.954	1.8	-4.628	-5.230	48.5	6.983
275818.5	3098095.7	1.9	24.892	20.176	39.0	32.042	5.2	25.498	4.435	4.892	47.8	6.603	1.4	-4.461	-4.934	47.9	6.652
275818.9	3098096.6	1.9	24.043	18.702	37.9	30.460	0.0	24.240	4.376	4.785	47.6	6.484	1.1	-4.405	-4.834	47.7	6.540
275819.2	3098097.6	1.9	24.892	20.176	39.0	32.042	5.2	25.498	4.435	4.892	47.8	6.603	1.4	-4.461	-4.934	47.9	6.652
275819.5	3098098.5	1.9	27.294	24.103	41.4	36.413	7.9	28.976	4.610	5.206	48.5	6.954	1.8	-4.628	-5.230	48.5	6.983
275819.8	3098099.5	1.9	30.904	29.595	43.8	42.789	7.9	34.051	4.891	5.711	49.4	7.519	2.1	-4.895	-5.705	49.4	7.517
275820.1	3098100.4	1.9	35.337	35.982	45.5	50.432	6.7	40.133	5.258	6.370	50.5	8.260	2.2	-5.244	-6.326	50.3	8.217
275820.4	3098101.4	1.9	40.224	42.787	46.8	58.726	4.9	46.732	5.677	7.122	51.4	9.107	2.1	-5.641	-7.034	51.3	9.017
275820.8	3098102.3	1.9	45.180	49.566	47.7	67.067	3.0	53.370	6.098	7.871	52.2	9.957	2.0	-6.039	-7.738	52.0	9.816
275821.1	3098103.3	1.9	49.784	55.810	48.3	74.788	1.0	59.514	6.456	8.492	52.8	10.668	1.8	-6.375	-8.317	52.5	10.479
275821.4	3098104.2	1.9	53.598	60.960	48.7	81.172	1.0	64.594	6.679	8.848	53.0	11.086	1.8	-6.582	-8.641	52.7	10.862
275821.7	3098105.2	1.9	56.246	64.522	48.9	85.596	3.0	68.115	6.713	8.834	52.8	11.095	2.0	-6.609	-8.612	52.5	10.855
275822.0	3098106.1	1.9	57.534	66.217	49.0	87.720	4.9	69.806	6.537	8.417	52.2	10.657	2.4	-6.436	-8.199	51.9	10.424
275822.3	3098107.1	1.9	57.501	66.075	49.0	87.591	6.9	69.703	6.173	7.655	51.1	9.834	3.0	-6.084	-7.455	50.8	9.623
275822.6	3098108.0	1.9	56.380	64.393	48.8	85.587	8.7	68.108	5.675	6.664	49.6	8.753	3.7	-5.602	-6.490	49.2	8.573
275823.0	3098109.0	1.9	54.492	61.603	48.5	82.246	10.5	65.449	5.106	5.576	47.5	7.560	4.6	-5.047	-5.429	47.1	7.412
275823.3	3098109.9	1.9	52.147	58.133	48.1	78.095	12.2	62.146	4.516	4.502	44.9	6.377	5.5	-4.469	-4.377	44.4	6.256
275823.6	3098110.9	1.9	49.585	54.336	47.6	73.560	13.8	58.537	3.944	3.514	41.7	5.282	6.6	-3.906	-3.407	41.1	5.183
275823.9	3098111.8	1.9	46.972	50.461	47.1	68.940	15.3	54.861	3.409	2.650	37.9	4.318	7.8	-3.378	-2.557	37.1	4.237
275824.2	3098112.8	1.9	44.408	46.673	46.4	64.424	16.6	51.267	2.923	1.923	33.3	3.498	9.1	-2.897	-1.837	32.4	3.430
275824.5	3098113.7	1.9	41.947	43.066	45.8	60.119	17.7	47.841	2.486	1.328	28.1	2.819	10.6	-2.464	-1.246	26.8	2.761
275824.8	3098114.7	1.9	39.617	39.693	45.1	56.081	18.7	44.628	2.099	0.857	22.2	2.267	12.3	-2.079	-0.770	20.3	2.217
275825.2	3098115.6	1.9	37.425	36.574	44.3	52.329	19.6	41.642	1.757	0.500	15.9	1.827	14.2	-1.739	-0.394	12.8	1.783
275825.5	3098116.6	1.9	35.371	33.712	43.6	48.863	20.2	38.884	1.456	0.272	10.6	1.482	16.3	-1.439	-0.102	4.0	1.443
275825.8	3098117.5	1.9	33.450	31.098	42.9	45.673	20.8	36.345	1.193	0.242	11.4	1.218	18.5	-1.177	0.122	-5.9	1.183
275826.1	3098118.5	1.9	31.655	28.718	42.2	42.741	21.2	34.012	0.964	0.338	19.3	1.021	20.4	-0.948	0.290	-17.0	0.991
275826.4	3098119.4	1.9	29.978	26.557	41.5	40.049	21.4	31.870	0.763	0.438	29.8	0.880	21.5	-0.748	0.413	-28.9	0.854
275826.7	3098120.4	1.9	28.409	24.595	40.9	37.576	21.6	29.902	0.590	0.517	41.2	0.784	21.6	-0.574	0.502	-41.2	0.762
275827.0	3098121.3	1.9	26.943	22.814	40.3	35.304	21.7	28.094	0.440	0.573	52.5	0.722	20.5	-0.422	0.564	-53.2	0.704
275827.4	3098122.3	1.9	25.571	21.197	39.7	33.214	21.7	26.431	0.311	0.610	63.0	0.685	18.6	-0.291	0.604	-64.3	0.671
275827.7	3098123.2	1.9	24.286	19.729	39.1	31.290	21.7	24.899	0.203	0.633	72.2	0.665	16.4	-0.178	0.628	-74.2	0.653
275828.0	3098124.2	1.9	23.083	18.393	38.5	29.515	21.5	23.487	0.119	0.643	79.5	0.654	14.2	-0.081	0.640	-82.8	0.645
275828.3	3098125.1	1.9	21.955	17.178	38.0	27.877	21.4	22.184	0.079	0.645	83.0	0.650	12.2	0.003	0.642	89.7	0.642
275828.6	3098126.1	1.9	20.898	16.069	37.6	26.362	21.2	20.978	0.103	0.640	80.8	0.648	10.5	0.075	0.638	83.3	0.642
275828.9	3098127.0	1.9	19.906	15.057	37.1	24.960	21.0	19.862	0.151	0.629	76.5	0.647	9.1	0.136	0.628	77.8	0.643
275829.2	3098128.0	1.9	18.975	14.132	36.7	23.659	20.7	18.827	0.197	0.616	72.3	0.646	7.9	0.188	0.615	73.0	0.643
275829.6	3098128.9	1.9	18.101	13.284	36.3	22.452	20.4	17.867	0.238	0.599	68.3	0.645	6.9	0.232	0.599	68.8	0.642
275829.9	3098129.9	1.9	17.279	12.506	35.9	21.330	20.2	16.974	0.273	0.582	64.8	0.643	6.0	0.269	0.581	65.1	0.640

TRIPLE Araucaria (9.0m ground clearance to achieve 9kV/m Electric Field)

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PLS-CADD Version 18.00x64    2:28:01 PM 06 July 2023
Scottish and Southern Energy
Project Name: 'C:\Users\AM25305\Desktop\CSR ASTI-\PLS Model ASTI\profile 637.don'

Criteria Notes:
  Design criteria developed for SSE Beauly Blackhillock Line reconductoring
  Global wind notes: wind directions are annotated NNW-330, E-90, etc as `wind from` - angles in GIB wind are `wind to` or wind azumuth
  delete - survey and maps confirm angle as per XYZ 19/08/08.Terrain 289: angle has been corrected in pfl. CHECK xyz
  delete220/08/08.PFL 180 and 181 points edited
  tower 229 is a D10 with extended crossarms. It should be modeled???Erection loads??CHECK.

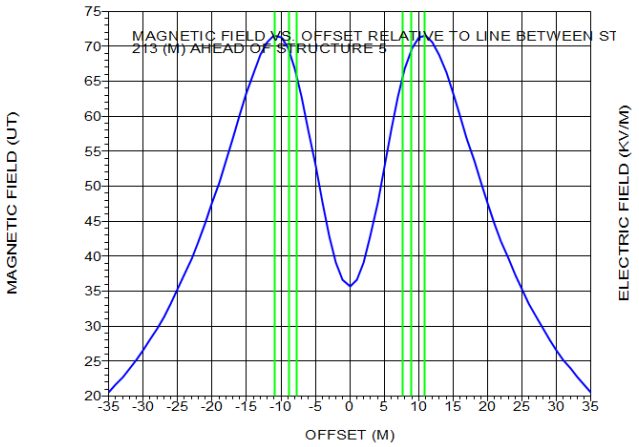

3D EMF Calculation Notes:
  1) Calculations based on the EPRI Red Book methods (3rd Edition, 2005 - 7.4 Calculation of Magnetic Fields and Appendices 7.1 Calculation
of Field Ellipse Parameters and 7.6 Electric Field Calculations for 3D Geometry).
  2) All wire positions are modeled at the specified weather case and wind direction. Height above ground determined by the modeled ground
TIN.
  3) Only the effects of wires are being analyzed. The effects of structures are not included unless enabled as noted below.
  4) Ground return is being ignored for magnetic field calculations.

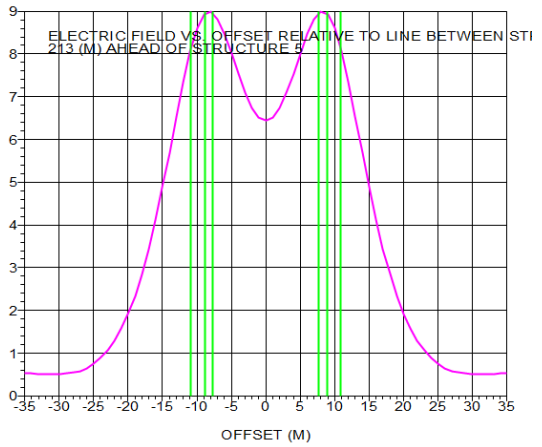

Meter height above ground:                  1.00 (m)
Maximum wire distance:                    150.00 (m)
Maximum cable segment size:                 3.00 (m)
Cross section offset +/-:                  35.00 (m)
Result interval:                            1.00 (m)
Electric field limit:                       9.00 (kV/m)
Magnetic field limit:                     360.00 (uT)
Space potential limit:                      0.00 (kV)
Contour Map Spacing:                           3 (m)
Analyzing spans between these structures:  1 - 6

One or more sections have wind from both directions which is not supported. A wind direction of left is being used for those sections.

Section Data for 3D EMF Results:
```

Section Number	Section Note	Voltage Ph-Ph (kV)	Current (Amps)	Cable Filename	Cable Description	Conductors Per Phase	Bundle Diameter (cm)	Cable Radius (cm)	Weather Case	Condition	Wind Dir.	WC Temperature (deg C)	Effective Radius (cm)
1		400.0	4570.0	araucaria lumpi - 30.5.wir 700mm² AAAC - Araucaria		3	57.735	1.863	90°C	Creep RS	Left	90.000	16.700
2		400.0	4570.0	araucaria lumpi - 30.5.wir 700mm² AAAC - Araucaria		3	57.735	1.863	90°C	Creep RS	Left	90.000	16.700





TRIPLE Araucaria (9.0m ground clearance to achieve 9kV/m Electric Field)

3D EMF Point Results Span from 5 to 6:

Measurement			B					H	EF					Space Potential			
X (m)	Y (m)	Z (m)	Real (uT)	Imaginary (uT)	Angle (deg)	Magnitude (uT)	Polarization Axial Ratio %	Magnitude (A/m)	Real (kV/m)	Imaginary (kV/m)	Angle (deg)	Magnitude (kV/m)	Polarization Axial Ratio %	Real (kV)	Imaginary (kV)	Angle (deg)	Magnitude (kV)
275818.8	3098059.8	1.9	16.631	12.096	36.0	20.564	19.3	16.364	0.185	0.497	69.6	0.530	7.4	0.179	0.496	70.2	0.527
275819.1	3098060.8	1.9	17.391	12.820	36.4	21.605	19.6	17.193	0.147	0.505	73.8	0.526	8.6	0.137	0.504	74.7	0.522
275819.4	3098061.7	1.9	18.197	13.605	36.8	22.720	19.8	18.080	0.106	0.510	78.3	0.521	10.1	0.089	0.508	80.1	0.516
275819.7	3098062.7	1.9	19.052	14.457	37.2	23.916	19.9	19.032	0.071	0.511	82.1	0.516	11.9	0.033	0.509	86.3	0.510
275820.0	3098063.6	1.9	19.958	15.383	37.6	25.198	20.1	20.052	0.076	0.507	81.5	0.513	13.9	-0.032	0.505	-86.4	0.506
275820.3	3098064.5	1.9	20.919	16.391	38.1	26.575	20.2	21.148	0.131	0.497	75.2	0.514	16.3	-0.107	0.494	-77.8	0.505
275820.7	3098065.5	1.9	21.939	17.488	38.6	28.056	20.3	22.326	0.211	0.479	66.3	0.523	18.7	-0.193	0.475	-67.9	0.512
275821.0	3098066.4	1.9	23.020	18.683	39.1	29.648	20.4	23.593	0.307	0.450	55.8	0.545	20.6	-0.292	0.444	-56.7	0.532
275821.3	3098067.4	1.9	24.168	19.986	39.6	31.361	20.3	24.956	0.418	0.409	44.4	0.585	21.7	-0.405	0.400	-44.6	0.569
275821.6	3098068.3	1.9	25.385	21.406	40.1	33.206	20.3	26.424	0.547	0.353	32.9	0.651	21.4	-0.534	0.338	-32.3	0.633
275821.9	3098069.3	1.9	26.676	22.953	40.7	35.191	20.1	28.004	0.694	0.281	22.1	0.748	19.9	-0.682	0.255	-20.5	0.728
275822.2	3098070.2	1.9	28.043	24.637	41.3	37.328	19.9	29.705	0.861	0.201	13.2	0.884	17.9	-0.848	0.145	-9.7	0.861
275822.5	3098071.2	1.9	29.491	26.466	41.9	39.626	19.6	31.533	1.050	0.165	8.9	1.063	15.6	-1.038	0.002	-0.1	1.038
275822.9	3098072.1	1.9	31.021	28.449	42.5	42.091	19.1	33.495	1.264	0.267	11.9	1.292	13.5	-1.251	-0.181	8.2	1.264
275823.2	3098073.1	1.9	32.635	30.589	43.1	44.729	18.6	35.594	1.504	0.474	17.5	1.577	11.7	-1.491	-0.413	15.5	1.547
275823.5	3098074.0	1.9	34.331	32.885	43.8	47.540	17.9	37.831	1.774	0.755	23.0	1.928	10.2	-1.759	-0.701	21.7	1.894
275823.8	3098075.0	1.9	36.103	35.331	44.4	50.515	17.1	40.198	2.074	1.107	28.1	2.351	8.9	-2.058	-1.056	27.2	2.313
275824.1	3098075.9	1.9	37.941	37.905	45.0	53.631	16.2	42.679	2.406	1.537	32.6	2.855	7.7	-2.388	-1.484	31.9	2.811
275824.4	3098076.9	1.9	39.821	40.573	45.5	56.850	15.2	45.240	2.769	2.049	36.5	3.445	6.7	-2.749	-1.993	35.9	3.395
275824.7	3098077.8	1.9	41.708	43.275	46.1	60.102	14.0	47.828	3.162	2.645	39.9	4.122	5.8	-3.138	-2.583	39.5	4.064
275825.1	3098078.8	1.9	43.544	45.920	46.5	63.283	12.7	50.359	3.577	3.318	42.8	4.879	5.0	-3.550	-3.248	42.5	4.811
275825.4	3098079.7	1.9	45.244	48.383	46.9	66.241	11.3	52.713	4.005	4.051	45.3	5.697	4.3	-3.972	-3.971	45.0	5.617
275825.7	3098080.7	1.9	46.694	50.492	47.2	68.774	9.9	54.728	4.428	4.811	47.4	6.538	3.6	-4.388	-4.720	47.1	6.445
275826.0	3098081.6	1.9	47.750	52.046	47.5	70.632	8.3	56.207	4.821	5.548	49.0	7.350	2.9	-4.774	-5.446	48.8	7.243
275826.3	3098082.6	1.9	48.253	52.827	47.6	71.548	6.7	56.936	5.154	6.201	50.3	8.064	2.4	-5.102	-6.089	50.0	7.944
275826.6	3098083.5	1.9	48.062	52.646	47.6	71.285	5.0	56.727	5.399	6.703	51.1	8.608	1.9	-5.343	-6.586	50.9	8.481
275827.0	3098084.5	1.9	47.091	51.392	47.5	69.704	3.4	55.469	5.532	7.003	51.7	8.925	1.6	-5.476	-6.886	51.5	8.798
275827.3	3098085.4	1.9	45.345	49.078	47.3	66.819	1.8	53.173	5.545	7.076	51.9	8.990	1.4	-5.493	-6.967	51.7	8.872
275827.6	3098086.4	1.9	42.933	45.847	46.9	62.811	0.2	49.984	5.448	6.937	51.9	8.821	1.4	-5.404	-6.844	51.7	8.720
275827.9	3098087.3	1.9	40.052	41.955	46.3	58.004	1.3	46.158	5.268	6.633	51.5	8.471	1.4	-5.235	-6.561	51.4	8.394
275828.2	3098088.3	1.9	36.949	37.715	45.6	52.798	2.6	42.016	5.039	6.233	51.0	8.016	1.5	-5.019	-6.185	50.9	7.965
275828.5	3098089.2	1.9	33.889	33.461	44.6	47.624	3.6	37.898	4.800	5.807	50.4	7.534	1.5	-4.792	-5.783	50.4	7.510
275828.8	3098090.2	1.9	31.134	29.533	43.5	42.913	4.1	34.149	4.582	5.415	49.8	7.093	1.4	-4.584	-5.413	49.7	7.093
275829.2	3098091.1	1.9	28.930	26.293	42.3	39.093	3.7	31.109	4.409	5.105	49.2	6.745	1.2	-4.420	-5.119	49.2	6.763
275829.5	3098092.1	1.9	27.498	24.120	41.3	36.578	2.2	29.108	4.300	4.907	48.8	6.524	1.0	-4.315	-4.933	48.8	6.554
275829.8	3098093.0	1.9	27.001	23.348	40.9	35.696	0.0	28.406	4.262	4.839	48.6	6.448	0.9	-4.280	-4.869	48.7	6.482
275830.1	3098094.0	1.9	27.498	24.120	41.3	36.578	2.2	29.108	4.300	4.907	48.8	6.524	1.0	-4.315	-4.933	48.8	6.554
275830.4	3098094.9	1.9	28.930	26.293	42.3	39.093	3.7	31.109	4.409	5.105	49.2	6.745	1.2	-4.420	-5.119	49.2	6.763
275830.7	3098095.9	1.9	31.134	29.533	43.5	42.913	4.1	34.149	4.582	5.415	49.8	7.093	1.4	-4.584	-5.413	49.7	7.093
275831.0	3098096.8	1.9	33.889	33.461	44.6	47.624	3.6	37.898	4.800	5.807	50.4	7.534	1.5	-4.792	-5.783	50.4	7.510
275831.4	3098097.8	1.9	36.949	37.715	45.6	52.798	2.6	42.016	5.039	6.233	51.0	8.016	1.5	-5.019	-6.185	50.9	7.965
275831.7	3098098.7	1.9	40.052	41.955	46.3	58.004	1.3	46.158	5.268	6.633	51.5	8.471	1.4	-5.235	-6.561	51.4	8.394
275832.0	3098099.7	1.9	42.933	45.847	46.9	62.811	0.2	49.984	5.448	6.937	51.9	8.821	1.4	-5.404	-6.844	51.7	8.720
275832.3	3098100.6	1.9	45.345	49.078	47.3	66.819	1.8	53.173	5.545	7.076	51.9	8.990	1.4	-5.493	-6.967	51.7	8.872
275832.6	3098101.6	1.9	47.091	51.392	47.5	69.704	3.4	55.469	5.532	7.003	51.7	8.925	1.6	-5.476	-6.886	51.5	8.798
275832.9	3098102.5	1.9	48.062	52.646	47.6	71.285	5.0	56.727	5.399	6.703	51.1	8.608	1.9	-5.343	-6.586	50.9	8.481
275833.2	3098103.5	1.9	48.253	52.827	47.6	71.548	6.7	56.936	5.154	6.201	50.3	8.064	2.4	-5.102	-6.089	50.0	7.944
275833.6	3098104.4	1.9	47.750	52.046	47.5	70.632	8.3	56.207	4.821	5.548	49.0	7.350	2.9	-4.774	-5.446	48.8	7.243
275833.9	3098105.4	1.9	46.694	50.492	47.2	68.774	9.9	54.728	4.428	4.811	47.4	6.538	3.6	-4.388	-4.720	47.1	6.445
275834.2	3098106.3	1.9	45.244	48.383	46.9	66.241	11.3	52.713	4.005	4.051	45.3	5.697	4.3	-3.972	-3.971	45.0	5.617
275834.5	3098107.3	1.9	43.544	45.920	46.5	63.283	12.7	50.359	3.577	3.318	42.8	4.879	5.0	-3.550	-3.248	42.5	4.811
275834.8	3098108.2	1.9	41.708	43.275	46.1	60.102	14.0	47.828	3.162	2.645	39.9	4.122	5.8	-3.138	-2.583	39.5	4.064
275835.1	3098109.2	1.9	39.821	40.573	45.5	56.850	15.2	45.240	2.769	2.049	36.5	3.445	6.7	-2.749	-1.993	35.9	3.395
275835.4	3098110.1	1.9	37.941	37.905	45.0	53.631	16.2	42.679	2.406	1.537	32.6	2.855	7.7	-2.388	-1.484	31.9	2.811
275835.8	3098111.1	1.9	36.103	35.331	44.4	50.515	17.1	40.198	2.074	1.107	28.1	2.351	8.9	-2.058	-1.056	27.2	2.313
275836.1	3098112.0	1.9	34.331	32.885	43.8	47.540	17.9	37.831	1.774	0.755	23.0	1.928	10.2	-1.759	-0.701	21.7	1.894
275836.4	3098113.0	1.9	32.635	30.589	43.1	44.729	18.6	35.594	1.504	0.474	17.5	1.577	11.7	-1.491	-0.413	15.5	1.547
275836.7	3098113.9	1.9	31.021	28.449	42.5	42.091	19.1	33.495	1.264	0.267	11.9	1.292	13.5	-1.251	-0.181	8.2	1.264
275837.0	3098114.9	1.9	29.491	26.466	41.9	39.626	19.6	31.533	1.050	0.165	8.9	1.063	15.6	-1.038	0.002	-0.1	1.038
275837.3	3098115.8	1.9	28.043	24.637	41.3	37.328	19.9	29.705	0.861	0.201	13.2	0.884	17.9	-0.848	0.145	-9.7	0.861
275837.6	3098116.8	1.9	26.676	22.953	40.7	35.191	20.1	28.004	0.694	0.281	22.1	0.748	19.9	-0.682	0.255	-20.5	0.728
275838.0	3098117.7	1.9	25.385	21.406	40.1	33.206	20.3	26.424	0.547	0.353	32.9	0.651	21.4	-0.534	0.338	-32.3	0.633
275838.3	3098118.7	1.9	24.168	19.986	39.6	31.361	20.3	24.956	0.418	0.409	44.4	0.585	21.7	-0.405	0.400	-44.6	0.569
275838.6	3098119.6	1.9	23.020	18.683	39.1	29.648	20.4	23.593	0.307	0.450	55.8	0.545	20.6	-0.292	0.444	-56.7	0.532
275838.9	3098120.6	1.9	21.939	17.488	38.6	28.056	20.3	22.326	0.211	0.479	66.3	0.523	18.7	-0.193	0.475	-67.9	0.512
275839.2	3098121.5	1.9	20.919	16.391	38.1	26.575	20.2	21.148	0.131	0.497	75.2	0.514	16.3	-0.107	0.494	-77.8	0.505
275839.5	3098122.5	1.9	19.958	15.383	37.6	25.198	20.1	20.052	0.076	0.507	81.5	0.513	13.9	-0.032	0.505	-86.4	0.506
275839.8	3098123.4	1.9	19.052	14.457	37.2	23.916	19.9	19.032	0.071	0.511	82.1	0.516	11.9	0.033	0.509	86.3	0.510
275840.2	3098124.4	1.9	18.197	13.605	36.8	22.720	19.8	18.080	0.106	0.510	78.3	0.521	10.1	0.089	0.508	80.1	0.516
275840.5	3098125.3	1.9	17.391	12.820	36.4	21.605	19.6	17.193	0.147	0.505	73.8	0.526	8.6	0.137	0.504	74.7	0.522
275840.8	3098126.2	1.9	16.631	12.096	36.0	20.564	19.3	16.364	0.185	0.497	69.6	0.530	7.4	0.179	0.496	70.2	0.527

Appendix C WSP Assessment

SCOTTISH & SOUTHERN ELECTRICITY NETWORK (SSEN)

EMF ASSESSMENT STUDY FOR 400kV OHTL

SCOTTISH & SOUTHERN ELECTRICITY NETWORK (SSEN)

EMF ASSESSMENT STUDY FOR 400KV OHTL
REPORT

TYPE OF DOCUMENT (THIRD ISSUE)

PROJECT NO. 70111023

OUR REF. NO. 70111023-509

DATE: JULY 2025

SCOTTISH & SOUTHERN ELECTRICITY NETWORK (SSEN)

EMF ASSESSMENT STUDY FOR 400KV OHTL

REPORT

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QUALITY CONTROL

Issue/revision	First issue	Second issue	Third issue
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Checked by	[redacted]	[redacted]	[redacted]
Authorised by	[redacted]	[redacted]	[redacted]
Project number	70111023	70111023	70111023
Report number	70111023-509	70111023-509	70111023-509

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CONTENTS

TERMINOLOGY

Term	Definition
ENA	*Energy Network Association*
EMF	*Electro Magnetic Fields*
ELF	*Extremely Low Frequency*
ICNIRP	*International Commission on Non-Ionizing Radiation Protection*
INIRC	*International Non-Ionizing Radiation Committee*
IARC	*International Agency for Research on Cancer*
NPS	*National Policy Statement*
OHTL	*Overhead Transmission Line*
SCENIHR	*Scientific Committee on Emerging and Newly Identified Health Risks*
SSEN	*Scottish and Southern Electricity Network*
WHO	*World Health Organisation*

1 BACKGROUND AND SCOPE OF WORK

WSP is assigned as the consultant to perform a 400kV Substation and 400kV OHL EMF Assessment Study Report for Scottish & Southern Electricity Networks (SSEN). The EMF Assessment Study is essential to ensure that personnel available in Substations or nearby to the OHTL are not exposed to a harmful level of Electromagnetic Field (EMF).

As per our proposal (70111023) to undertake the EMF studies, the following report is issued by WSP.

- **EMF assessment Study Report for 400kV OHTL of SSEN – Transmission**

  This report covers the EMF assessment study for the 400kV OHTL of SSEN Transmission. The proposed tower cross-section diagram considered for the entire study is shown below.

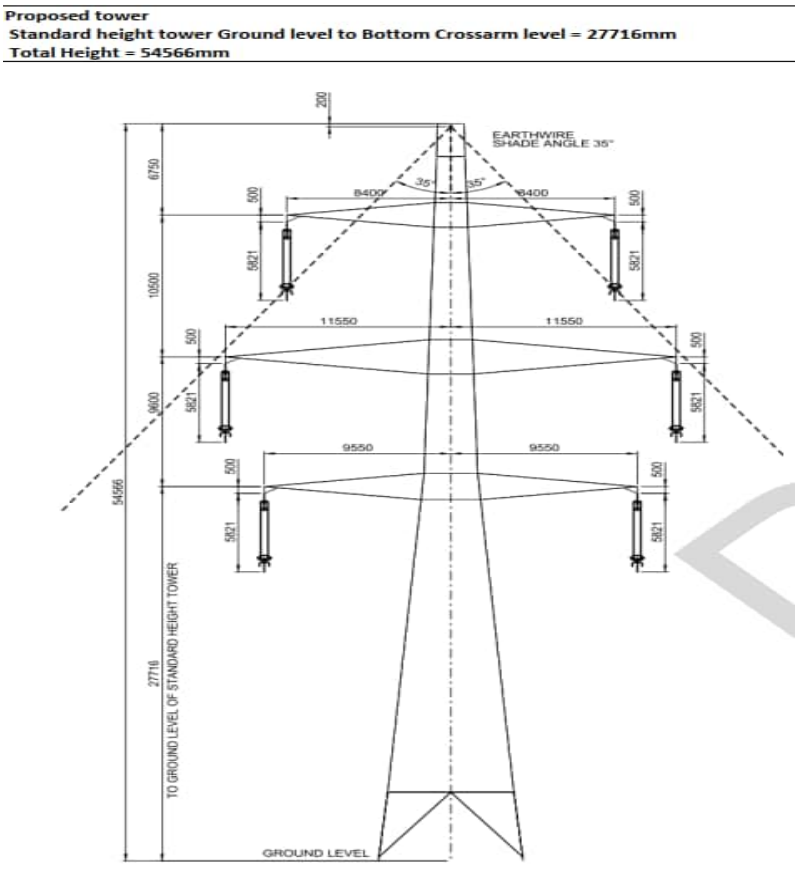


Figure 1- Proposed Suspension Tower AD & BD Diagram

2 INPUT DATA

The following are the input data received from SSEN for the undertaking the EMF studies.

Sl. No.	DESCRIPTION	VALUES	UNIT
A	**Source Fault Level of 400kV OHTL**		
	Phase Fault	45	kA
	Earth Fault	-	-
B	**X/R Ratio of 400kV OHTL**		
	Phase Fault	19.95	
	Earth Fault	6.7	
C	**Length of the Overhead Transmission Line**		
	Minimum	76	km
	Maximum	115	km
D	**400kV Tension Insulator Details**		
	Creepage Distance	10500	mm
	String Length	7.6	m
	Mechanical Strength	300	kN
	No. of Discs	22	-
	Disc Type	Glass	-
	Arc Horn Distance	2800	mm
E	**400kV Suspension Insulator Details**		
	Creepage Distance	4290	mm
	String Length	6	m
	Mechanical Strength	300	kN
	No. of Discs	24	-
	Disc Type	Glass	-
	Arc Horn Distance	2683	mm

F	**400kV OHTL Conductors Details**		
	Number of Conductor per phase	3	-
	Bundle Spacing	500	mm
	Maximum Continuous Current Rating of each circuit	5000	A
	Minimum Continuous Current Rating of each circuit	3370	A
	Soil Resistivity	100	ohm-m
	400kV Tower Footing Resistance	5	ohm
	400kV Transmission Line Minimum Ground Clearance	9	m

3 SIMULATION MODEL DEVELOPMENT

3.1 SIMULATION TOOL

CDEGS (**C**urrent **D**istribution, **E**lectromagnetic Fields, **G**rounding and **S**oil Structure Analysis) tool was used to perform the EMF voltage assessment study for 400kV Overhead Transmission Line Tower.

CDEGS is a powerful set of integrated software tools designed to accurately analyse a variety of electromagnetic related problems encountered in all industries involving electric networks.

The use of CDEGS for EMF analysis is recognised within the industry as standard practice.

3.2 CONSIDERATIONS FOR THE STUDY

The following are the data considered as per the confirmation provided by SSEN

- 400kV Span Length is considered to be 350m.
- Ground Clearence of 400kV OHTL is considered as 9m.
- Optimum phasing is also included in the 400kV OHTL model.
- Maximum 400kV Overhead Transmission Line Length (i.e. 115km) is considered for the entire study.
- EMF observation points is extended up to 170m on cross section side of the tower.

3.3 MODEL DEVELOPMENT

The following are the models that have been developed in CDEGS simulation tool to carry out the required EMF assessment study. The insulator lengths provided within the inputs table in section 2 are approximate lengths and final lengths will be confirmed by SSEN during their detailed design. Slight variation in these lengths will have negligible impact on the EMF assessment as the conductor has been sagged to have a minimum clearance to ground of 9m and the EMF values are taken at this closest point to ground where fields are at their maximum.

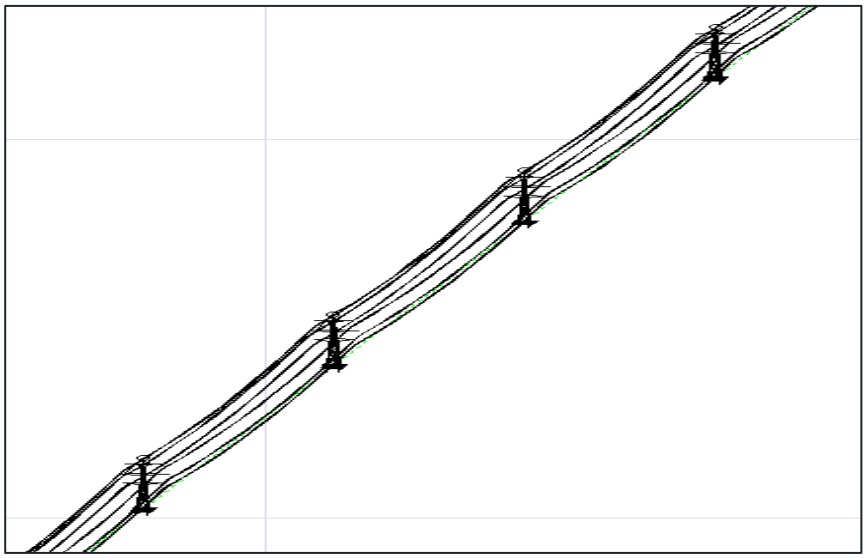


Figure 2 400kV OHTL Model

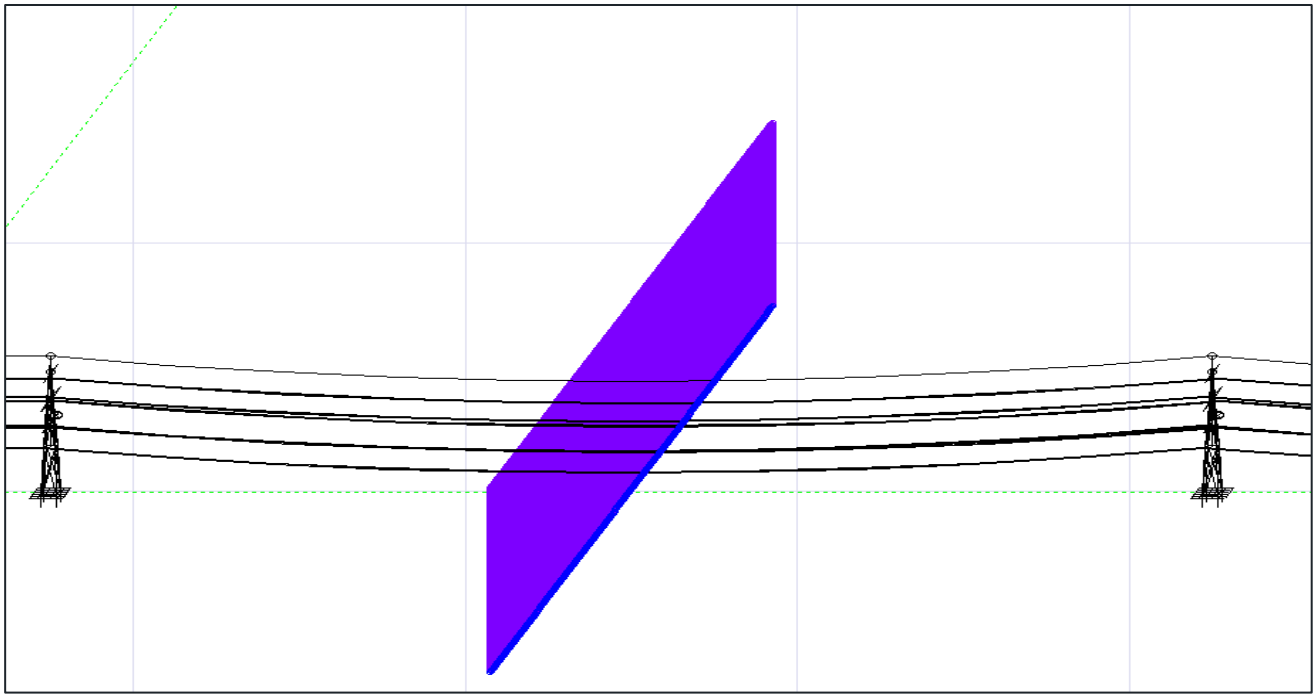


Figure 3 EMF Measuring points in YZ Plane in the mid of span

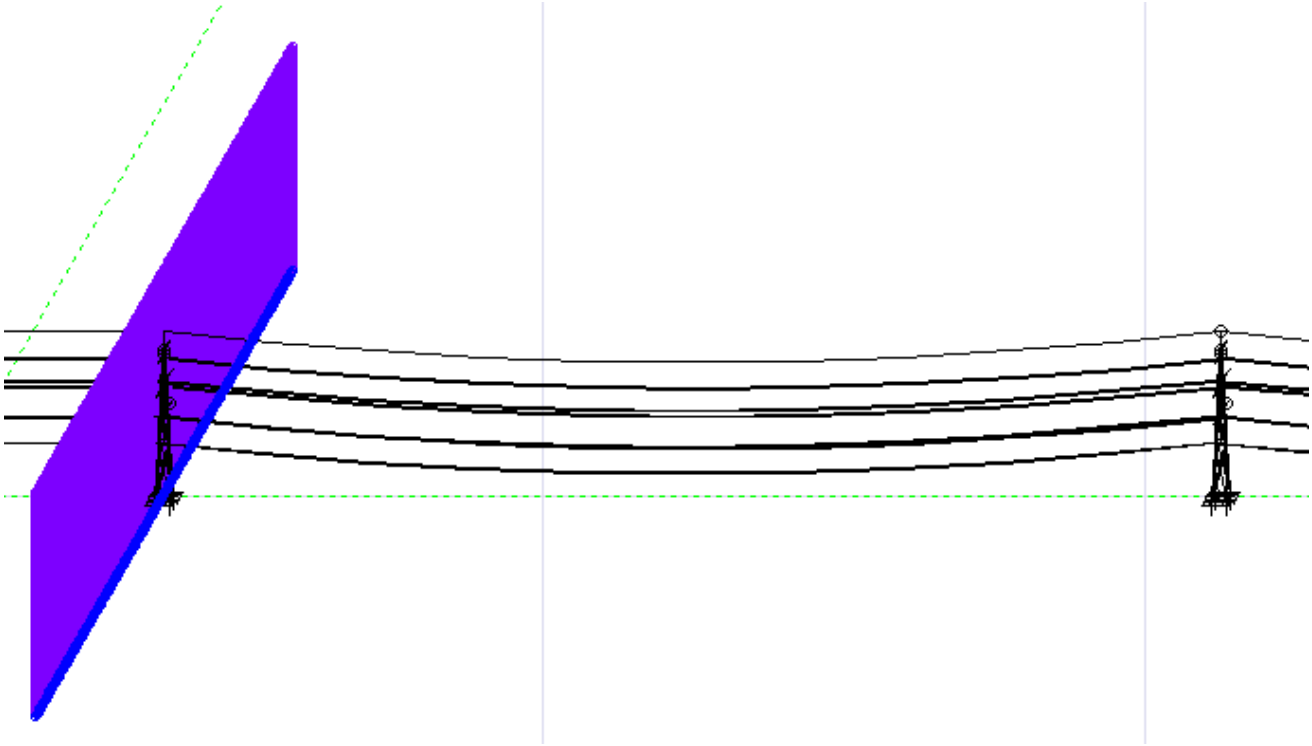


Figure 4 EMF Measuring points in YZ Plane in the mid of tower

4 STANDARD EXPOSURE LIMITS

4.1 PUBLIC EXPOSURE LIMITS

In March 2004, the UK adopted the 1998 guidelines published by ICNIRP. These guidelines (See Table 1) are designed to set conservative exposure levels for the general public to electric and magnetic fields, and they are endorsed by the UK's Health Protection Agency, the World Health Organisation and the UK Government.

It is the policy of the electricity industry to follow these independent guidelines. A Code of Practice CoP, published jointly in 2012 by industry and the Department for Energy and Climate Change (now part of the Department for Business, Energy and Industrial Strategy). This CoP sets out all the practical details needed to apply the exposure limits for transmission lines. All exposures in homes already comply with the ICNIRP guidelines. The electricity industry designs all new equipment to comply with the Government guidelines as set out in the Code of Practice. This includes measures such as adhering to statutory ground clearance requirements and ensuring optimum phasing of high voltage double-circuit overhead lines.

The CoP sets the maximum levels for long term public exposure as 360 µT for magnetic fields and 9 kV/m for electric fields. Long term exposure relates to places of residence or similar where people regularly spend extended periods of time. In other environments, where exposure can be deemed not to be for a significant period of time, the ICNIRP occupational guidelines, rather that the ICNIRP general public guidelines, shall be deemed to apply.

Table 1 – Public Exposure Limits for Power Frequency EMFs

Sl. No.	Public Exposure Levels	Electric Fields	Magnetic Fields
1	*Reference level* *(external unperturbed field)*	*5kV/m*	*100 µT*
2	*Field corresponding to the basic restriction* *(external unperturbed field)*	*9kV/m*	*360 µT*

4.2 OCCUPATIONAL EXPOSURE LIMITS

Occupational exposure (see Table 2) is defined as any exposure experienced by an individual during work related activities. The limits for occupational exposure are stated in the Control of Electromagnetic Fields at Work Regulations 2016. These limits are enforceable and should not be exceeded.

Table 2– Occupational Exposure Limits for Power Frequency EMFs

Sl. No.	Occupational Exposure Levels	Electric Fields	Magnetic Fields
1	*Reference level (external unperturbed field)*	*10kV/m*	*1000 µT*
2	*Field corresponding to the basic restriction (external unperturbed field)*	*20kV/m*	*6000 µT*

5 CASE SCENARIO

Based on the measuring profile and OHTL loading conditions, the following are the cases considered as discussed with SSEN.

Case A considers the expected continuous operating current for the proposed OHTL.

Case B considers the maximum possible current for the OHTL based on the substation equipment ratings being capped at 5000A. It should however be noted that some substation plant is limited at 4000A so although this assessment has been carried out, it is presented to consider the worst case load conditions however case A is representative of the actual operational values.

5.1 CASE - A

With partial loading of the OHTL (i.e. 3375A), the magnitudes of Electric and Magnetic Fields are measured at the mid of span.

5.2 CASE - B

With full loading of the OHTL (i.e. 5000A), the magnitudes of Electric and Magnetic Fields are measured at the mid of span.

6 STUDY RESULTS

This section presents the simulation results of the EMF assessment study for the Partial and full loading of the 400kV OHTL Circuit and results are tabulated in the Table 3 and Table 4.

6.1 SIMULATED GRAPH FOR ELECTRIC FIELD

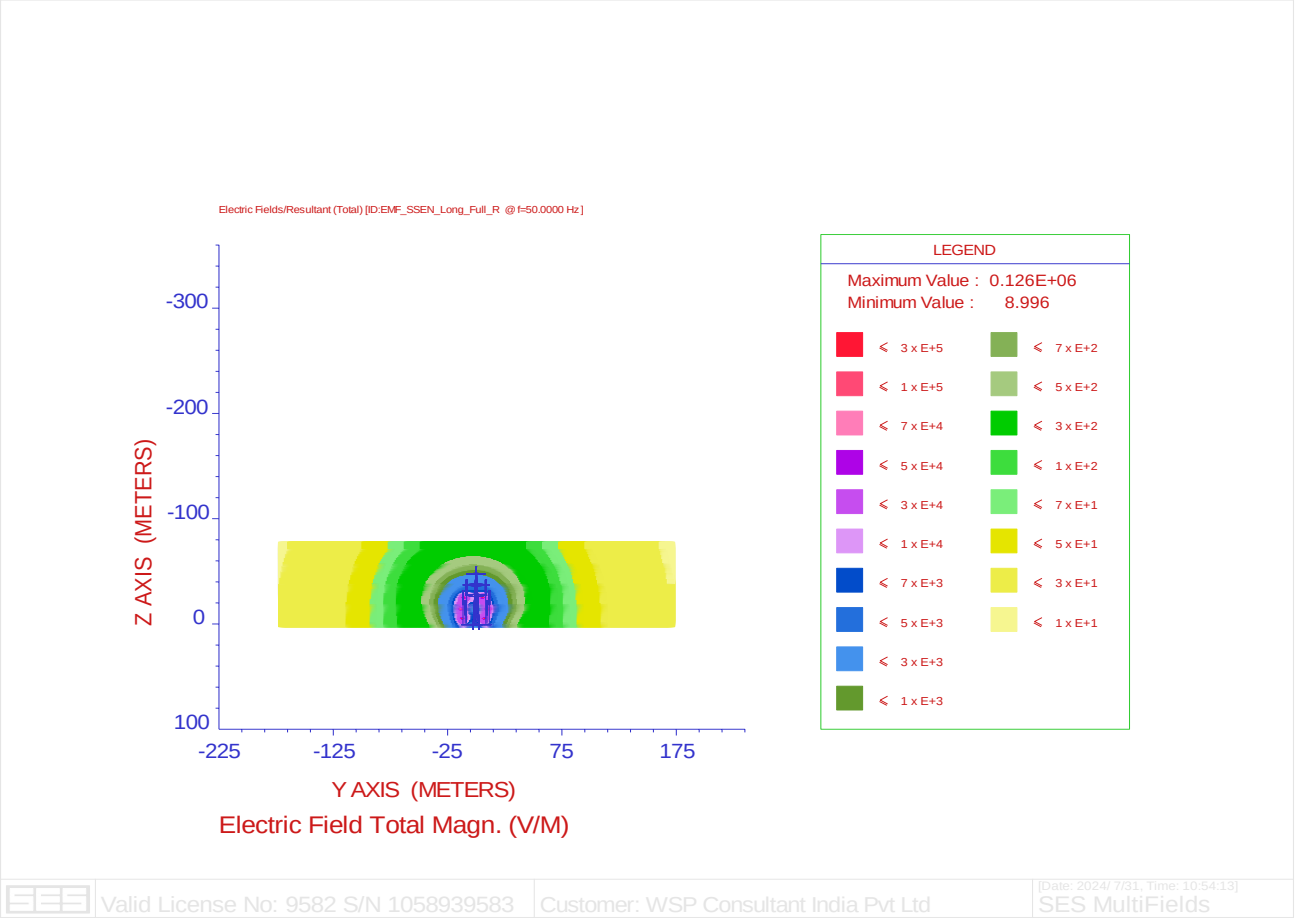


Figure 5 Electric Field Graph for Case A

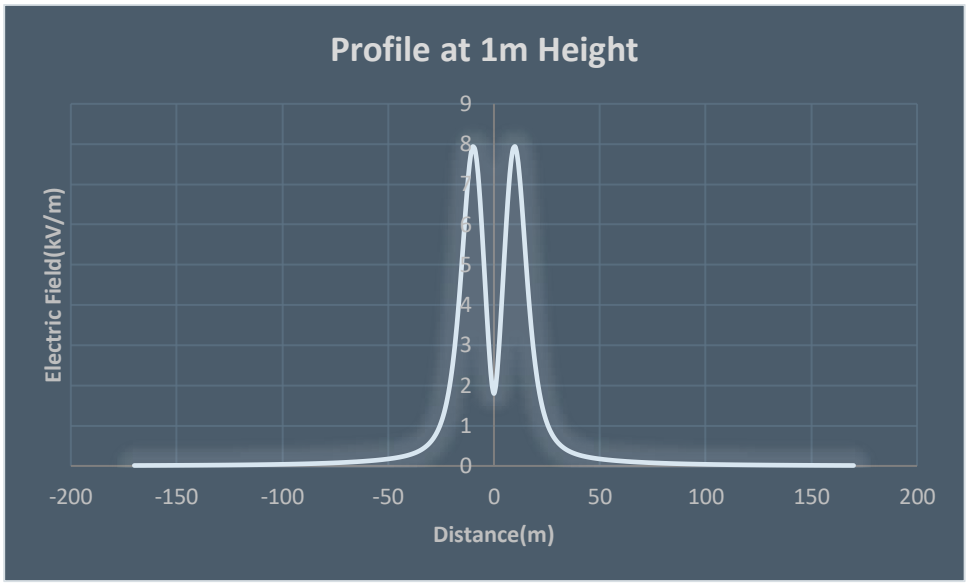


Figure 6 Electric Field Profile at 1m Height for Case A

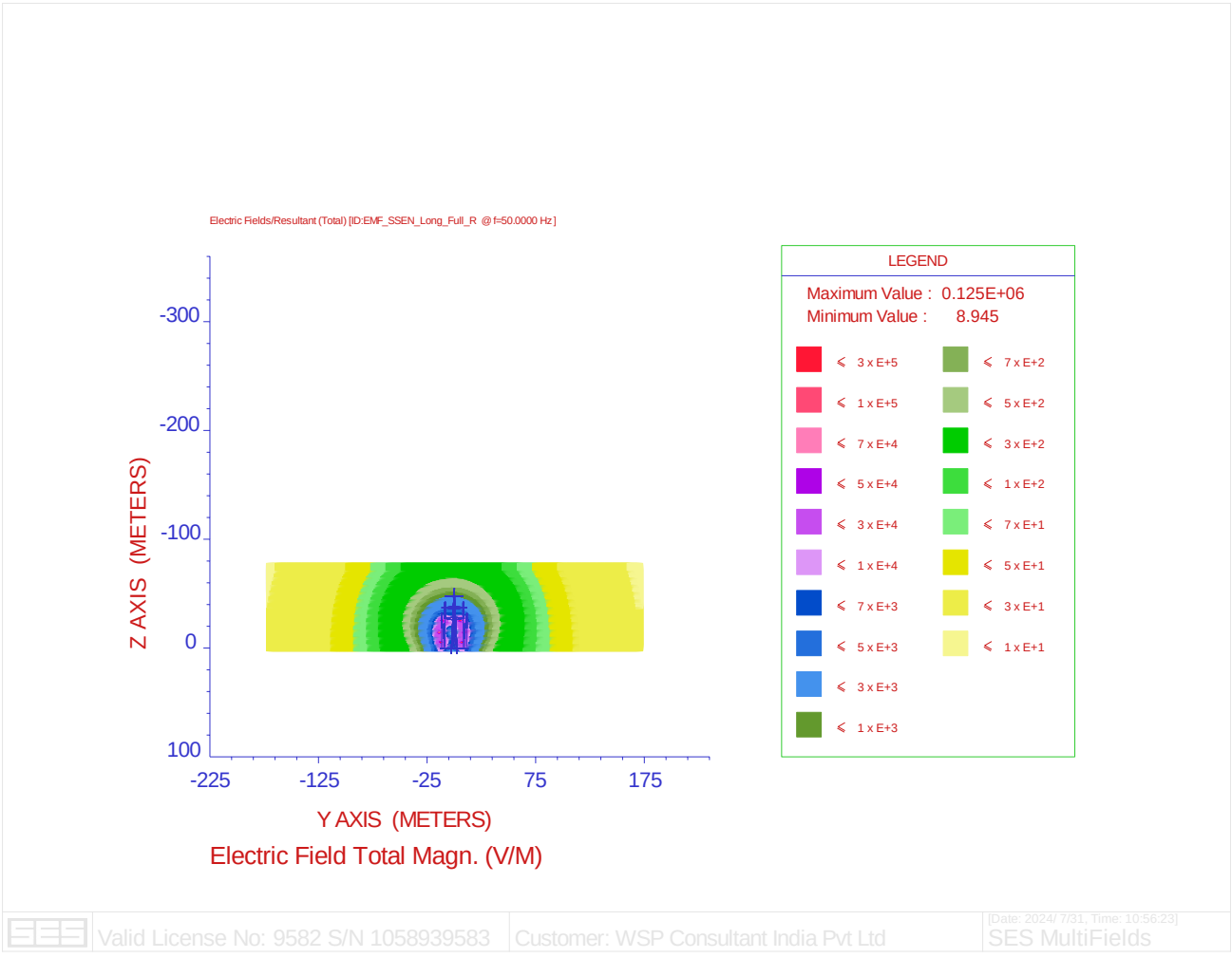


Figure 7 Electric Field Graph for Case B

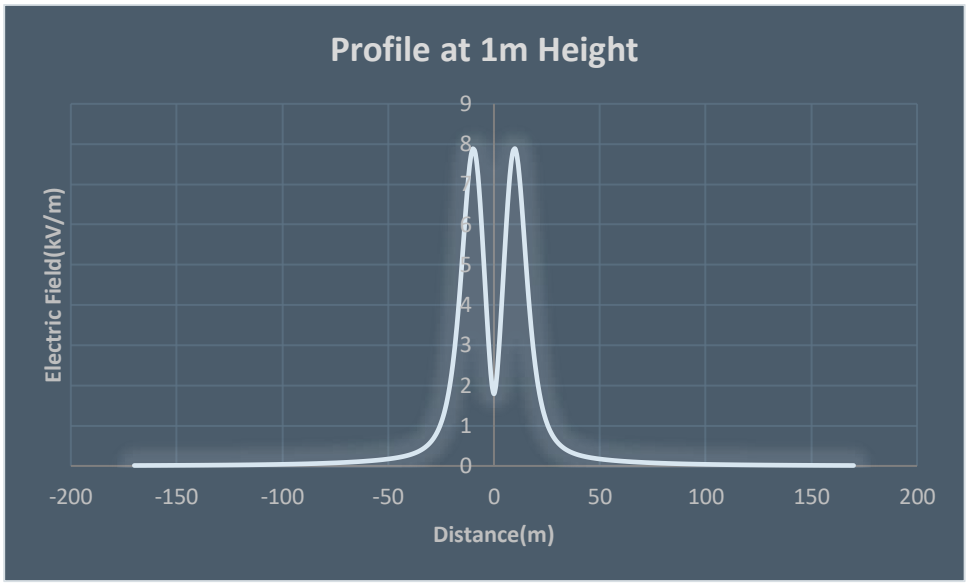


Figure 8 Electric Field Profile at 1m Height for Case B

6.2 TABULATED CASE RESULTS FOR ELECTRIC FIELD

Table 3 Electric Field result with change in OHTL loading and profile location

CASES	MAGNITUDE OF ELECTRIC FIELD FOR VARIOUS CASES					
	PROFILE LOCATION	400kV OHTL LOADING	SIMULATED VALUE AT 1m HEIGHT FROM GROUND		UK PUBLIC EXPOSURE LIMIT	SAFE/ UNSAFE
			±9 m from Centre (Lowest Conductor Below)	±170m from Centre		
	TOWER/MID OF SPAN	A	kV/m		kV/m	
A	MID OF SPAN	3375 A	7.936394	0.010479	9.0	SAFE
B	MID OF SPAN	5000 A	7.881355	0.01043		SAFE

6.3 SIMULATED GRAPH FOR MAGNETIC FIELD

Figure 9 Magnetic Field Graph for Case A

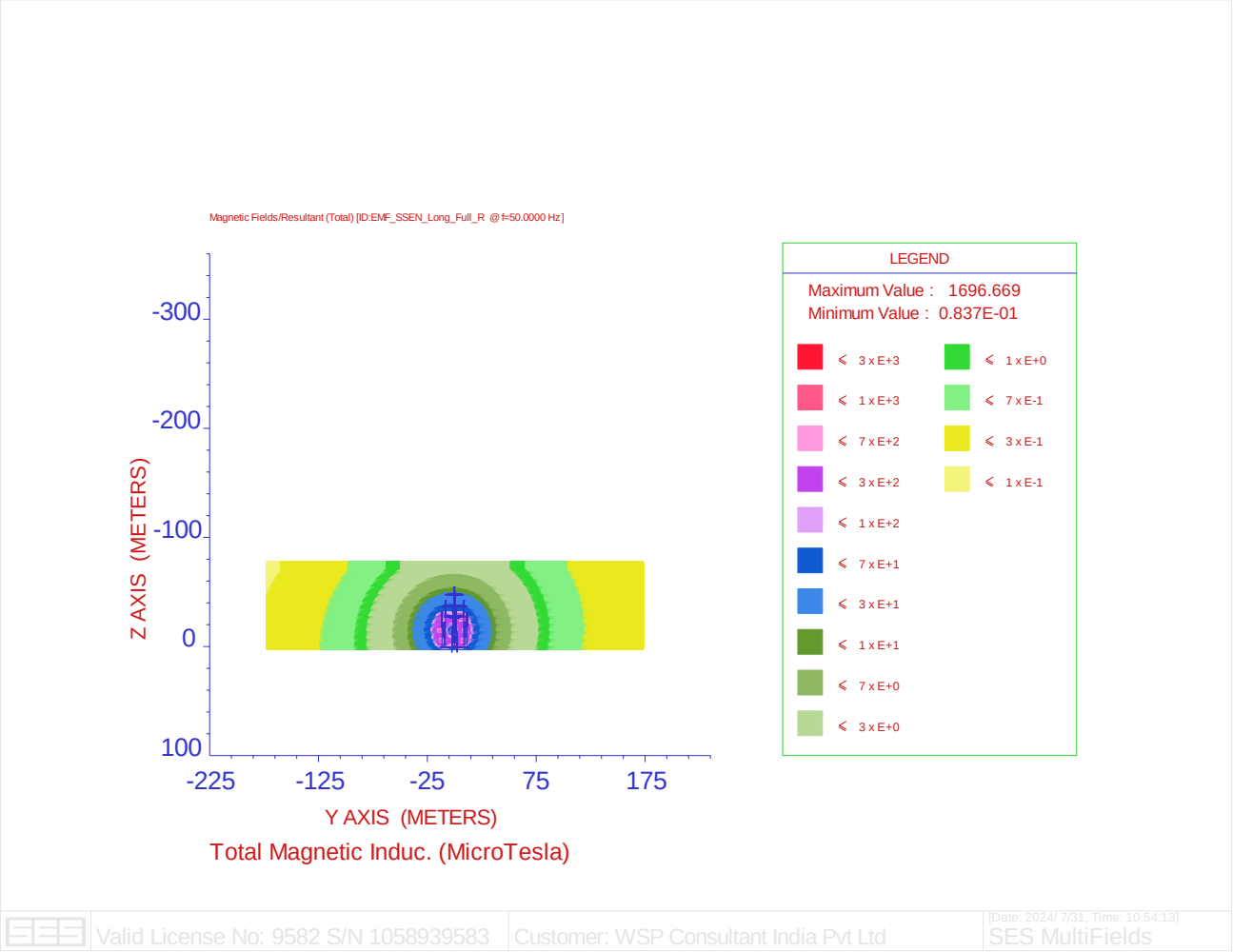


Figure 10 Magnetic Field Graph for Case A

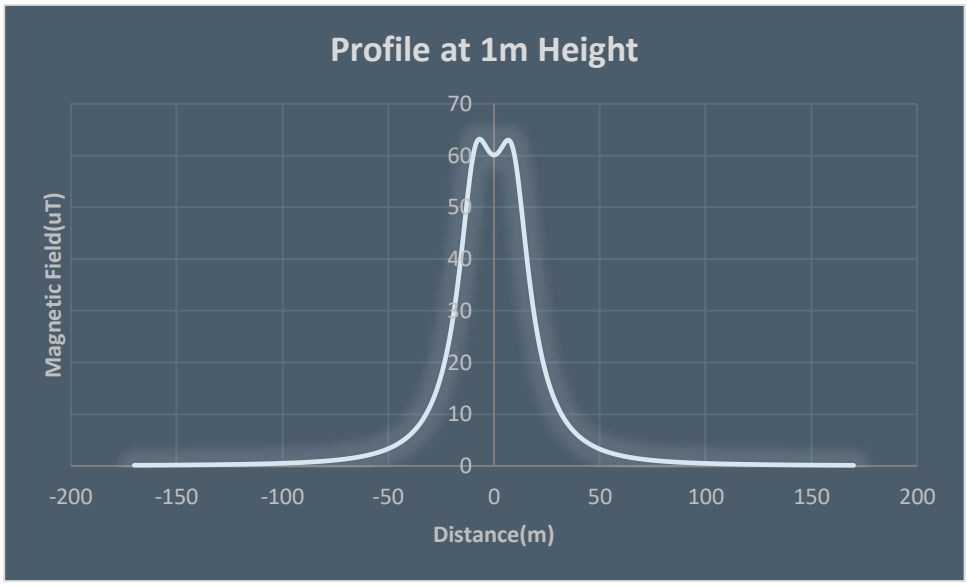


Figure 11 Magnetic Field Profile at 1m Height for Case A

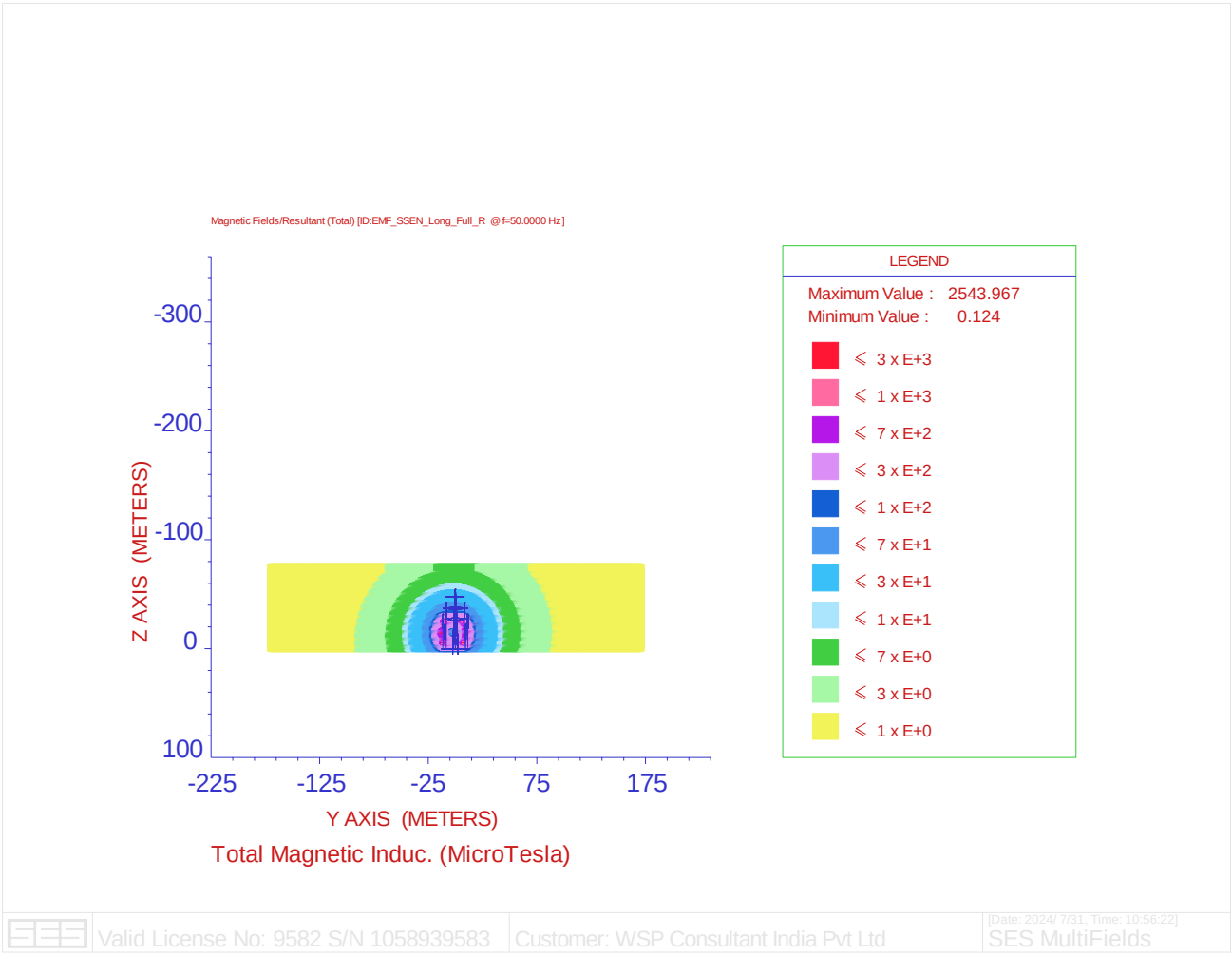


Figure 12 Magnetic Field Graph for Case B

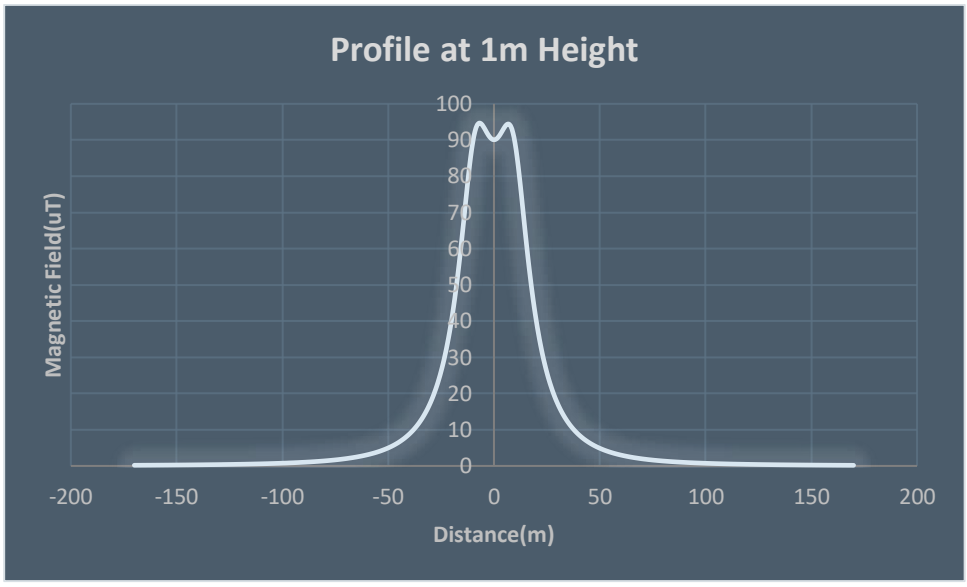


Figure 13 Magnetic Field Profile at 1m Height for Case B

6.4 TABULATED CASE RESULTS FOR MAGNETIC FIELD

Table 4 Magnetic Field result with change in OHTL loading and profile location

CASES	MAGNITUDE OF MAGNETIC FIELD FOR VARIOUS CASES					
	PROFILE LOCATION	400kV OHTL LOADING	SIMULATED VALUE AT 1m HEIGHT FROM GROUND		UK PUBLIC EXPOSURE LIMIT	SAFE/ UNSAFE
			±9 m from Centre (Lowest Conductor Below)	±170m from Centre		
	TOWER/MID OF SPAN	A	Micro Tesla		Micro Tesla	
A	MID OF SPAN	3375 A	62.74127	0.123508	360	SAFE
B	MID OF SPAN	5000 A	92.30611	0.182544		SAFE

7 CONCLUSION

- In all the simulated test cases, the results have shown that the simulated values of Electric Field are well within the UK Exposure Limit.
- Similarly, the simulated value of the Magnetic Field is well within the UK Exposure Limit.

8 REFERENCES

- ICNIRP- Guidelines for Limiting Exposure to time varying Electric, Magnetic and EMF (Up to 300GHz)
- Electric and Magnetic Fields the facts – Produced by ENA - September 2017
- Working Group C4.208, "EMC within Power Plants and Substations," CIGRE2013
- IEEE Reference paper - Magnetic field calculations within substation environment for EMC studies
- National Policy Statement for Electricity Networks Infrastructure (EN-5)

Appendix D PLS CADD Report for Cumulative Assessment

Optimal Phasing of Adjacent Circuits

```
PLS-CADD Version 20.01x64    14:23:43 02 July 2025
Scottish and Southern Energy
Project Name: 'C:\PLS\Combined_EMF_Check Temp\Combined_EMF_Check.don'
Line Title: 'Max Op'

3D EMF Calculation Notes:
  1) Calculations based on the EPRI Red Book methods (3rd Edition, 2005 - 7.4 Calculation of Magnetic Fields and Appendices 7.1 Calculation of Field Ellipse Parameters and 7.6 Electric Field Calculations for 3D Geometry).
  2) All wire positions are modeled at the specified weather case and wind direction. Height above ground determined by the modeled ground TIN.
  3) Only the effects of wires are being analyzed. The effects of structures are not included unless enabled as noted below.
  4) Ground return is being ignored for magnetic field calculations.

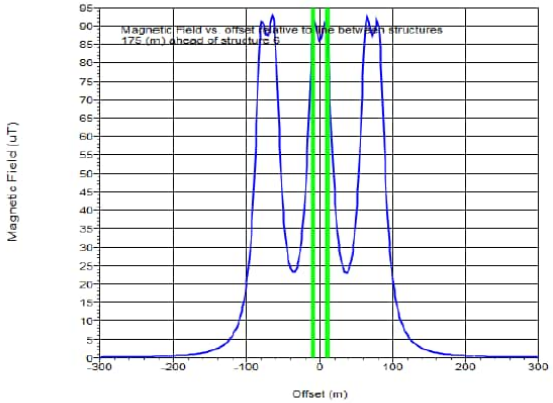

Meter height above ground:                  1.00 (m)
Maximum wire distance:                    300.00 (m)
Maximum cable segment size:                 3.00 (m)
Cross section offset +/-:                 300.00 (m)
Result interval:                            1.00 (m)
Electric field limit:                       9.00 (kV/m)
Magnetic field limit:                     360.00 (uT)
Space potential limit:                      0.00 (kV)
Contour Map Spacing:                           3 (m)
Analyzing spans between these structures:  6 - 7

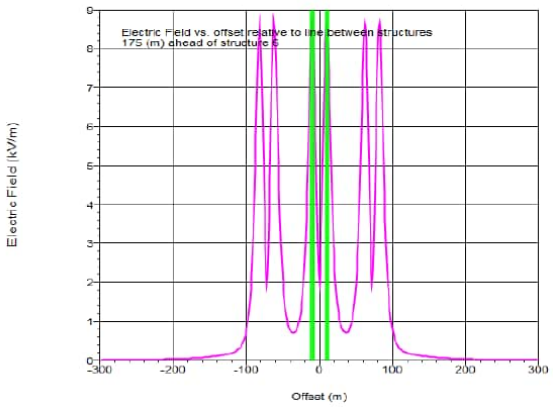
One or more sections have wind from both directions which is not supported. A wind direction of left is being used for those sections.

Section Data for 3D EMF Results:

 Section Section Voltage Current | ----------------------Cable---------------------- | Conductors   Bundle |   Cable Weather    Condition  Wind          WC |Effective
  Number    Note   Ph-Ph         |                Filename                Description |  Per Phase Diameter |   Radius    Case               Dir. Temperature |  Radius
                     (kV)  (Amps) |                                                    |                    (cm) |     (cm)                              (deg C) |    (cm)
-------------------------------------------------------------------------------------------------------------------------------------------------------------------
       1          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
       2          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
       3          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
       4          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
       5          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
       6          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
       7          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
       8          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
       9          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
      10          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
      11          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
      12          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
      13          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
      14          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
      15          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
      16          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
      17          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700
      18          400.0  5000.0   700mm aaac araucaria.wir 700mm² AAAC - Araucaria (H)          3   57.735    1.863  Max Op     Creep FE  Left      90.000    16.700

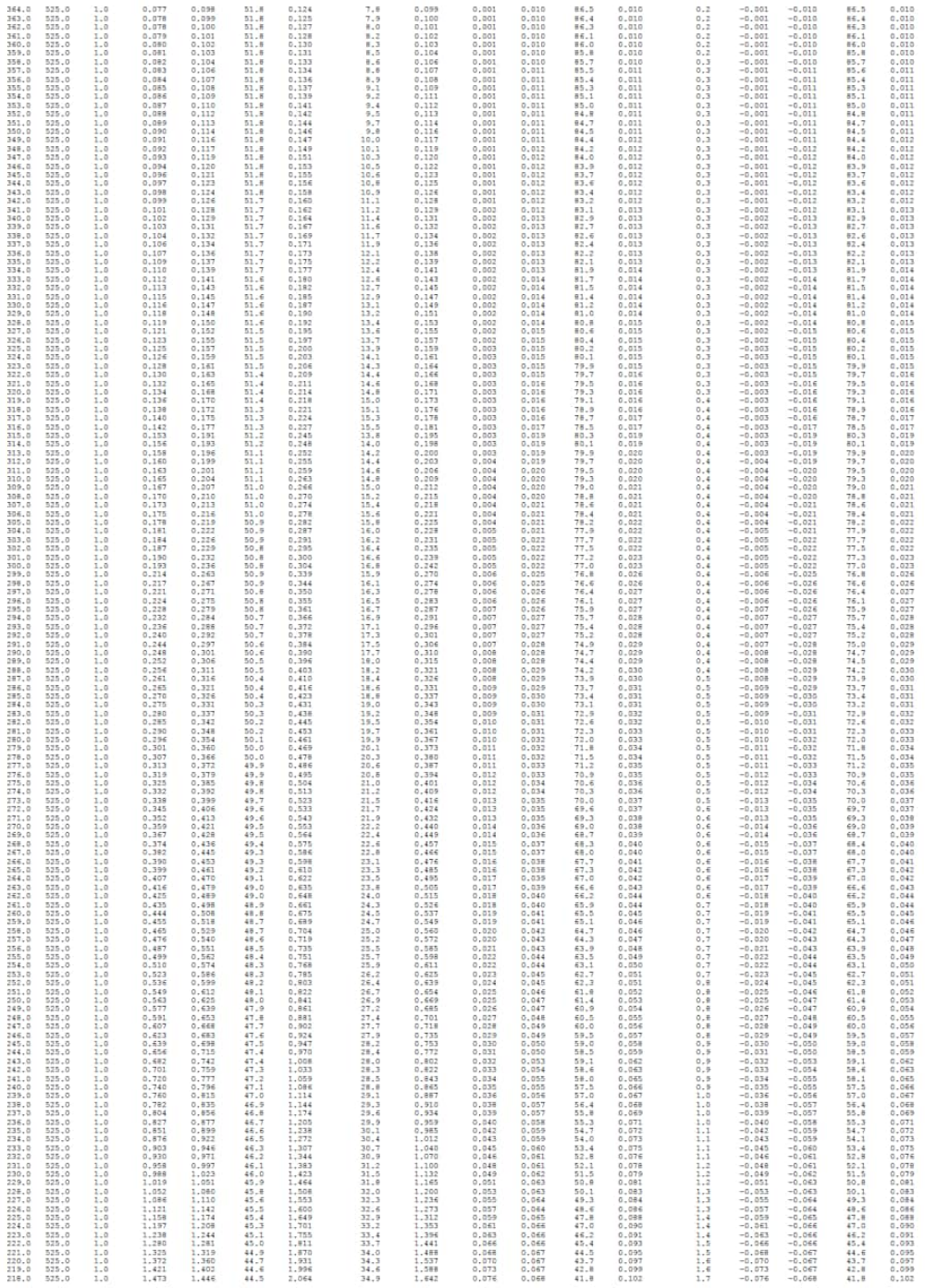
Wire low point cross section results between structures 6 and 7
```



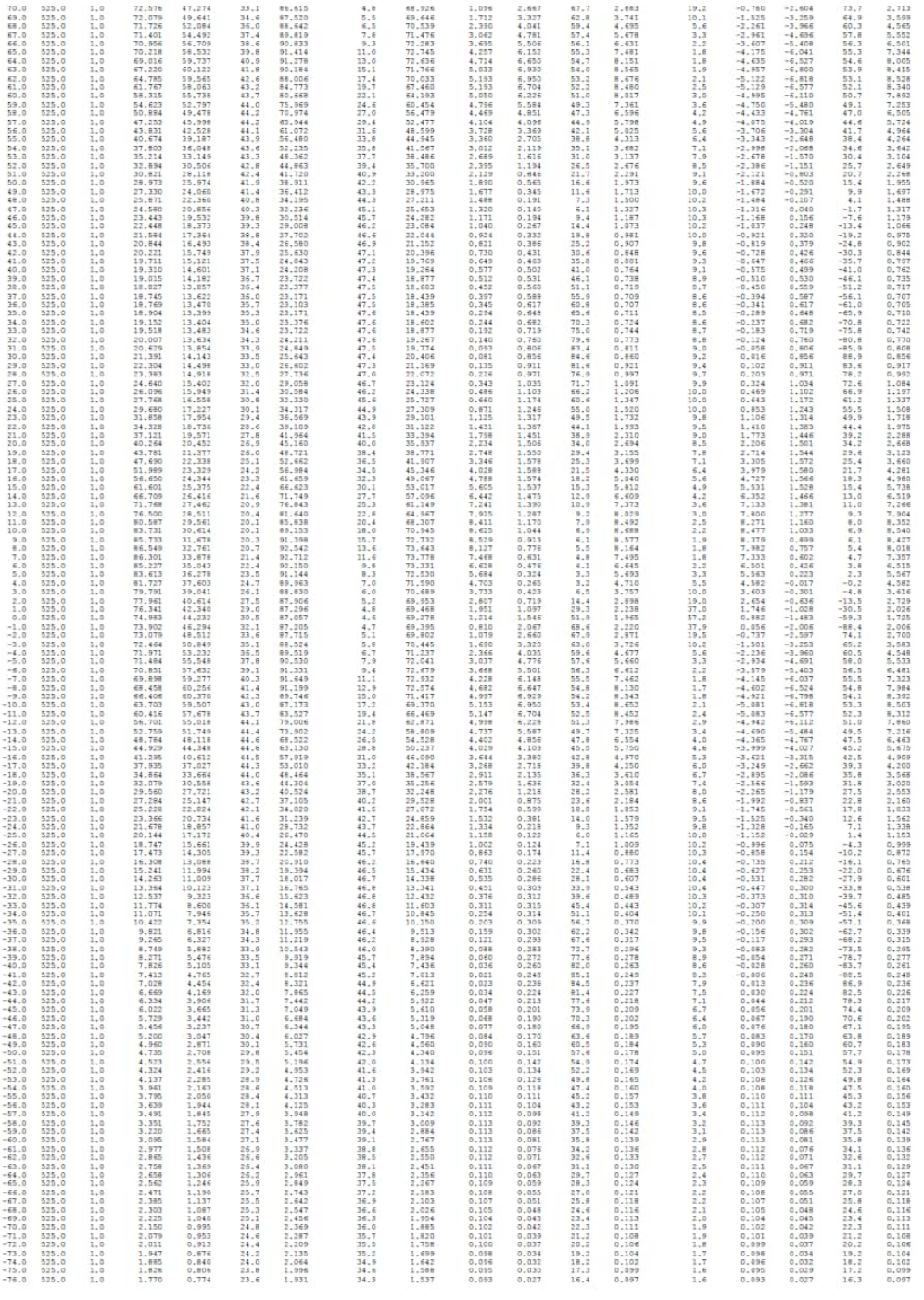


3D EMF Point Results Span from 6 to 7:

Measurement			B					H	EF					Space Potential			
X (m)	Y (m)	Z (m)	Real (uT)	Imaginary (uT)	Angle (deg)	Magnitude (uT)	Polarization Axial Ratio %	Magnitude (A/m)	Real (kV/m)	Imaginary (kV/m)	Angle (deg)	Magnitude (kV/m)	Polarization Axial Ratio %	Real (kV)	Imaginary (kV)	Angle (deg)	Magnitude (kV)
372.0	525.0	1.0	0.052	0.066	51.7	0.084	7.5	0.067	0.000	0.007	89.1	0.007	0.2	-0.000	-0.007	89.1	0.007
371.0	525.0	1.0	0.071	0.090	51.8	0.115	6.8	0.092	0.000	0.009	87.5	0.009	0.2	-0.000	-0.009	87.5	0.009
370.0	525.0	1.0	0.072	0.091	51.8	0.116	6.9	0.093	0.000	0.009	87.3	0.009	0.2	-0.000	-0.009	87.3	0.009
369.0	525.0	1.0	0.073	0.092	51.8	0.118	7.1	0.094	0.000	0.009	87.2	0.009	0.2	-0.000	-0.009	87.2	0.009
368.0	525.0	1.0	0.073	0.093	51.8	0.119	7.2	0.095	0.000	0.009	87.1	0.009	0.2	-0.000	-0.009	87.1	0.009
367.0	525.0	1.0	0.074	0.094	51.8	0.120	7.3	0.096	0.001	0.010	86.9	0.010	0.2	-0.001	-0.010	86.9	0.010
366.0	525.0	1.0	0.075	0.095	51.8	0.121	7.5	0.097	0.001	0.010	86.8	0.010	0.2	-0.001	-0.010	86.8	0.010
365.0	525.0	1.0	0.076	0.096	51.8	0.123	7.6	0.098	0.001	0.010	86.7	0.010	0.2	-0.001	-0.010	86.7	0.010



217.0	525.0	1.0	1.527	1.492	44.3	2.135	35.2	1.699	0.078	0.068	40.8	0.104	1.7	-0.078	-0.068	40.8	0.104
216.0	525.0	1.0	1.584	1.540	44.2	2.209	35.5	1.758	0.081	0.068	39.8	0.106	1.8	-0.081	-0.068	39.8	0.106
215.0	525.0	1.0	1.644	1.590	44.0	2.287	35.7	1.820	0.084	0.068	38.8	0.108	1.9	-0.084	-0.068	38.8	0.108
214.0	525.0	1.0	1.707	1.643	43.9	2.369	36.0	1.885	0.088	0.068	37.7	0.111	1.9	-0.088	-0.068	37.7	0.111
213.0	525.0	1.0	1.774	1.698	43.8	2.456	36.3	1.954	0.091	0.068	36.6	0.113	2.0	-0.091	-0.067	36.6	0.113
212.0	525.0	1.0	1.844	1.756	43.6	2.547	36.6	2.026	0.094	0.067	35.5	0.116	2.1	-0.094	-0.067	35.4	0.116
211.0	525.0	1.0	1.918	1.817	43.5	2.642	36.9	2.103	0.098	0.067	34.2	0.118	2.2	-0.098	-0.067	34.2	0.118
210.0	525.0	1.0	1.996	1.881	43.3	2.743	37.2	2.183	0.101	0.066	33.0	0.121	2.2	-0.101	-0.066	33.0	0.121
209.0	525.0	1.0	2.079	1.948	43.1	2.849	37.5	2.267	0.105	0.065	31.7	0.124	2.3	-0.105	-0.065	31.7	0.124
208.0	525.0	1.0	2.166	2.019	43.0	2.961	37.8	2.356	0.109	0.064	30.3	0.127	2.4	-0.109	-0.064	30.3	0.127
207.0	525.0	1.0	2.259	2.093	42.8	3.080	38.1	2.451	0.113	0.063	28.9	0.130	2.5	-0.113	-0.063	28.9	0.129
206.0	525.0	1.0	2.357	2.171	42.7	3.205	38.5	2.550	0.118	0.061	27.4	0.133	2.7	-0.118	-0.061	27.4	0.132
205.0	525.0	1.0	2.460	2.254	42.5	3.337	38.8	2.655	0.122	0.059	25.9	0.136	2.8	-0.122	-0.059	25.9	0.136
204.0	525.0	1.0	2.571	2.341	42.3	3.477	39.1	2.767	0.127	0.057	24.3	0.139	2.9	-0.126	-0.057	24.2	0.139
203.0	525.0	1.0	2.688	2.432	42.1	3.625	39.4	2.884	0.131	0.055	22.6	0.142	3.1	-0.131	-0.054	22.5	0.142
202.0	525.0	1.0	2.812	2.529	42.0	3.782	39.7	3.009	0.136	0.052	20.8	0.146	3.2	-0.136	-0.051	20.7	0.145
201.0	525.0	1.0	2.944	2.631	41.8	3.948	40.0	3.142	0.141	0.048	18.9	0.149	3.4	-0.141	-0.048	18.8	0.149
200.0	525.0	1.0	3.085	2.739	41.6	4.125	40.3	3.283	0.146	0.045	17.0	0.153	3.6	-0.146	-0.044	16.8	0.153
199.0	525.0	1.0	3.235	2.853	41.4	4.313	40.7	3.432	0.151	0.040	14.9	0.157	3.8	-0.151	-0.040	14.7	0.156
198.0	525.0	1.0	3.395	2.974	41.2	4.513	41.0	3.592	0.157	0.035	12.7	0.160	4.0	-0.156	-0.035	12.5	0.160
197.0	525.0	1.0	3.566	3.102	41.0	4.726	41.3	3.761	0.162	0.030	10.5	0.165	4.2	-0.162	-0.029	10.2	0.164
196.0	525.0	1.0	3.749	3.238	40.8	4.953	41.6	3.942	0.167	0.024	8.1	0.169	4.5	-0.167	-0.023	7.7	0.169
195.0	525.0	1.0	3.944	3.382	40.6	5.196	42.0	4.134	0.173	0.017	5.8	0.174	4.7	-0.173	-0.015	5.1	0.173
194.0	525.0	1.0	4.154	3.534	40.4	5.454	42.3	4.340	0.178	0.011	3.7	0.178	5.0	-0.178	-0.007	2.3	0.178
193.0	525.0	1.0	4.379	3.697	40.2	5.731	42.6	4.560	0.183	0.010	3.1	0.184	5.3	-0.183	0.002	-0.7	0.183
192.0	525.0	1.0	4.620	3.869	39.9	6.027	42.9	4.796	0.189	0.016	5.0	0.189	5.7	-0.189	0.012	-3.8	0.189
191.0	525.0	1.0	4.880	4.053	39.7	6.344	43.3	5.048	0.194	0.027	7.9	0.195	6.0	-0.193	0.024	-7.1	0.195
190.0	525.0	1.0	5.160	4.248	39.5	6.684	43.6	5.319	0.198	0.039	11.2	0.202	6.4	-0.198	0.037	-10.6	0.202
189.0	525.0	1.0	5.462	4.457	39.2	7.049	43.9	5.610	0.203	0.054	14.8	0.209	6.7	-0.202	0.052	-14.4	0.209
188.0	525.0	1.0	5.787	4.679	39.0	7.442	44.2	5.922	0.206	0.070	18.7	0.218	7.1	-0.206	0.068	-18.3	0.217
187.0	525.0	1.0	6.139	4.916	38.7	7.865	44.5	6.259	0.209	0.088	22.8	0.227	7.5	-0.209	0.086	-22.5	0.226
186.0	525.0	1.0	6.521	5.168	38.4	8.321	44.9	6.621	0.211	0.108	27.1	0.237	7.9	-0.211	0.107	-26.9	0.236
185.0	525.0	1.0	6.934	5.439	38.1	8.812	45.2	7.013	0.212	0.131	31.7	0.249	8.3	-0.211	0.129	-31.5	0.248
184.0	525.0	1.0	7.383	5.727	37.8	9.344	45.4	7.436	0.211	0.156	36.4	0.263	8.6	-0.211	0.155	-36.3	0.261
183.0	525.0	1.0	7.872	6.036	37.5	9.919	45.7	7.894	0.209	0.184	41.4	0.278	8.9	-0.208	0.182	-41.3	0.277
182.0	525.0	1.0	8.404	6.366	37.1	10.543	46.0	8.390	0.204	0.215	46.5	0.296	9.3	-0.203	0.213	-46.5	0.295
181.0	525.0	1.0	8.985	6.719	36.8	11.219	46.2	8.928	0.196	0.249	51.8	0.317	9.5	-0.195	0.248	-51.8	0.315
180.0	525.0	1.0	9.620	7.097	36.4	11.955	46.4	9.513	0.185	0.287	57.2	0.342	9.8	-0.183	0.286	-57.3	0.339
179.0	525.0	1.0	10.316	7.502	36.0	12.755	46.6	10.150	0.170	0.329	62.7	0.370	9.9	-0.167	0.327	-62.9	0.368
178.0	525.0	1.0	11.079	7.936	35.6	13.628	46.7	10.845	0.150	0.375	68.2	0.404	10.1	-0.146	0.373	-68.6	0.401
177.0	525.0	1.0	11.918	8.400	35.2	14.581	46.8	11.603	0.125	0.425	73.6	0.443	10.2	-0.118	0.423	-74.4	0.439
176.0	525.0	1.0	12.843	8.896	34.7	15.623	46.8	12.432	0.094	0.480	78.9	0.489	10.3	-0.082	0.478	-80.3	0.485
175.0	525.0	1.0	13.863	9.427	34.2	16.765	46.8	13.341	0.065	0.539	83.1	0.543	10.4	-0.036	0.537	-86.2	0.538
174.0	525.0	1.0	14.991	9.995	33.7	18.017	46.7	14.338	0.067	0.603	83.6	0.607	10.4	0.022	0.601	87.9	0.601
173.0	525.0	1.0	16.240	10.601	33.1	19.394	46.5	15.434	0.120	0.672	79.9	0.683	10.4	0.094	0.670	82.0	0.676
172.0	525.0	1.0	17.627	11.248	32.5	20.910	46.2	16.640	0.204	0.745	74.7	0.773	10.4	0.184	0.743	76.1	0.765
171.0	525.0	1.0	19.169	11.937	31.9	22.582	45.7	17.970	0.313	0.823	69.2	0.880	10.3	0.296	0.820	70.2	0.872
170.0	525.0	1.0	20.886	12.669	31.2	24.428	45.2	19.439	0.450	0.904	63.5	1.009	10.2	0.433	0.900	64.3	0.999
169.0	525.0	1.0	22.801	13.446	30.5	26.470	44.5	21.064	0.618	0.987	57.9	1.165	10.0	0.601	0.983	58.6	1.153
168.0	525.0	1.0	24.939	14.267	29.8	28.732	43.7	22.864	0.825	1.071	52.4	1.352	9.8	0.807	1.067	52.9	1.338
167.0	525.0	1.0	27.329	15.133	29.0	31.239	42.7	24.859	1.076	1.155	47.0	1.579	9.5	1.056	1.151	47.4	1.562
166.0	525.0	1.0	30.000	16.042	28.1	34.020	41.5	27.072	1.381	1.236	41.8	1.853	9.1	1.358	1.231	42.2	1.833
165.0	525.0	1.0	32.986	16.993	27.3	37.105	40.2	29.528	1.747	1.311	36.9	2.184	8.6	1.721	1.306	37.2	2.160
164.0	525.0	1.0	36.316	17.982	26.3	40.524	38.7	32.248	2.183	1.378	32.3	2.581	8.0	2.153	1.372	32.5	2.553
163.0	525.0	1.0	40.020	19.005	25.4	44.304	37.0	35.256	2.697	1.432	28.0	3.054	7.4	2.662	1.426	28.2	3.020
162.0	525.0	1.0	44.118	20.059	24.4	48.464	35.1	38.567	3.296	1.471	24.1	3.610	6.7	3.254	1.464	24.2	3.568
161.0	525.0	1.0	48.614	21.136	23.5	53.010	33.2	42.184	3.980	1.490	20.5	4.250	6.0	3.930	1.482	20.7	4.200
160.0	525.0	1.0	53.483	22.231	22.6	57.919	31.0	46.090	4.743	1.487	17.4	4.970	5.3	4.681	1.478	17.5	4.909
159.0	525.0	1.0	58.658	23.337	21.7	63.130	28.8	50.237	5.562	1.459	14.7	5.750	4.6	5.487	1.450	14.8	5.675
158.0	525.0	1.0	64.011	24.450	20.9	68.522	26.5	54.528	6.402	1.406	12.4	6.554	4.0	6.311	1.396	12.5	6.463
157.0	525.0	1.0	69.340	25.563	20.2	73.902	24.2	58.809	7.203	1.329	10.5	7.325	3.4	7.095	1.320	10.5	7.216
156.0	525.0	1.0	74.367	26.674	19.7	79.006	21.8	62.871	7.890	1.233	8.9	7.986	2.9	7.764	1.224	9.0	7.860
155.0	525.0	1.0	78.771	27.784	19.4	83.527	19.4	66.469	8.378	1.123	7.6	8.452	2.4	8.237	1.113	7.7	8.312
154.0	525.0	1.0	82.246	28.894	19.4	87.173	17.2	69.370	8.593	1.003	6.7	8.652	2.1	8.445	0.992	6.7	8.503
153.0	525.0	1.0	84.579	30.010	19.5	89.746	15.0	71.417	8.498	0.876	5.9	8.543	1.8	8.348	0.862	5.9	8.392
152.0	525.0	1.0	85.716	31.144	20.0	91.199	12.9	72.574	8.096	0.743	5.2	8.130	1.7	7.951	0.724	5.2	7.984
151.0	525.0	1.0	85.765	32.308	20.6	91.649	11.1	72.932	7.437	0.601	4.6	7.462	1.8	7.301	0.571	4.5	7.323
150.0	525.0	1.0	84.958	33.519	21.5	91.331	9.4	72.679	6.596	0.449	3.9	6.612	2.2	6.469	0.398	3.5	6.481
149.0	525.0	1.0	83.575	34.798	22.6	90.530	7.9	72.041	5.652	0.304	3.1	5.660	3.3	5.530	0.196	2.0	5.533
148.0	525.0	1.0	81.887	36.168	23.8	89.519	6.7	71.237	4.670	0.265	3.2	4.677	5.6	4.547	-0.043	-0.5	4.548
147.0	525.0	1.0	80.119	37.651	25.2	88.524	5.8	70.445	3.700	0.439	6.8	3.726	10.2	3.568	-0.326	-5.2	3.583
146.0	525.0	1.0	78.433	39.271	26.6	87.715	5.1	69.802	2.774	0.739	14.9	2.871	19.5	2.618	-0.660	-14.1	2.700
145.0	525.0	1.0	76.938	41.051	28.1	87.205	4.7	69.395	1.918	1.117	30.2	2.220	37.9	1.709	-1.051	-31.6	2.006
144.0	525.0	1.0	75.694	43.004	29.6	87.057	4.6	69.278	1.187	1.566	52.8	1.965	57.2	0.844	-1.505	-60.7	1.725
143.0	525.0	1.0	74.720	45.138	31.1	87.296	4.8	69.468	0.809	2.086	68.8	2.238	37.0	0.017	-2.026	-89.5	2.026
142.0	525.0	1.0	74.003	47.445	32.7	87.906	5.2	69.953	1.107	2.678	67.5	2.898	19.0	-0.776	-2.617	73.5	2.729
141.0	525.0	1.0	73.497	49.890	34.2	88.830	6.0	70.689	1.725	3.338	62.7	3.757	10.0	-1.540	-3.271	64.8	3.616
140.0	525.0	1.0	73.121	52.409	35.6	89.963	7.0	71.590	2.404	4.051	59.3	4.710	5.5	-2.276	-3.977	60.2	4.582
139.0	525.0	1.0	72.760	54.892	37.0	91.144	8.3	72.530	3.075	4.791	57.3	5.693	3.3	-2.974	-4.706	57.7	5.567
138.0	525.0	1.0	72.265	57.179	38.4	92.150	9.8	73.331	3.708	5.514	56.1	6.645	2.2	-3.620	-5.417	56.2	6.515
137.0	525.0	1.0	71.462	59.065	39.6	92.712	11.6	73.778	4.269	6.160	55.3	7.495	1.8	-4.188	-6.050	55.3	7.357
136.0	525.0	1.0	70.180	60.322	40.7	92.542	13.6	73.643	4.725	6.657	54.6	8.164	1.8	-4.647	-6.534	54.6	8.018
135.0	525.0	1.0	68.290	60.746	41.7	91.398	15.7	72.732	5.044	6.937	54.0	8.577	1.9	-4.968	-6.807	53.9	8.427
134.0	525.0	1.0	65.749	60.210	42.5	89.153	18.0	70.945	5.204	6.957	53.2	8.688	2.2	-5.133	-6.825	53.1	8.540
133.0	525.0	1.0	62.619	58.711	43.2	85.838	20.4	68.307	5.204	6.710	52.2	8.492	2.5	-5.140	-6.583	52.0	8.352
132.0	525.0	1.0	59.052	56.373	43.7	81.640	22.8	64.967	5.061	6.233	50.9	8.029	3.0	-5.006	-6.116	50.7	7.904
131.0	525.0	1.0	55.249	53.407	44.0	76.843	25.3	61.149	4.808	5.590	49.3	7.373	3.6	-4.762	-5.487	49.0	7.266
130.0	525.0	1.0	51.407	50.052	44.2	71.749	27.7	57.096	4.481	4.857	47.3	6.609	4.2	-4.445	-4.768	47.0	6.519
129.0	525.0	1.0	47.682	46.530	44.3	66.623	30.1	53.017	4.117	4.103	44.9	5.812	4.9	-4.089	-4.026	44.6	5.738
128.0	525.0	1.0	44.177	43.015	44.2	61.659	32.3	49.067	3.742	3.377	42.1	5.040	5.6	-3.720	-3.311	41.7	4.980
127.0	525.0	1.0	40.947	39.629	44.1	56.984	34.5	45.346	3.375	2.713	38.8	4.330	6.4	-3.357	-2.656	38.3	4.281
126.0	525.0	1.0	38.012	36.447	43.8	52.662	36.5	41.907	3.027	2.127	35.1	3.699	7.1	-3.013	-2.076	34.6	3.660
125.0	525.0	1.0	35.370	33.507	43.5	48.721	38.4	38.771	2.705	1.624	31.0	3.155	7.8	-2.694	-1.579	30.4	3.123
124.0	525.0	1.0	33.003	30.826	43.0	45.160	40.0	35.937	2.412	1.202	26.5	2.694	8.5	-2.403	-1.160	25.8	2.668
123.0	525.0	1.0	30.891	28.403	42.6	41.964	41.5	33.394	2.146	0.854	21.7	2.310	9.0	-2.139	-0.813	20.8	2.288
122.0	525.0	1.0	29.010	26.228	42.1	39.109	42.8	31.122	1.908	0.574	16.7	1.993	9.5	-1.902	-0.529	15.6	1.975
121.0	525.0	1.0	27.339	24.287	41.6	36.569	43.9	29.101	1.696	0.353	11.8	1.732	9.8	-1.691	-0.301	10.1	1.718
120.0	525.0	1.0	25.857	22.563	41.1	34.317	44.9	27.309	1.507	0.196	7.4	1.520	10.0	-1.503	-0.117	4.5	1.508
119.0	525.0	1.0	24.548	21.038	40.6	32.330	45.6	25.727	1.340	0.136	5.8	1.347	10.0	-1.336	0.029	-1.2	1.337
118.0	525.0	1.0	23.397	19.697	40.1	30.584	46.2	24.338	1.191	0.184	8.8	1.206	10.0	-1.188	0.145	-6.9	1.197
117.0	525.0	1.0	22.390	18.522	39.6	29.058	46.7	23.124	1.060	0.256	13.6	1.091	9.9	-1.058	0.236	-12.6	1.084
116.0	525.0	1.0	21.518	17.500	39.1	27.736	47.0	22.072	0.944	0.320	18.7	0.997	9.7	-0.942	0.309	-18.2	0.992
115.0	525.0	1.0	20.772	16.619	38.7	26.602	47.3	21.169	0.842	0.374	24.0	0.921	9.4	-0.840	0.367	-23.6	0.917
114.0	525.0	1.0	20.146	15.865	38.2	25.643	47.4	20.406	0.751	0.419	29.2	0.860	9.2	-0.749	0.414	-28.9	0.856
113.0	525.0	1.0	19.635	15.230	37.8	24.849	47.5	19.774	0.670	0.457	34.3	0.811	9.0	-0.669	0.454	-34.1	0.808
112.0	525.0	1.0	19.234	14.705	37.4	24.211	47.6	19.267	0.598	0.489	39.3	0.773	8.8	-0.597	0.487	-39.2	0.770
111.0	525.0	1.0	18.942	14.281	37.0	23.722	47.6	18.877	0.533	0.519	44.2	0.744	8.7	-0.531	0.518	-44.2	0.742
110.0	525.0	1.0	18.756	13.952	36.6	23.376	47.6	18.602	0.474	0.547	49.1	0.724	8.6	-0.472	0.546	-49.2	0.722
109.0	525.0	1.0	18.677	13.713	36.3	23.171	47.6	18.439	0.419	0.575	53.9	0.711	8.5	-0.416	0.575	-54.1	0.710
108.0	525.0	1.0	18.706	13.558	35.9	23.103	47.5	18.385	0.367	0.604	58.7	0.707	8.6	-0.363	0.604	-59.0	0.705
107.0	525.0	1.0	18.845	13.482	35.6	23.171	47.5	18.439	0.316	0.635	63.6	0.709	8.6	-0.311	0.635	-63.9	0.707
106.0	525.0	1.0	19.097	13.483	35.2	23.377	47.5	18.603	0.265	0.669	68.4	0.719	8.7	-0.259	0.669	-68.8	0.717
105.0	525.0	1.0	19.466	13.557	34.9	23.722	47.4	18.877	0.213	0.706	73.2	0.738	8.9	-0.204	0.706	-73.9	0.735
104.0	525.0	1.0	19.958	13.702	34.5	24.208	47.3	19.264	0.160	0.747	77.9	0.764	9.1	-0.145	0.748	-79.0	0.762
103.0	525.0	1.0	20.580	13.914	34.1	24.843	47.2	19.769	0.108	0.793	82.2	0.801	9.3	-0.080	0.793	-84.3	0.797
102.0	525.0	1.0	21.342	14.192	33.6	25.630	47.1	20.396	0.081	0.844	84.5	0.848	9.6	-0.005	0.843	-89.7	0.844
101.0	525.0	1.0	22.254	14.535	33.2	26.580	46.9	21.152	0.121	0.899	82.3	0.907	9.8	0.081	0.898	84.8	0.902
100.0	525.0	1.0	23.327	14.941	32.6	27.702	46.6	22.044	0.209	0.959	77.7	0.981	10.0	0.183	0.958	79.2	0.975
99.0	525.0	1.0	24.578	15.408	32.1	29.008	46.2	23.084	0.325	1.023	72.4	1.073	10.2	0.304	1.022	73.4	1.066
98.0	525.0	1.0	26.023	15.935	31.5	30.514	45.7	24.282	0.468	1.091	66.8	1.187	10.3	0.449	1.089	67.6	1.179
97.0	525.0	1.0	27.681	16.521	30.8	32.236	45.1	25.653	0.642	1.162	61.1	1.327	10.3	0.624	1.160	61.7	1.317
96.0	525.0	1.0	29.575	17.163	30.1	34.195	44.3	27.211	0.853	1.234	55.3	1.500	10.2	0.834	1.232	55.9	1.488
95.0	525.0	1.0	31.730	17.860	29.4	36.412	43.3	28.975	1.108	1.306	49.7	1.713	10.0	1.088	1.303	50.1	1.697
94.0	525.0	1.0	34.173	18.608	28.6	38.911	42.2	30.965	1.414	1.376	44.2	1.973	9.6	1.392	1.372	44.6	1.955
93.0	525.0	1.0	36.932	19.405	27.7	41.720	40.9	33.200	1.782	1.440	38.9	2.291	9.1	1.756	1.436	39.3	2.268
92.0	525.0	1.0	40.035	20.245	26.8	44.863	39.4	35.700	2.218	1.496	34.0	2.676	8.5	2.189	1.491	34.3	2.649
91.0	525.0	1.0	43.506	21.123	25.9	48.362	37.7	38.486	2.733	1.540	29.4	3.137	7.9	2.699	1.534	29.6	3.104
90.0	525.0	1.0	47.360	22.035	25.0	52.235	35.8	41.567	3.331	1.569	25.2	3.682	7.1	3.290	1.562	25.4	3.642
89.0	525.0	1.0	51.596	22.974	24.0	56.480	33.8	44.945	4.014	1.579	21.5	4.313	6.4	3.964	1.571	21.6	4.264
88.0	525.0	1.0	56.187	23.933	23.1	61.072	31.6	48.599	4.775	1.566	18.2	5.025	5.6	4.714	1.557	18.3	4.964
87.0	525.0	1.0	61.060	24.905	22.2	65.944	29.4	52.477	5.593	1.529	15.3	5.798	4.9	5.518	1.520	15.4	5.724
86.0	525.0	1.0	66.085	25.886	21.4	70.974	27.0	56.479	6.430	1.468	12.9	6.596	4.2	6.340	1.458	13.0	6.505
85.0	525.0	1.0	71.058	26.870	20.7	75.969	24.6	60.454	7.229	1.383	10.8	7.361	3.6	7.121	1.374	10.9	7.253
84.0	525.0	1.0	75.706	27.855	20.2	80.669	22.1	64.193	7.914	1.280	9.2	8.017	3.0	7.789	1.271	9.3	7.892
83.0	525.0	1.0	79.716	28.842	19.9	84.773	19.7	67.460	8.400	1.163	7.9	8.480	2.5	8.260	1.153	7.9	8.340
82.0	525.0	1.0	82.795	29.833	19.8	88.006	17.4	70.033	8.614	1.038	6.9	8.676	2.1	8.466	1.027	6.9	8.528
81.0	525.0	1.0	84.749	30.835	20.0	90.184	15.1	71.766	8.517	0.907	6.1	8.565	1.9	8.367	0.893	6.1	8.415
80.0	525.0	1.0	85.537	31.858	20.4	91.278	13.0	72.636	8.114	0.770	5.4	8.151	1.8	7.970	0.751	5.4	8.005
79.0	525.0	1.0	85.282	32.917	21.1	91.414	11.0	72.745	7.455	0.625	4.8	7.481	1.8	7.320	0.595	4.7	7.344
78.0	525.0	1.0	84.218	34.028	22.0	90.833	9.3	72.283	6.614	0.470	4.1	6.631	2.2	6.487	0.420	3.7	6.501
77.0	525.0	1.0	82.630	35.211	23.1	89.819	7.8	71.476	5.669	0.319	3.2	5.678	3.3	5.548	0.216	2.2	5.552
76.0	525.0	1.0	80.783	36.489	24.3	88.642	6.5	70.539	4.687	0.265	3.2	4.695	5.6	4.565	-0.025	-0.3	4.565
75.0	525.0	1.0	78.895	37.885	25.6	87.520	5.5	69.646	3.717	0.428	6.6	3.741	10.1	3.585	-0.309	-4.9	3.599
74.0	525.0	1.0	77.124	39.421	27.1	86.615	4.8	68.926	2.790	0.726	14.6	2.883	19.2	2.635	-0.644	-13.7	2.713
73.0	525.0	1.0	75.571	41.118	28.6	86.033	4.3	68.463	1.934	1.104	29.7	2.226	37.5	1.726	-1.036	-31.0	2.013
72.0	525.0	1.0	74.290	42.991	30.1	85.832	4.2	68.303	1.200	1.553	52.3	1.962	57.3	0.861	-1.491	-60.0	1.721
71.0	525.0	1.0	73.297	45.046	31.6	86.033	4.3	68.463	0.810	2.074	68.7	2.226	37.5	0.034	-2.013	-89.0	2.013



Optimal Phasing of Adjacent Circuits

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PLS-CADD Version 20.01x64    13:59:08 02 July 2025
Scottish and Southern Energy
Project Name: 'C:\PLS\Combined_EMF_Check Temp\Combined_EMF_Check.don'
Line Title: 'Max Op'

3D EMF Calculation Notes:
  1) Calculations based on the EPRI Red Book methods (3rd Edition, 2005 - 7.4 Calculation of Magnetic Fields and Appendices 7.1 Calculation of Field Ellipse Parameters and 7.6 Electric Field Calculations for 3D Geometry).
  2) All wire positions are modeled at the specified weather case and wind direction. Height above ground determined by the modeled ground TIN.
  3) Only the effects of wires are being analyzed. The effects of structures are not included unless enabled as noted below.
  4) Ground return is being ignored for magnetic field calculations.


Meter height above ground:                1.00  (m)
Maximum wire distance:                  300.00  (m)
Maximum cable segment size:               3.00  (m)
Cross section offset +/-:               300.00  (m)
Result interval:                          1.00  (m)
Electric field limit:                     9.00  (kV/m)
Magnetic field limit:                   360.00  (uT)
Space potential limit:                    0.00  (kV)
Contour Map Spacing:                         3  (m)
Analyzing spans between these structures:  6 - 7

One or more sections have wind from both directions which is not supported. A wind direction of left is being used for those sections.
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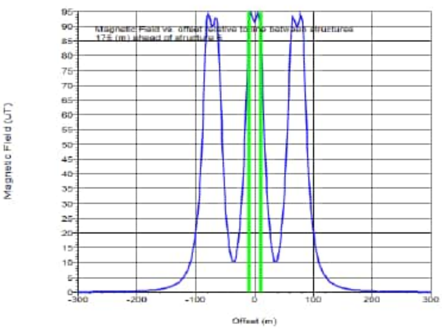
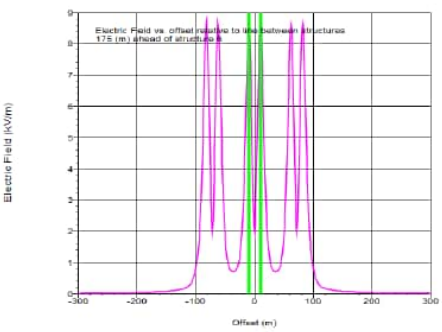
Section Data for 3D EMF Results:

Section Number	Section Note	Voltage Ph-Ph (kV)	Current (Amps)	Cable Filename	Cable Description	Conductors Per Phase	Bundle Diameter (cm)	Cable Radius (cm)	Weather Case	Condition	Wind Dir.	WC Temperature (deg C)	Effective Radius (cm)
1		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
2		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
3		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
4		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
5		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
6		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
7		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
8		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
9		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
10		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
11		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
12		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
13		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
14		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
15		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
16		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
17		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700
18		400.0	5000.0	700mm aaac araucaria.wir	700mm² AAAC - Araucaria (H)	3	57.735	1.863	Max Op	Creep FE	Left	90.000	16.700

Wire low point cross section results between structures 6 and 7





3D EMF Point Results Span from 6 to 7:

Measurement X (m)	Measurement Y (m)	Measurement Z (m)	B Real (uT)	B Imaginary (uT)	B Angle (deg)	B Magnitude (uT)	B Polarization Axial Ratio %	H Magnitude (A/m)	EF Real (kV/m)	EF Imaginary (kV/m)	EF Angle (deg)	EF Magnitude (kV/m)	EF Polarization Axial Ratio %	Space Potential Real (kV)	Space Potential Imaginary (kV)	Space Potential Angle (deg)	Space Potential Magnitude (kV)
372.0	525.0	1.0	0.052	0.066	51.7	0.084	7.5	0.067	0.002	0.008	78.2	0.008	0.2	-0.002	-0.008	78.2	0.008
371.0	525.0	1.0	0.023	0.062	69.6	0.066	12.7	0.053	0.001	0.009	86.2	0.009	0.2	0.001	-0.009	-86.2	0.009
370.0	525.0	1.0	0.023	0.063	69.5	0.067	12.9	0.053	0.001	0.009	86.3	0.009	0.2	0.001	-0.009	-86.3	0.009
369.0	525.0	1.0	0.024	0.064	69.5	0.068	13.1	0.054	0.001	0.009	86.4	0.009	0.2	0.001	-0.009	-86.4	0.009
368.0	525.0	1.0	0.024	0.064	69.5	0.069	13.3	0.055	0.001	0.009	86.5	0.009	0.2	0.001	-0.009	-86.5	0.009
367.0	525.0	1.0	0.024	0.065	69.4	0.069	13.5	0.055	0.001	0.009	86.6	0.009	0.2	0.001	-0.009	-86.6	0.009
366.0	525.0	1.0	0.025	0.066	69.4	0.070	13.8	0.056	0.001	0.009	86.7	0.009	0.2	0.001	-0.009	-86.7	0.009
365.0	525.0	1.0	0.025	0.066	69.4	0.071	14.0	0.057	0.001	0.009	86.8	0.009	0.2	0.001	-0.009	-86.8	0.009
364.0	525.0	1.0	0.025	0.067	69.3	0.072	14.2	0.057	0.000	0.009	86.9	0.009	0.2	0.000	-0.009	-86.9	0.009
363.0	525.0	1.0	0.026	0.068	69.3	0.073	14.4	0.058	0.000	0.009	87.0	0.009	0.2	0.000	-0.009	-87.0	0.009
362.0	525.0	1.0	0.026	0.069	69.2	0.074	14.6	0.059	0.000	0.009	87.1	0.009	0.2	0.000	-0.009	-87.1	0.009
361.0	525.0	1.0	0.026	0.070	69.2	0.074	14.9	0.059	0.000	0.009	87.2	0.010	0.2	0.000	-0.009	-87.2	0.010
360.0	525.0	1.0	0.027	0.070	69.1	0.075	15.1	0.060	0.000	0.010	87.3	0.010	0.2	0.000	-0.010	-87.3	0.010
359.0	525.0	1.0	0.027	0.071	69.1	0.076	15.3	0.061	0.000	0.010	87.5	0.010	0.2	0.000	-0.010	-87.5	0.010
358.0	525.0	1.0	0.028	0.072	69.0	0.077	15.5	0.061	0.000	0.010	87.6	0.010	0.2	0.000	-0.010	-87.6	0.010
357.0	525.0	1.0	0.028	0.073	69.0	0.078	15.7	0.062	0.000	0.010	87.7	0.010	0.2	0.000	-0.010	-87.7	0.010
356.0	525.0	1.0	0.028	0.074	68.9	0.079	16.0	0.063	0.000	0.010	87.8	0.010	0.2	0.000	-0.010	-87.8	0.010
355.0	525.0	1.0	0.029	0.075	68.9	0.080	16.2	0.064	0.000	0.010	87.9	0.010	0.2	0.000	-0.010	-87.9	0.010
354.0	525.0	1.0	0.029	0.076	68.8	0.081	16.4	0.065	0.000	0.010	88.0	0.010	0.2	0.000	-0.010	-88.0	0.010
353.0	525.0	1.0	0.030	0.076	68.8	0.082	16.7	0.065	0.000	0.010	88.2	0.010	0.2	0.000	-0.010	-88.2	0.010
352.0	525.0	1.0	0.030	0.077	68.7	0.083	16.9	0.066	0.000	0.010	88.3	0.010	0.2	0.000	-0.010	-88.3	0.010
351.0	525.0	1.0	0.031	0.078	68.6	0.084	17.1	0.067	0.000	0.010	88.4	0.010	0.2	0.000	-0.010	-88.4	0.010
350.0	525.0	1.0	0.031	0.079	68.6	0.085	17.3	0.068	0.000	0.011	88.5	0.011	0.2	0.000	-0.011	-88.5	0.011
349.0	525.0	1.0	0.032	0.080	68.5	0.086	17.6	0.069	0.000	0.011	88.6	0.011	0.2	0.000	-0.011	-88.6	0.011
348.0	525.0	1.0	0.032	0.081	68.5	0.087	17.8	0.070	0.000	0.011	88.8	0.011	0.2	0.000	-0.011	-88.8	0.011
347.0	525.0	1.0	0.033	0.082	68.4	0.089	18.0	0.070	0.000	0.011	88.9	0.011	0.2	0.000	-0.011	-88.9	0.011
346.0	525.0	1.0	0.033	0.083	68.3	0.090	18.3	0.071	0.000	0.011	89.0	0.011	0.2	0.000	-0.011	-89.0	0.011
345.0	525.0	1.0	0.034	0.084	68.2	0.091	18.5	0.072	0.000	0.011	89.2	0.011	0.2	0.000	-0.011	-89.2	0.011
344.0	525.0	1.0	0.034	0.086	68.2	0.092	18.7	0.073	0.000	0.011	89.3	0.011	0.2	0.000	-0.011	-89.3	0.011
343.0	525.0	1.0	0.035	0.087	68.1	0.093	18.9	0.074	0.000	0.011	89.4	0.011	0.2	0.000	-0.011	-89.4	0.011
342.0	525.0	1.0	0.035	0.088	68.0	0.095	19.2	0.075	0.000	0.011	89.5	0.011	0.2	0.000	-0.011	-89.6	0.011
341.0	525.0	1.0	0.036	0.089	68.0	0.096	19.4	0.076	0.000	0.012	89.7	0.012	0.2	0.000	-0.012	-89.7	0.012
340.0	525.0	1.0	0.037	0.090	67.9	0.097	19.6	0.077	0.000	0.012	89.8	0.012	0.2	0.000	-0.012	-89.8	0.012
339.0	525.0	1.0	0.037	0.091	67.8	0.099	19.9	0.078	0.000	0.012	89.9	0.012	0.2	0.000	-0.012	-90.0	0.012
338.0	525.0	1.0	0.038	0.092	67.7	0.100	20.1	0.079	0.000	0.012	89.8	0.012	0.3	-0.000	-0.012	89.9	0.012
337.0	525.0	1.0	0.039	0.094	67.6	0.101	20.4	0.081	0.000	0.012	89.7	0.012	0.3	-0.000	-0.012	89.7	0.012
336.0	525.0	1.0	0.039	0.095	67.5	0.103	20.6	0.082	0.000	0.012	89.5	0.012	0.3	-0.000	-0.012	89.6	0.012
335.0	525.0	1.0	0.040	0.096	67.5	0.104	20.8	0.083	0.000	0.012	89.4	0.012	0.3	-0.000	-0.012	89.4	0.012
334.0	525.0	1.0	0.041	0.097	67.4	0.106	21.1	0.084	0.000	0.012	89.3	0.012	0.3	-0.000	-0.012	89.3	0.012
333.0	525.0	1.0	0.041	0.099	67.3	0.107	21.3	0.085	0.000	0.013	89.1	0.013	0.3	-0.000	-0.013	89.1	0.013
332.0	525.0	1.0	0.042	0.100	67.2	0.109	21.5	0.086	0.000	0.013	89.0	0.013	0.3	-0.000	-0.013	89.0	0.013
331.0	525.0	1.0	0.043	0.101	67.1	0.110	21.8	0.088	0.000	0.013	88.8	0.013	0.3	-0.000	-0.013	88.8	0.013
330.0	525.0	1.0	0.044	0.103	67.0	0.112	22.0	0.089	0.000	0.013	88.6	0.013	0.3	-0.000	-0.013	88.6	0.013
329.0	525.0	1.0	0.044	0.104	66.9	0.113	22.2	0.090	0.000	0.013	88.5	0.013	0.3	-0.000	-0.013	88.5	0.013
328.0	525.0	1.0	0.045	0.106	66.8	0.115	22.5	0.092	0.000	0.013	88.3	0.013	0.3	-0.000	-0.013	88.3	0.013
327.0	525.0	1.0	0.046	0.107	66.7	0.117	22.7	0.093	0.000	0.013	88.1	0.013	0.3	-0.000	-0.013	88.2	0.013
326.0	525.0	1.0	0.047	0.109	66.6	0.119	23.0	0.094	0.000	0.014	88.0	0.014	0.3	-0.000	-0.014	88.0	0.014
325.0	525.0	1.0	0.048	0.110	66.5	0.120	23.2	0.096	0.001	0.014	87.8	0.014	0.3	-0.001	-0.014	87.8	0.014
324.0	525.0	1.0	0.049	0.112	66.4	0.122	23.4	0.097	0.001	0.014	87.6	0.014	0.3	-0.001	-0.014	87.6	0.014
323.0	525.0	1.0	0.050	0.114	66.3	0.124	23.7	0.099	0.001	0.014	87.5	0.014	0.3	-0.001	-0.014	87.5	0.014
322.0	525.0	1.0	0.051	0.115	66.2	0.126	23.9	0.100	0.001	0.014	87.3	0.014	0.3	-0.001	-0.014	87.3	0.014
321.0	525.0	1.0	0.052	0.117	66.1	0.128	24.2	0.102	0.001	0.014	87.1	0.014	0.3	-0.001	-0.014	87.1	0.014
320.0	525.0	1.0	0.053	0.119	66.0	0.130	24.4	0.103	0.001	0.015	86.9	0.015	0.3	-0.001	-0.015	86.9	0.015
319.0	525.0	1.0	0.054	0.120	65.9	0.132	24.6	0.105	0.001	0.015	86.7	0.015	0.3	-0.001	-0.015	86.7	0.015
318.0	525.0	1.0	0.055	0.122	65.8	0.134	24.9	0.107	0.001	0.015	86.6	0.015	0.3	-0.001	-0.015	86.6	0.015
317.0	525.0	1.0	0.056	0.124	65.7	0.136	25.1	0.108	0.001	0.015	86.4	0.015	0.3	-0.001	-0.015	86.4	0.015
316.0	525.0	1.0	0.057	0.126	65.6	0.138	25.4	0.110	0.001	0.015	86.2	0.015	0.3	-0.001	-0.015	86.2	0.015
315.0	525.0	1.0	0.046	0.125	69.6	0.133	25.8	0.106	0.001	0.017	88.0	0.017	0.4	0.001	-0.017	-88.0	0.017
314.0	525.0	1.0	0.047	0.127	69.4	0.135	26.0	0.108	0.001	0.017	88.2	0.017	0.4	0.001	-0.017	-88.2	0.017
313.0	525.0	1.0	0.049	0.129	69.3	0.137	26.3	0.109	0.000	0.017	88.4	0.017	0.4	0.000	-0.017	-88.4	0.017
312.0	525.0	1.0	0.050	0.131	69.1	0.140	26.5	0.111	0.000	0.017	88.6	0.017	0.4	0.000	-0.017	-88.6	0.017
311.0	525.0	1.0	0.051	0.133	68.9	0.142	26.7	0.113	0.000	0.017	88.8	0.017	0.4	0.000	-0.017	-88.9	0.017
310.0	525.0	1.0	0.053	0.135	68.7	0.145	26.9	0.115	0.000	0.018	89.1	0.018	0.4	0.000	-0.018	-89.1	0.018
309.0	525.0	1.0	0.054	0.137	68.5	0.147	27.2	0.117	0.000	0.018	89.3	0.018	0.4	0.000	-0.018	-89.3	0.018
308.0	525.0	1.0	0.055	0.139	68.3	0.150	27.4	0.119	0.000	0.018	89.5	0.018	0.4	0.000	-0.018	-89.6	0.018
307.0	525.0	1.0	0.057	0.142	68.2	0.152	27.6	0.121	0.000	0.018	89.7	0.018	0.4	0.000	-0.018	-89.8	0.018
306.0	525.0	1.0	0.058	0.144	68.0	0.155	27.8	0.124	0.000	0.018	89.7	0.018	0.4	-0.000	-0.018	90.0	0.018
305.0	525.0	1.0	0.060	0.146	67.8	0.158	28.1	0.126	0.000	0.019	89.6	0.019	0.4	-0.000	-0.019	89.7	0.019
304.0	525.0	1.0	0.061	0.149	67.6	0.161	28.3	0.128	0.000	0.019	89.4	0.019	0.4	-0.000	-0.019	89.5	0.019
303.0	525.0	1.0	0.063	0.151	67.4	0.164	28.5	0.130	0.000	0.019	89.2	0.019	0.4	-0.000	-0.019	89.2	0.019
302.0	525.0	1.0	0.065	0.154	67.2	0.167	28.8	0.133	0.000	0.019	88.9	0.019	0.5	-0.000	-0.019	88.9	0.019
301.0	525.0	1.0	0.066	0.156	67.0	0.170	29.0	0.135	0.000	0.019	88.7	0.019	0.5	-0.000	-0.019	88.7	0.019
300.0	525.0	1.0	0.068	0.159	66.9	0.173	29.2	0.138	0.001	0.020	88.4	0.020	0.5	-0.001	-0.020	88.4	0.020
299.0	525.0	1.0	0.085	0.186	65.4	0.204	25.8	0.163	0.001	0.022	88.1	0.022	0.4	-0.001	-0.022	88.2	0.022
298.0	525.0	1.0	0.087	0.189	65.2	0.208	26.0	0.166	0.001	0.022	87.9	0.022	0.5	-0.001	-0.022	87.9	0.022
297.0	525.0	1.0	0.089	0.192	65.1	0.212	26.2	0.169	0.001	0.023	87.6	0.023	0.5	-0.001	-0.023	87.6	0.023
296.0	525.0	1.0	0.091	0.195	64.9	0.216	26.5	0.172	0.001	0.023	87.4	0.023	0.5	-0.001	-0.023	87.4	0.023
295.0	525.0	1.0	0.094	0.199	64.7	0.220	26.7	0.175	0.001	0.023	87.1	0.023	0.5	-0.001	-0.023	87.1	0.023
294.0	525.0	1.0	0.096	0.202	64.6	0.224	26.9	0.178	0.001	0.024	86.8	0.024	0.5	-0.001	-0.024	86.8	0.024
293.0	525.0	1.0	0.098	0.205	64.4	0.228	27.2	0.181	0.001	0.024	86.5	0.024	0.5	-0.001	-0.024	86.6	0.024
292.0	525.0	1.0	0.101	0.209	64.2	0.232	27.4	0.185	0.002	0.024	86.3	0.024	0.5	-0.002	-0.024	86.3	0.024
291.0	525.0	1.0	0.103	0.213	64.1	0.236	27.7	0.188	0.002	0.024	86.0	0.024	0.5	-0.002	-0.024	86.0	0.024
290.0	525.0	1.0	0.106	0.216	63.9	0.241	27.9	0.192	0.002	0.025	85.7	0.025	0.5	-0.002	-0.025	85.7	0.025
289.0	525.0	1.0	0.109	0.220	63.7	0.245	28.1	0.195	0.002	0.025	85.4	0.025	0.5	-0.002	-0.025	85.4	0.025
288.0	525.0	1.0	0.111	0.224	63.6	0.250	28.4	0.199	0.002	0.025	85.1	0.025	0.5	-0.002	-0.025	85.1	0.025
287.0	525.0	1.0	0.114	0.228	63.4	0.255	28.6	0.203	0.002	0.026	84.8	0.026	0.5	-0.002	-0.026	84.8	0.026
286.0	525.0	1.0	0.117	0.232	63.2	0.260	28.9	0.207	0.002	0.026	84.5	0.026	0.5	-0.002	-0.026	84.5	0.026
285.0	525.0	1.0	0.120	0.236	63.1	0.265	29.1	0.211	0.003	0.026	84.2	0.026	0.5	-0.003	-0.026	84.2	0.026
284.0	525.0	1.0	0.123	0.241	62.9	0.270	29.3	0.215	0.003	0.027	83.9	0.027	0.6	-0.003	-0.027	83.9	0.027
283.0	525.0	1.0	0.126	0.245	62.7	0.276	29.6	0.219	0.003	0.027	83.6	0.027	0.6	-0.003	-0.027	83.6	0.027
282.0	525.0	1.0	0.130	0.249	62.5	0.281	29.8	0.224	0.003	0.027	83.2	0.027	0.6	-0.003	-0.027	83.2	0.027
281.0	525.0	1.0	0.133	0.254	62.4	0.287	30.1	0.228	0.003	0.027	82.9	0.028	0.6	-0.003	-0.028	82.9	0.028
280.0	525.0	1.0	0.137	0.259	62.2	0.293	30.3	0.233	0.004	0.028	82.6	0.028	0.6	-0.004	-0.028	82.6	0.028
279.0	525.0	1.0	0.140	0.264	62.0	0.299	30.5	0.238	0.004	0.028	82.2	0.028	0.6	-0.004	-0.028	82.2	0.028
278.0	525.0	1.0	0.144	0.269	61.8	0.305	30.8	0.243	0.004	0.029	81.9	0.029	0.6	-0.004	-0.029	81.9	0.029
277.0	525.0	1.0	0.148	0.274	61.6	0.311	31.0	0.248	0.004	0.029	81.5	0.029	0.6	-0.004	-0.029	81.5	0.029
276.0	525.0	1.0	0.152	0.279	61.5	0.318	31.2	0.253	0.005	0.029	81.2	0.030	0.6	-0.005	-0.029	81.2	0.030
275.0	525.0	1.0	0.156	0.285	61.3	0.325	31.5	0.258	0.005	0.030	80.8	0.030	0.6	-0.005	-0.030	80.8	0.030
274.0	525.0	1.0	0.160	0.290	61.1	0.332	31.7	0.264	0.005	0.030	80.4	0.030	0.7	-0.005	-0.030	80.4	0.030
273.0	525.0	1.0	0.165	0.296	60.9	0.339	32.0	0.270	0.005	0.030	80.0	0.031	0.7	-0.005	-0.030	80.1	0.031
272.0	525.0	1.0	0.169	0.302	60.7	0.346	32.2	0.276	0.006	0.031	79.7	0.031	0.7	-0.006	-0.031	79.7	0.031
271.0	525.0	1.0	0.174	0.308	60.5	0.354	32.4	0.282	0.006	0.031	79.3	0.032	0.7	-0.006	-0.031	79.3	0.032
270.0	525.0	1.0	0.179	0.314	60.4	0.362	32.7	0.288	0.006	0.032	78.9	0.032	0.7	-0.006	-0.032	78.9	0.032
269.0	525.0	1.0	0.184	0.321	60.2	0.370	32.9	0.294	0.007	0.032	78.5	0.033	0.7	-0.007	-0.032	78.5	0.033
268.0	525.0	1.0	0.189	0.327	60.0	0.378	33.2	0.301	0.007	0.032	78.1	0.033	0.7	-0.007	-0.032	78.1	0.033
267.0	525.0	1.0	0.195	0.334	59.8	0.387	33.4	0.308	0.007	0.033	77.7	0.034	0.7	-0.007	-0.033	77.7	0.034
266.0	525.0	1.0	0.200	0.341	59.6	0.396	33.6	0.315	0.008	0.033	77.2	0.034	0.7	-0.008	-0.033	77.2	0.034
265.0	525.0	1.0	0.206	0.349	59.4	0.405	33.9	0.322	0.008	0.034	76.8	0.035	0.8	-0.008	-0.034	76.8	0.035
264.0	525.0	1.0	0.212	0.356	59.2	0.414	34.1	0.330	0.008	0.034	76.4	0.035	0.8	-0.008	-0.034	76.4	0.035
263.0	525.0	1.0	0.218	0.364	59.0	0.424	34.3	0.338	0.009	0.035	75.9	0.036	0.8	-0.009	-0.035	75.9	0.036
262.0	525.0	1.0	0.225	0.372	58.8	0.434	34.6	0.346	0.009	0.035	75.5	0.036	0.8	-0.009	-0.035	75.5	0.036
261.0	525.0	1.0	0.232	0.380	58.6	0.445	34.8	0.354	0.009	0.035	75.0	0.037	0.8	-0.009	-0.035	75.0	0.037
260.0	525.0	1.0	0.238	0.388	58.4	0.456	35.0	0.363	0.010	0.036	74.5	0.037	0.8	-0.010	-0.036	74.5	0.037
259.0	525.0	1.0	0.246	0.397	58.3	0.467	35.3	0.372	0.010	0.036	74.1	0.038	0.8	-0.010	-0.036	74.1	0.038
258.0	525.0	1.0	0.253	0.406	58.1	0.478	35.5	0.381	0.011	0.037	73.6	0.038	0.9	-0.011	-0.037	73.6	0.038
257.0	525.0	1.0	0.261	0.415	57.9	0.490	35.7	0.390	0.011	0.037	73.1	0.039	0.9	-0.011	-0.037	73.1	0.039
256.0	525.0	1.0	0.269	0.425	57.7	0.503	35.9	0.400	0.012	0.038	72.6	0.040	0.9	-0.012	-0.038	72.6	0.040
255.0	525.0	1.0	0.277	0.435	57.5	0.516	36.2	0.410	0.012	0.038	72.1	0.040	0.9	-0.012	-0.038	72.1	0.040
254.0	525.0	1.0	0.286	0.445	57.3	0.529	36.4	0.421	0.013	0.039	71.5	0.041	0.9	-0.013	-0.039	71.5	0.041
253.0	525.0	1.0	0.295	0.455	57.1	0.543	36.6	0.432	0.014	0.039	71.0	0.042	0.9	-0.014	-0.039	71.0	0.042
252.0	525.0	1.0	0.304	0.466	56.9	0.557	36.8	0.443	0.014	0.040	70.5	0.042	1.0	-0.014	-0.040	70.5	0.042
251.0	525.0	1.0	0.314	0.478	56.7	0.572	37.1	0.455	0.015	0.040	69.9	0.043	1.0	-0.015	-0.040	69.9	0.043
250.0	525.0	1.0	0.324	0.489	56.5	0.587	37.3	0.467	0.015	0.041	69.3	0.044	1.0	-0.015	-0.041	69.4	0.044
249.0	525.0	1.0	0.335	0.501	56.3	0.603	37.5	0.480	0.016	0.041	68.8	0.044	1.0	-0.016	-0.041	68.8	0.044
248.0	525.0	1.0	0.346	0.514	56.0	0.619	37.7	0.493	0.017	0.042	68.2	0.045	1.0	-0.017	-0.042	68.2	0.045
247.0	525.0	1.0	0.357	0.527	55.8	0.636	38.0	0.506	0.018	0.042	67.6	0.046	1.1	-0.018	-0.043	67.6	0.046
246.0	525.0	1.0	0.369	0.540	55.6	0.654	38.2	0.521	0.018	0.043	67.0	0.047	1.1	-0.018	-0.043	67.0	0.047
245.0	525.0	1.0	0.382	0.554	55.4	0.673	38.4	0.535	0.019	0.044	66.4	0.048	1.1	-0.019	-0.044	66.4	0.048
244.0	525.0	1.0	0.395	0.568	55.2	0.692	38.6	0.550	0.020	0.044	65.7	0.048	1.1	-0.020	-0.044	65.7	0.048
243.0	525.0	1.0	0.416	0.593	55.0	0.725	37.7	0.577	0.020	0.047	66.5	0.051	1.1	-0.020	-0.047	66.5	0.051
242.0	525.0	1.0	0.430	0.609	54.8	0.745	37.9	0.593	0.021	0.047	65.8	0.052	1.2	-0.021	-0.047	65.8	0.052
241.0	525.0	1.0	0.445	0.625	54.6	0.767	38.2	0.610	0.022	0.048	65.1	0.053	1.2	-0.022	-0.048	65.1	0.053
240.0	525.0	1.0	0.460	0.641	54.3	0.789	38.4	0.628	0.023	0.048	64.5	0.054	1.2	-0.023	-0.048	64.5	0.054
239.0	525.0	1.0	0.476	0.658	54.1	0.812	38.6	0.647	0.024	0.049	63.8	0.055	1.2	-0.024	-0.049	63.8	0.055
238.0	525.0	1.0	0.493	0.676	53.9	0.837	38.9	0.666	0.025	0.050	63.0	0.056	1.3	-0.025	-0.050	63.1	0.056
237.0	525.0	1.0	0.510	0.695	53.7	0.862	39.1	0.686	0.026	0.050	62.3	0.057	1.3	-0.026	-0.050	62.3	0.057
236.0	525.0	1.0	0.528	0.714	53.5	0.888	39.3	0.707	0.027	0.051	61.6	0.058	1.3	-0.027	-0.051	61.6	0.058
235.0	525.0	1.0	0.547	0.734	53.3	0.916	39.5	0.729	0.029	0.051	60.8	0.059	1.3	-0.029	-0.051	60.8	0.059
234.0	525.0	1.0	0.567	0.755	53.1	0.944	39.8	0.752	0.030	0.052	60.0	0.060	1.4	-0.030	-0.052	60.0	0.060
233.0	525.0	1.0	0.588	0.777	52.9	0.974	40.0	0.775	0.031	0.052	59.2	0.061	1.4	-0.031	-0.052	59.2	0.061
232.0	525.0	1.0	0.610	0.799	52.6	1.006	40.2	0.800	0.033	0.053	58.4	0.062	1.4	-0.033	-0.053	58.4	0.062
231.0	525.0	1.0	0.633	0.823	52.4	1.038	40.4	0.826	0.034	0.053	57.6	0.063	1.5	-0.034	-0.053	57.6	0.063
230.0	525.0	1.0	0.657	0.847	52.2	1.072	40.7	0.853	0.035	0.054	56.7	0.065	1.5	-0.035	-0.054	56.7	0.065
229.0	525.0	1.0	0.682	0.873	52.0	1.108	40.9	0.882	0.037	0.054	55.9	0.066	1.6	-0.037	-0.054	55.9	0.066
228.0	525.0	1.0	0.709	0.899	51.8	1.145	41.1	0.911	0.039	0.055	55.0	0.067	1.6	-0.039	-0.055	55.0	0.067
227.0	525.0	1.0	0.736	0.927	51.6	1.184	41.3	0.942	0.040	0.055	54.0	0.069	1.6	-0.040	-0.055	54.0	0.068
226.0	525.0	1.0	0.765	0.956	51.3	1.225	41.5	0.975	0.042	0.056	53.1	0.070	1.7	-0.042	-0.056	53.1	0.070
225.0	525.0	1.0	0.796	0.986	51.1	1.267	41.7	1.009	0.044	0.056	52.1	0.071	1.7	-0.044	-0.056	52.1	0.071
224.0	525.0	1.0	0.828	1.018	50.9	1.312	41.9	1.044	0.046	0.057	51.1	0.073	1.8	-0.046	-0.057	51.1	0.073
223.0	525.0	1.0	0.861	1.051	50.7	1.359	42.2	1.081	0.048	0.057	50.1	0.074	1.8	-0.048	-0.057	50.1	0.074
222.0	525.0	1.0	0.897	1.086	50.4	1.408	42.4	1.121	0.050	0.057	49.1	0.076	1.9	-0.050	-0.057	49.1	0.076
221.0	525.0	1.0	0.934	1.122	50.2	1.460	42.6	1.162	0.052	0.058	48.0	0.078	1.9	-0.052	-0.058	48.0	0.078
220.0	525.0	1.0	0.974	1.160	50.0	1.514	42.8	1.205	0.054	0.058	46.9	0.079	2.0	-0.054	-0.058	46.9	0.079
219.0	525.0	1.0	1.015	1.199	49.8	1.571	43.0	1.250	0.057	0.058	45.7	0.081	2.0	-0.057	-0.058	45.7	0.081
218.0	525.0	1.0	1.059	1.241	49.5	1.631	43.2	1.298	0.059	0.058	44.6	0.083	2.1	-0.059	-0.058	44.6	0.083

-77.0	525.0	1.0	1.334	0.593	24.0	1.460	42.6	1.162	0.076	0.016	12.1	0.078	1.9	0.076	0.016	12.0	0.078
-78.0	525.0	1.0	1.288	0.568	23.8	1.408	42.4	1.121	0.075	0.014	11.0	0.076	1.9	0.075	0.014	10.9	0.076
-79.0	525.0	1.0	1.245	0.545	23.6	1.359	42.2	1.081	0.073	0.013	9.9	0.074	1.8	0.073	0.013	9.9	0.074
-80.0	525.0	1.0	1.204	0.523	23.5	1.312	41.9	1.044	0.072	0.011	8.9	0.073	1.8	0.072	0.011	8.9	0.073
-81.0	525.0	1.0	1.164	0.502	23.3	1.267	41.7	1.009	0.071	0.010	7.9	0.071	1.7	0.071	0.010	7.9	0.071
-82.0	525.0	1.0	1.126	0.482	23.2	1.225	41.5	0.975	0.069	0.008	7.0	0.070	1.7	0.069	0.008	6.9	0.070
-83.0	525.0	1.0	1.090	0.463	23.0	1.184	41.3	0.942	0.068	0.007	6.0	0.069	1.6	0.068	0.007	6.0	0.069
-84.0	525.0	1.0	1.055	0.445	22.8	1.145	41.1	0.911	0.067	0.006	5.1	0.067	1.6	0.067	0.006	5.0	0.067
-85.0	525.0	1.0	1.022	0.427	22.7	1.108	40.9	0.882	0.066	0.005	4.2	0.066	1.6	0.066	0.005	4.1	0.066
-86.0	525.0	1.0	0.990	0.411	22.5	1.072	40.7	0.853	0.064	0.004	3.4	0.065	1.5	0.064	0.004	3.3	0.065
-87.0	525.0	1.0	0.960	0.395	22.4	1.038	40.4	0.826	0.063	0.003	2.6	0.063	1.5	0.063	0.003	2.4	0.063
-88.0	525.0	1.0	0.931	0.381	22.2	1.006	40.2	0.800	0.062	0.002	1.8	0.062	1.4	0.062	0.002	1.6	0.062
-89.0	525.0	1.0	0.903	0.366	22.1	0.974	40.0	0.775	0.061	0.001	1.1	0.061	1.4	0.061	0.001	0.8	0.061
-90.0	525.0	1.0	0.876	0.353	21.9	0.944	39.8	0.752	0.060	0.001	0.8	0.060	1.4	0.060	-0.000	-0.0	0.060
-91.0	525.0	1.0	0.850	0.340	21.8	0.916	39.5	0.729	0.059	0.001	1.1	0.059	1.3	0.059	-0.001	-0.8	0.059
-92.0	525.0	1.0	0.826	0.328	21.7	0.888	39.3	0.707	0.058	0.002	1.7	0.058	1.3	0.058	-0.002	-1.6	0.058
-93.0	525.0	1.0	0.802	0.316	21.5	0.862	39.1	0.686	0.057	0.002	2.4	0.057	1.3	0.057	-0.002	-2.3	0.057
-94.0	525.0	1.0	0.779	0.305	21.4	0.837	38.9	0.666	0.055	0.003	3.1	0.056	1.3	0.055	-0.003	-3.1	0.056
-95.0	525.0	1.0	0.757	0.294	21.2	0.812	38.6	0.647	0.054	0.004	3.8	0.055	1.2	0.054	-0.004	-3.8	0.055
-96.0	525.0	1.0	0.736	0.284	21.1	0.789	38.4	0.628	0.053	0.004	4.5	0.054	1.2	0.053	-0.004	-4.5	0.054
-97.0	525.0	1.0	0.716	0.274	21.0	0.767	38.2	0.610	0.052	0.005	5.2	0.053	1.2	0.052	-0.005	-5.1	0.053
-98.0	525.0	1.0	0.697	0.265	20.8	0.745	37.9	0.593	0.052	0.005	5.8	0.052	1.2	0.052	-0.005	-5.8	0.052
-99.0	525.0	1.0	0.678	0.256	20.7	0.725	37.7	0.577	0.051	0.006	6.5	0.051	1.1	0.051	-0.006	-6.5	0.051
-100.0	525.0	1.0	0.645	0.249	21.1	0.692	38.6	0.550	0.048	0.005	5.8	0.048	1.1	0.048	-0.005	-5.7	0.048
-101.0	525.0	1.0	0.628	0.241	21.0	0.673	38.4	0.535	0.047	0.005	6.4	0.048	1.1	0.047	-0.005	-6.4	0.048
-102.0	525.0	1.0	0.611	0.233	20.9	0.654	38.2	0.521	0.046	0.006	7.0	0.047	1.1	0.046	-0.006	-7.0	0.047
-103.0	525.0	1.0	0.595	0.226	20.8	0.636	38.0	0.506	0.046	0.006	7.6	0.046	1.1	0.046	-0.006	-7.6	0.046
-104.0	525.0	1.0	0.579	0.219	20.7	0.619	37.7	0.493	0.045	0.006	8.2	0.045	1.0	0.045	-0.006	-8.2	0.045
-105.0	525.0	1.0	0.564	0.212	20.6	0.603	37.5	0.480	0.044	0.007	8.8	0.044	1.0	0.044	-0.007	-8.8	0.044
-106.0	525.0	1.0	0.550	0.205	20.5	0.587	37.3	0.467	0.043	0.007	9.4	0.044	1.0	0.043	-0.007	-9.4	0.044
-107.0	525.0	1.0	0.536	0.199	20.4	0.572	37.1	0.455	0.042	0.007	9.9	0.043	1.0	0.042	-0.007	-9.9	0.043
-108.0	525.0	1.0	0.522	0.193	20.2	0.557	36.8	0.443	0.042	0.008	10.5	0.042	1.0	0.042	-0.008	-10.5	0.042
-109.0	525.0	1.0	0.509	0.187	20.1	0.543	36.6	0.432	0.041	0.008	11.0	0.042	0.9	0.041	-0.008	-11.0	0.042
-110.0	525.0	1.0	0.497	0.181	20.0	0.529	36.4	0.421	0.040	0.008	11.5	0.041	0.9	0.040	-0.008	-11.5	0.041
-111.0	525.0	1.0	0.485	0.176	19.9	0.516	36.2	0.410	0.039	0.008	12.1	0.040	0.9	0.039	-0.008	-12.1	0.040
-112.0	525.0	1.0	0.473	0.171	19.8	0.503	35.9	0.400	0.039	0.009	12.6	0.040	0.9	0.039	-0.009	-12.6	0.040
-113.0	525.0	1.0	0.462	0.166	19.7	0.490	35.7	0.390	0.038	0.009	13.1	0.039	0.9	0.038	-0.009	-13.1	0.039
-114.0	525.0	1.0	0.451	0.161	19.6	0.478	35.5	0.381	0.037	0.009	13.6	0.038	0.9	0.037	-0.009	-13.6	0.038
-115.0	525.0	1.0	0.440	0.156	19.6	0.467	35.3	0.372	0.037	0.009	14.1	0.038	0.8	0.037	-0.009	-14.1	0.038
-116.0	525.0	1.0	0.430	0.152	19.5	0.456	35.0	0.363	0.036	0.009	14.5	0.037	0.8	0.036	-0.009	-14.5	0.037
-117.0	525.0	1.0	0.420	0.148	19.4	0.445	34.8	0.354	0.035	0.010	15.0	0.037	0.8	0.035	-0.010	-15.0	0.037
-118.0	525.0	1.0	0.410	0.143	19.3	0.434	34.6	0.346	0.035	0.010	15.5	0.036	0.8	0.035	-0.010	-15.5	0.036
-119.0	525.0	1.0	0.401	0.139	19.2	0.424	34.3	0.338	0.034	0.010	15.9	0.036	0.8	0.034	-0.010	-15.9	0.036
-120.0	525.0	1.0	0.392	0.136	19.1	0.414	34.1	0.330	0.034	0.010	16.4	0.035	0.8	0.034	-0.010	-16.4	0.035
-121.0	525.0	1.0	0.383	0.132	19.0	0.405	33.9	0.322	0.033	0.010	16.8	0.035	0.8	0.033	-0.010	-16.8	0.035
-122.0	525.0	1.0	0.374	0.128	18.9	0.396	33.6	0.315	0.033	0.010	17.2	0.034	0.7	0.033	-0.010	-17.2	0.034
-123.0	525.0	1.0	0.366	0.125	18.8	0.387	33.4	0.308	0.032	0.010	17.7	0.034	0.7	0.032	-0.010	-17.7	0.034
-124.0	525.0	1.0	0.358	0.122	18.8	0.378	33.2	0.301	0.031	0.010	18.1	0.033	0.7	0.031	-0.010	-18.1	0.033
-125.0	525.0	1.0	0.350	0.118	18.7	0.370	32.9	0.294	0.031	0.010	18.5	0.033	0.7	0.031	-0.010	-18.5	0.033
-126.0	525.0	1.0	0.343	0.115	18.6	0.362	32.7	0.288	0.030	0.010	18.9	0.032	0.7	0.030	-0.010	-18.9	0.032
-127.0	525.0	1.0	0.336	0.112	18.5	0.354	32.4	0.282	0.030	0.010	19.3	0.032	0.7	0.030	-0.010	-19.3	0.032
-128.0	525.0	1.0	0.328	0.110	18.4	0.346	32.2	0.276	0.029	0.011	19.7	0.031	0.7	0.029	-0.011	-19.7	0.031
-129.0	525.0	1.0	0.322	0.107	18.4	0.339	32.0	0.270	0.029	0.011	20.1	0.031	0.7	0.029	-0.011	-20.1	0.031
-130.0	525.0	1.0	0.315	0.104	18.3	0.332	31.7	0.264	0.029	0.011	20.4	0.030	0.7	0.029	-0.011	-20.4	0.030
-131.0	525.0	1.0	0.308	0.102	18.2	0.325	31.5	0.258	0.028	0.011	20.8	0.030	0.6	0.028	-0.011	-20.8	0.030
-132.0	525.0	1.0	0.302	0.099	18.2	0.318	31.2	0.253	0.028	0.011	21.2	0.030	0.6	0.028	-0.011	-21.2	0.030
-133.0	525.0	1.0	0.296	0.097	18.1	0.311	31.0	0.248	0.027	0.011	21.5	0.029	0.6	0.027	-0.011	-21.5	0.029
-134.0	525.0	1.0	0.290	0.094	18.0	0.305	30.8	0.243	0.027	0.011	21.9	0.029	0.6	0.027	-0.011	-21.9	0.029
-135.0	525.0	1.0	0.284	0.092	17.9	0.299	30.5	0.238	0.026	0.011	22.2	0.028	0.6	0.026	-0.011	-22.2	0.028
-136.0	525.0	1.0	0.279	0.090	17.9	0.293	30.3	0.233	0.026	0.011	22.6	0.028	0.6	0.026	-0.011	-22.6	0.028
-137.0	525.0	1.0	0.273	0.088	17.8	0.287	30.1	0.228	0.026	0.011	22.9	0.028	0.6	0.026	-0.011	-22.9	0.028
-138.0	525.0	1.0	0.268	0.086	17.8	0.281	29.8	0.224	0.025	0.011	23.2	0.027	0.6	0.025	-0.011	-23.2	0.027
-139.0	525.0	1.0	0.263	0.084	17.7	0.276	29.6	0.219	0.025	0.011	23.6	0.027	0.6	0.025	-0.011	-23.6	0.027
-140.0	525.0	1.0	0.258	0.082	17.6	0.270	29.3	0.215	0.024	0.011	23.9	0.027	0.6	0.024	-0.011	-23.9	0.027
-141.0	525.0	1.0	0.253	0.080	17.6	0.265	29.1	0.211	0.024	0.011	24.2	0.026	0.5	0.024	-0.011	-24.2	0.026
-142.0	525.0	1.0	0.248	0.078	17.5	0.260	28.9	0.207	0.024	0.011	24.5	0.026	0.5	0.024	-0.011	-24.5	0.026
-143.0	525.0	1.0	0.243	0.076	17.5	0.255	28.6	0.203	0.023	0.011	24.8	0.026	0.5	0.023	-0.011	-24.8	0.026
-144.0	525.0	1.0	0.239	0.075	17.4	0.250	28.4	0.199	0.023	0.011	25.1	0.025	0.5	0.023	-0.011	-25.1	0.025
-145.0	525.0	1.0	0.234	0.073	17.3	0.245	28.1	0.195	0.023	0.011	25.4	0.025	0.5	0.023	-0.011	-25.4	0.025
-146.0	525.0	1.0	0.230	0.072	17.3	0.241	27.9	0.192	0.022	0.011	25.7	0.025	0.5	0.022	-0.011	-25.7	0.025
-147.0	525.0	1.0	0.226	0.070	17.2	0.236	27.7	0.188	0.022	0.011	26.0	0.024	0.5	0.022	-0.011	-26.0	0.024
-148.0	525.0	1.0	0.222	0.069	17.2	0.232	27.4	0.185	0.022	0.011	26.3	0.024	0.5	0.022	-0.011	-26.3	0.024
-149.0	525.0	1.0	0.218	0.067	17.1	0.228	27.2	0.181	0.021	0.011	26.6	0.024	0.5	0.021	-0.011	-26.6	0.024
-150.0	525.0	1.0	0.214	0.066	17.1	0.224	26.9	0.178	0.021	0.011	26.8	0.024	0.5	0.021	-0.011	-26.8	0.024
-151.0	525.0	1.0	0.210	0.064	17.0	0.220	26.7	0.175	0.021	0.011	27.1	0.023	0.5	0.021	-0.011	-27.1	0.023
-152.0	525.0	1.0	0.206	0.063	17.0	0.216	26.5	0.172	0.020	0.011	27.4	0.023	0.5	0.020	-0.011	-27.4	0.023
-153.0	525.0	1.0	0.203	0.062	17.0	0.212	26.2	0.169	0.020	0.011	27.6	0.023	0.5	0.020	-0.011	-27.6	0.023
-154.0	525.0	1.0	0.199	0.061	16.9	0.208	26.0	0.166	0.020	0.011	27.9	0.022	0.5	0.020	-0.011	-27.9	0.022
-155.0	525.0	1.0	0.196	0.059	16.9	0.204	25.8	0.163	0.020	0.010	28.2	0.022	0.4	0.020	-0.010	-28.2	0.022
-156.0	525.0	1.0	0.162	0.060	20.1	0.173	29.2	0.138	0.017	0.009	28.4	0.020	0.5	0.017	-0.009	-28.4	0.020
-157.0	525.0	1.0	0.159	0.058	20.1	0.170	29.0	0.135	0.017	0.009	28.7	0.019	0.5	0.017	-0.009	-28.7	0.019
-158.0	525.0	1.0	0.157	0.057	20.1	0.167	28.8	0.133	0.017	0.009	28.9	0.019	0.5	0.017	-0.009	-28.9	0.019
-159.0	525.0	1.0	0.154	0.056	20.1	0.164	28.5	0.130	0.017	0.009	29.2	0.019	0.4	0.017	-0.009	-29.2	0.019
-160.0	525.0	1.0	0.151	0.055	20.2	0.161	28.3	0.128	0.016	0.009	29.5	0.019	0.4	0.016	-0.009	-29.5	0.019
-161.0	525.0	1.0	0.148	0.054	20.2	0.158	28.1	0.126	0.016	0.009	29.7	0.019	0.4	0.016	-0.009	-29.7	0.019
-162.0	525.0	1.0	0.146	0.054	20.2	0.155	27.8	0.124	0.016	0.009	30.0	0.018	0.4	0.016	-0.009	-30.0	0.018
-163.0	525.0	1.0	0.143	0.053	20.2	0.152	27.6	0.121	0.016	0.009	30.2	0.018	0.4	0.016	-0.009	-30.2	0.018
-164.0	525.0	1.0	0.141	0.052	20.2	0.150	27.4	0.119	0.016	0.009	30.4	0.018	0.4	0.016	-0.009	-30.4	0.018
-165.0	525.0	1.0	0.138	0.051	20.2	0.147	27.2	0.117	0.015	0.009	30.7	0.018	0.4	0.015	-0.009	-30.7	0.018
-166.0	525.0	1.0	0.136	0.050	20.2	0.145	26.9	0.115	0.015	0.009	30.9	0.018	0.4	0.015	-0.009	-30.9	0.018
-167.0	525.0	1.0	0.133	0.049	20.3	0.142	26.7	0.113	0.015	0.009	31.1	0.017	0.4	0.015	-0.009	-31.1	0.017
-168.0	525.0	1.0	0.131	0.048	20.3	0.140	26.5	0.111	0.015	0.009	31.4	0.017	0.4	0.015	-0.009	-31.4	0.017
-169.0	525.0	1.0	0.129	0.048	20.3	0.137	26.3	0.109	0.014	0.009	31.6	0.017	0.4	0.014	-0.009	-31.6	0.017
-170.0	525.0	1.0	0.127	0.047	20.3	0.135	26.0	0.108	0.014	0.009	31.8	0.017	0.4	0.014	-0.009	-31.8	0.017
-171.0	525.0	1.0	0.125	0.046	20.3	0.133	25.8	0.106	0.014	0.009	32.0	0.017	0.4	0.014	-0.009	-32.0	0.017
-172.0	525.0	1.0	0.132	0.040	16.7	0.138	25.4	0.110	0.014	0.007	26.2	0.015	0.3	0.014	-0.007	-26.2	0.015
-173.0	525.0	1.0	0.130	0.039	16.7	0.136	25.1	0.108	0.013	0.007	26.4	0.015	0.3	0.013	-0.007	-26.4	0.015
-174.0	525.0	1.0	0.128	0.038	16.6	0.134	24.9	0.107	0.013	0.007	26.6	0.015	0.3	0.013	-0.007	-26.6	0.015
-175.0	525.0	1.0	0.126	0.038	16.5	0.132	24.6	0.105	0.013	0.007	26.7	0.015	0.3	0.013	-0.007	-26.7	0.015
-176.0	525.0	1.0	0.124	0.037	16.5	0.130	24.4	0.103	0.013	0.007	26.9	0.015	0.3	0.013	-0.007	-26.9	0.015
-177.0	525.0	1.0	0.123	0.036	16.4	0.128	24.2	0.102	0.013	0.007	27.1	0.014	0.3	0.013	-0.007	-27.1	0.014
-178.0	525.0	1.0	0.121	0.035	16.3	0.126	23.9	0.100	0.013	0.007	27.3	0.014	0.3	0.013	-0.007	-27.3	0.014
-179.0	525.0	1.0	0.119	0.035	16.2	0.124	23.7	0.099	0.012	0.006	27.5	0.014	0.3	0.012	-0.006	-27.5	0.014
-180.0	525.0	1.0	0.117	0.034	16.2	0.122	23.4	0.097	0.012	0.006	27.6	0.014	0.3	0.012	-0.006	-27.6	0.014
-181.0	525.0	1.0	0.116	0.033	16.1	0.120	23.2	0.096	0.012	0.006	27.8	0.014	0.3	0.012	-0.006	-27.8	0.014
-182.0	525.0	1.0	0.114	0.033	16.0	0.119	23.0	0.094	0.012	0.006	28.0	0.014	0.3	0.012	-0.006	-28.0	0.014
-183.0	525.0	1.0	0.112	0.032	15.9	0.117	22.7	0.093	0.012	0.006	28.2	0.013	0.3	0.012	-0.006	-28.2	0.013
-184.0	525.0	1.0	0.111	0.031	15.9	0.115	22.5	0.092	0.012	0.006	28.3	0.013	0.3	0.012	-0.006	-28.3	0.013
-185.0	525.0	1.0	0.109	0.031	15.8	0.113	22.2	0.090	0.012	0.006	28.5	0.013	0.3	0.012	-0.006	-28.5	0.013
-186.0	525.0	1.0	0.108	0.030	15.7	0.112	22.0	0.089	0.011	0.006	28.6	0.013	0.3	0.011	-0.006	-28.6	0.013
-187.0	525.0	1.0	0.106	0.030	15.7	0.110	21.8	0.088	0.011	0.006	28.8	0.013	0.3	0.011	-0.006	-28.8	0.013
-188.0	525.0	1.0	0.105	0.029	15.6	0.109	21.5	0.086	0.011	0.006	29.0	0.013	0.3	0.011	-0.006	-29.0	0.013
-189.0	525.0	1.0	0.103	0.029	15.5	0.107	21.3	0.085	0.011	0.006	29.1	0.013	0.3	0.011	-0.006	-29.1	0.013
-190.0	525.0	1.0	0.102	0.028	15.4	0.106	21.1	0.084	0.011	0.006	29.3	0.012	0.3	0.011	-0.006	-29.3	0.012
-191.0	525.0	1.0	0.100	0.028	15.4	0.104	20.8	0.083	0.011	0.006	29.4	0.012	0.3	0.011	-0.006	-29.4	0.012
-192.0	525.0	1.0	0.099	0.027	15.3	0.103	20.6	0.082	0.011	0.006	29.6	0.012	0.3	0.011	-0.006	-29.6	0.012
-193.0	525.0	1.0	0.098	0.027	15.2	0.101	20.4	0.081	0.010	0.006	29.7	0.012	0.3	0.010	-0.006	-29.7	0.012
-194.0	525.0	1.0	0.096	0.026	15.1	0.100	20.1	0.079	0.010	0.006	29.9	0.012	0.3	0.010	-0.006	-29.9	0.012
-195.0	525.0	1.0	0.095	0.026	15.1	0.099	19.9	0.078	0.010	0.006	30.0	0.012	0.2	0.010	-0.006	-30.0	0.012
-196.0	525.0	1.0	0.094	0.025	15.0	0.097	19.6	0.077	0.010	0.006	30.2	0.012	0.2	0.010	-0.006	-30.2	0.012
-197.0	525.0	1.0	0.093	0.025	14.9	0.096	19.4	0.076	0.010	0.006	30.3	0.012	0.2	0.010	-0.006	-30.3	0.012
-198.0	525.0	1.0	0.091	0.024	14.9	0.095	19.2	0.075	0.010	0.006	30.4	0.011	0.2	0.010	-0.006	-30.4	0.011
-199.0	525.0	1.0	0.090	0.024	14.8	0.093	18.9	0.074	0.010	0.006	30.6	0.011	0.2	0.010	-0.006	-30.6	0.011
-200.0	525.0	1.0	0.089	0.023	14.7	0.092	18.7	0.073	0.010	0.006	30.7	0.011	0.2	0.010	-0.006	-30.7	0.011
-201.0	525.0	1.0	0.088	0.023	14.6	0.091	18.5	0.072	0.010	0.006	30.8	0.011	0.2	0.010	-0.006	-30.8	0.011
-202.0	525.0	1.0	0.087	0.023	14.6	0.090	18.3	0.071	0.009	0.006	31.0	0.011	0.2	0.009	-0.006	-31.0	0.011
-203.0	525.0	1.0	0.086	0.022	14.5	0.089	18.0	0.070	0.009	0.006	31.1	0.011	0.2	0.009	-0.006	-31.1	0.011
-204.0	525.0	1.0	0.085	0.022	14.4	0.087	17.8	0.070	0.009	0.006	31.2	0.011	0.2	0.009	-0.006	-31.2	0.011
-205.0	525.0	1.0	0.084	0.021	14.4	0.086	17.6	0.069	0.009	0.006	31.4	0.011	0.2	0.009	-0.006	-31.4	0.011
-206.0	525.0	1.0	0.083	0.021	14.3	0.085	17.3	0.068	0.009	0.006	31.5	0.011	0.2	0.009	-0.006	-31.5	0.011
-207.0	525.0	1.0	0.082	0.021	14.2	0.084	17.1	0.067	0.009	0.005	31.6	0.010	0.2	0.009	-0.005	-31.6	0.010
-208.0	525.0	1.0	0.081	0.020	14.1	0.083	16.9	0.066	0.009	0.005	31.7	0.010	0.2	0.009	-0.005	-31.7	0.010
-209.0	525.0	1.0	0.080	0.020	14.1	0.082	16.7	0.065	0.009	0.005	31.8	0.010	0.2	0.009	-0.005	-31.8	0.010
-210.0	525.0	1.0	0.079	0.020	14.0	0.081	16.4	0.065	0.009	0.005	32.0	0.010	0.2	0.009	-0.005	-32.0	0.010
-211.0	525.0	1.0	0.078	0.019	13.9	0.080	16.2	0.064	0.009	0.005	32.1	0.010	0.2	0.009	-0.005	-32.1	0.010
-212.0	525.0	1.0	0.077	0.019	13.9	0.079	16.0	0.063	0.008	0.005	32.2	0.010	0.2	0.008	-0.005	-32.2	0.010
-213.0	525.0	1.0	0.076	0.019	13.8	0.078	15.7	0.062	0.008	0.005	32.3	0.010	0.2	0.008	-0.005	-32.3	0.010
-214.0	525.0	1.0	0.075	0.018	13.7	0.077	15.5	0.061	0.008	0.005	32.4	0.010	0.2	0.008	-0.005	-32.4	0.010
-215.0	525.0	1.0	0.074	0.018	13.6	0.076	15.3	0.061	0.008	0.005	32.5	0.010	0.2	0.008	-0.005	-32.5	0.010
-216.0	525.0	1.0	0.073	0.018	13.6	0.075	15.1	0.060	0.008	0.005	32.6	0.010	0.2	0.008	-0.005	-32.7	0.010
-217.0	525.0	1.0	0.072	0.017	13.5	0.074	14.9	0.059	0.008	0.005	32.8	0.010	0.2	0.008	-0.005	-32.8	0.010
-218.0	525.0	1.0	0.072	0.017	13.4	0.074	14.6	0.059	0.008	0.005	32.9	0.009	0.2	0.008	-0.005	-32.9	0.009
-219.0	525.0	1.0	0.071	0.017	13.4	0.073	14.4	0.058	0.008	0.005	33.0	0.009	0.2	0.008	-0.005	-33.0	0.009
-220.0	525.0	1.0	0.070	0.017	13.3	0.072	14.2	0.057	0.008	0.005	33.1	0.009	0.2	0.008	-0.005	-33.1	0.009
-221.0	525.0	1.0	0.069	0.016	13.2	0.071	14.0	0.057	0.008	0.005	33.2	0.009	0.2	0.008	-0.005	-33.2	0.009
-222.0	525.0	1.0	0.068	0.016	13.2	0.070	13.8	0.056	0.008	0.005	33.3	0.009	0.2	0.008	-0.005	-33.3	0.009
-223.0	525.0	1.0	0.068	0.016	13.1	0.069	13.5	0.055	0.007	0.005	33.4	0.009	0.2	0.007	-0.005	-33.4	0.009
-224.0	525.0	1.0	0.067	0.015	13.0	0.069	13.3	0.055	0.007	0.005	33.5	0.009	0.2	0.007	-0.005	-33.5	0.009
-225.0	525.0	1.0	0.066	0.015	12.9	0.068	13.1	0.054	0.007	0.005	33.6	0.009	0.2	0.007	-0.005	-33.6	0.009
-226.0	525.0	1.0	0.065	0.015	12.9	0.067	12.9	0.053	0.007	0.005	33.7	0.009	0.2	0.007	-0.005	-33.7	0.009
-227.0	525.0	1.0	0.065	0.015	12.8	0.066	12.7	0.053	0.007	0.005	33.8	0.009	0.2	0.007	-0.005	-33.8	0.009
-228.0	525.0	1.0	0.083	0.013	9.3	0.084	7.5	0.067	0.007	0.002	18.2	0.008	0.2	0.007	-0.002	-18.2	0.008

Appendix E Arcadis Complex EMF Assessment Report

Scottish & Southern Electricity Networks

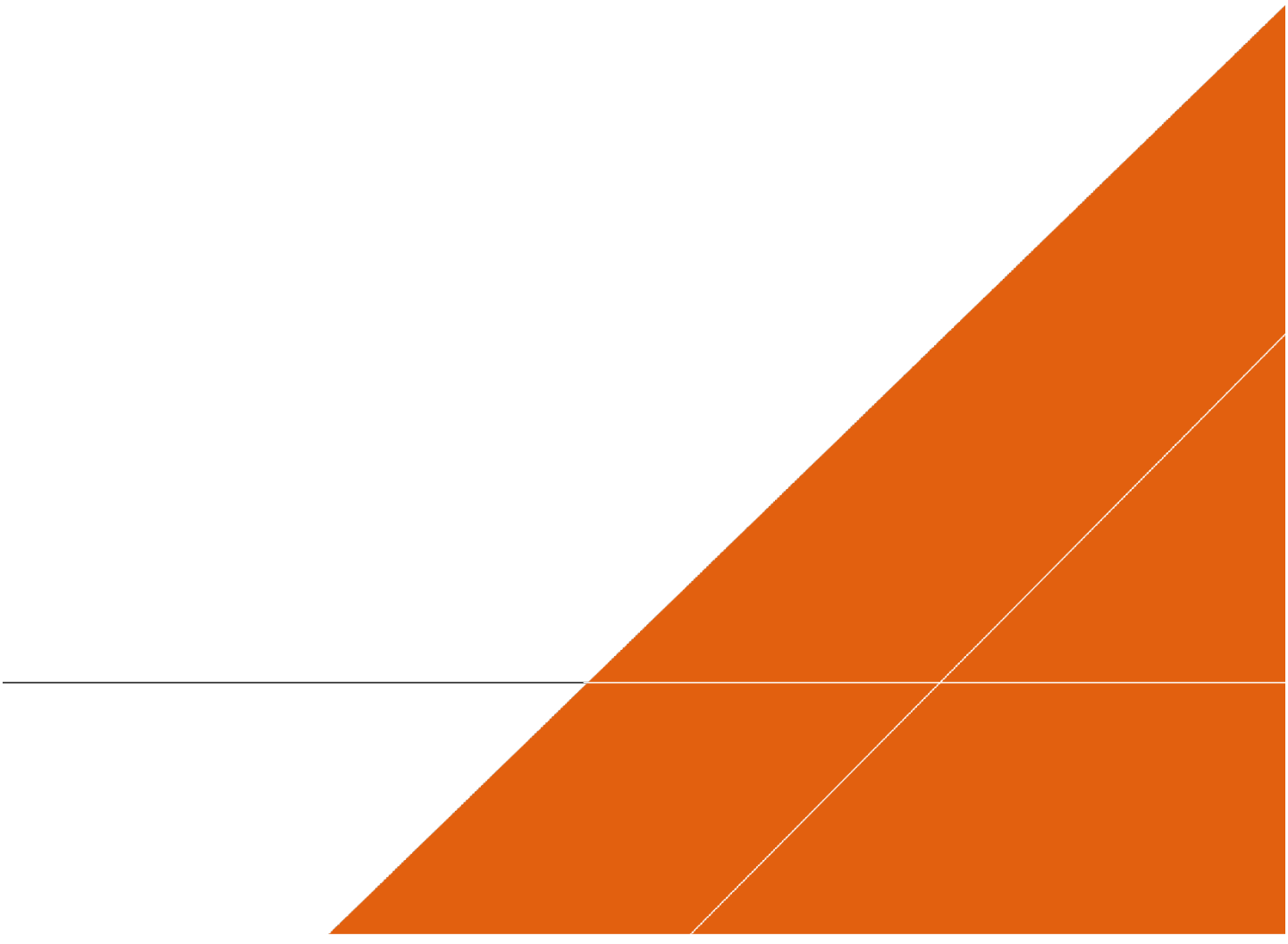
ARCADIS Design & Consultancy for natural and built assets

SSEN BEAULY TO BLACKHILLOCK TO NEW DEER TO PETERHEAD PROJECT

Electric and Magnetic Fields in Overhead Line Duck-Under Scenarios

6096/134/R/HN/05

SEPTEMBER 2025



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SSEN BEAULY TO BLACKHILLOCK TO NEW DEER TO PETERHEAD PROJECT

Electric and Magnetic Fields in Overhead line Duck-Under Scenarios

Author [redacted]

Checker [redacted]

Approver [redacted]

Report No 6096/134/R/HN/05

Date SEPTEMBER 2025

VERSION CONTROL

Version	Date	Author	Changes
A	05/08/2025	[redacted]	First Issue – Project specific report produced based on 6096/134/R/HN/02C as per Clients request.
B	18/09/2025	[redacted]	Second Issue – Administrative changes at Clients Request

CONTENTS

APPENDICES

APPENDIX A

ASTI 400 kV OHL Tower (Information Only)

ASTI 400 kV OHL Phase and Earth Wire

Duck-under Parameters and Phasing

APPENDIX B

CDEGS (HIFREQ) Results

Executive Summary

Scottish and Southern Electricity Networks/ SSEN Transmission plc ("SSEN") is proposing to construct and operate approximately 158 kilometres (km) of new double circuit 400 kilovolts (kV) overhead transmission line (OHL) between the proposed Fanellan and Greens 400kV substations and 28km of new double circuit 400 kV OHL between the proposed Greens and Netherton 400kV substation.

In July 2022, National Grid ESO (as of 1 October 2024 now known as the National Energy System Operator (NESO)) published the Pathway to 2030 Holistic Network Design (Pathway to 2023 HND), setting out the electricity transmission network infrastructure required to enable the forecasted growth in renewable electricity across Great Britain, in light of the UK and Scottish Government's 2030 offshore wind allocations of 50 gigawatt (GW) and 11 GW (through the Crown Estate and ScotWind leasing rounds) which are the main driver for these upgrades.

The proposed 400 kV overhead line (OHL) will consist of steel lattice towers using a new tower series known as the ASTI SSE400 or AS4 for short. These towers are expected to average 57 m in height across the routes. The conductor system is proposed to be 3 x 700 mm^2 AAAC Araucaria with 500 mm bundle spacing. The circuit is designed to function up to 90°C while maintaining a minimum ground clearance of 9 m under normal conditions. Although it is capable of operating at to 90°C, it is not currently intended to be used at this maximum rating.

This report details the EMF assessment in OHL duck-under scenarios (see Section 4). In the context of OHL, a duck-under describes a configuration where one transmission line passes beneath another, typically to prevent routing conflicts or ensure adequate clearances in constrained spaces. The primary objective of this report is to provide an EMF assessment for the general public exposure at a height of 1 m above ground at the crossing of the proposed Beauly Blackhillock New Deer Peterhead and other SSEN overhead lines. This report details the input data, EMF limits, and EMF calculations conducted using the CDEGS software package, alongside a risk assessment based on industry guideline.

Main Results

Arcadis carried out an EMF assessment of the proposed 400 kV OHL duck under scenario with existing SSEN 400 kV, 275 kV and 132 kV OHL's using CDEGS (HIFREQ). All six scenarios are listed below. The calculation profile was placed at the OHL duck-under 1 m above ground. The power flow on both circuits was considered in same direction. The study acknowledges the limitation in accurately modelling insulator end fittings and conductor assembly hardware in HIFREQ; however, this does not impact EMF calculation at ground level itself.

i) OHL Crossing 1
ii) OHL Crossing 2
iii) OHL Crossing 3
iv) OHL Crossing 4
v) OHL Crossing 5
vi) OHL Crossing 6

To ensure public exposure remains within safe limits, set exposure thresholds at 9 kV/m for electric fields and 360 µT for magnetic fields were used.

The calculation considers all duck-under configuration for the 275 kV and 132 kV OHLs, maintaining a statutory clearances (6.7 m for 132 kV, 7.0 m for 275 kV). The exception was made for 400 kV OHL duck-under scenario where actual ground clearance from PLS-CADD model were used. At the crossing location, the ground clearance of the oversailing ASTI 400 kV overhead lines was modelled using a conservative approach, bounded between a minimum clearance of 9 meters and the conductor sag profile derived from PLS-CADD simulations, as detailed in Appendix A.

The EMF was assessed using CDEGS (HIFREQ), with all calculated values for the various duck-under scenarios remaining within the safe threshold with the exception of crossing 5. Crossing 5 exceeds the UK exposure limit for electric field which is 9 kV/m. Although this crossing exceeds this limit, it does however still comply with the EMF public exposure guidelines as the location in which this crossing occurs is not deemed by SSEN to be an area where members of the public spend significant time.

As exposure can be deemed not to be for a significant period of time, the ICNIRP occupational guidelines apply in which this crossing remains in compliance with.

It should be noted that this analysis is considered conservative and further work shall be progressed within the detailed design stage to further reduce the electric field magnitude at this crossing as low as reasonably practicable through phasing adjustments or increase of ground clearance however the current proposal remains compliant with the Code of Practice.

The corresponding graphs are shown in Appendix B.

Recommendations

It is advisable for SSEN to review all input data and assumptions outlined in the report during the detailed design stage to ensure compliance with public EMF exposure limits.

1. Introduction

Scottish and Southern Electricity Networks/ SSEN Transmission plc ("SSEN") is proposing to build a number of projects including new high-voltage electricity 400 kV transmission lines, 400 kV Substations and HVDC (high voltage direct current) link to deliver the UK Government's 50 GW offshore wind by 2030 target. This has been set out as part of the Pathway to 2030 Holistic Network Design. Figure 1 illustrates the SSEN Pathway to 2030 projects.

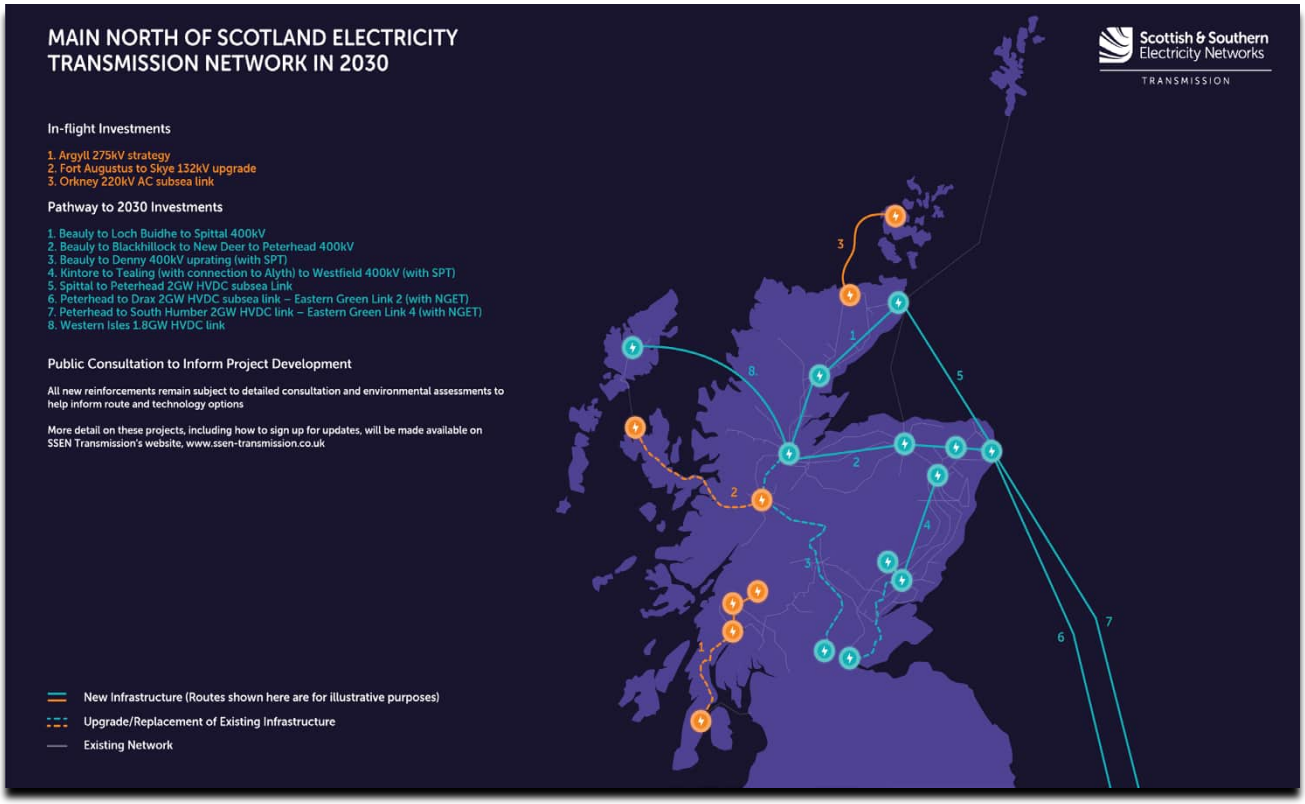


Figure 1. SSEN Pathway to 2030 Transmission Network

The Beauly Blackhillock New Deer Peterhead 400 kV overhead line (OHL) will consist of steel lattice towers using a new tower series known as the ASTI SSE400 or AS4 for short. These towers are expected to average 57 m in height across the routes. The conductor system is proposed to be 3x700 mm^2 AAAC Araucaria with 500 mm bundle spacing. The circuit is designed to function up to 90°C while maintaining a minimum ground clearance of 9 m under normal conditions. Although it is capable of operating at 90°C, it is not currently intended to be used at this maximum rating.

Arcadis Consulting (UK) Ltd ("Arcadis") has been commissioned by SSEN to conduct an electric and magnetic fields (EMFs) assessment for the ASTI 400 kV OHL tower. Arcadis completed a report summarising the EMF calculations for AS4 tower [1].

This report details the EMF assessment in OHL duck-under scenarios (see Section 4). In the context of OHL, a duck-under describes a configuration where one transmission line passes beneath another, typically to prevent routing conflicts or ensure adequate clearances in constrained spaces. The primary objective of this report is to provide an EMF assessment for the general public exposure at a height of 1 m above ground at the crossing of the Beauly Blackhillock New Deer Peterhead OHL and other SSEN existing overhead lines. This report details the input data, EMF limits, and EMF calculations conducted using the CDEGS software package, alongside a risk assessment based on industry guideline. Sections 2 of the report remains unchanged from previous Arcadis report 6096/134/R/HN/01B [1].

[1] Arcadis Report 6096/134/R/HN/01B- SSE ASTI Project - 400 kV Overhead Line Tower Electric and Magnetic Fields, 18th February 2025

2. Electric & Magnetic Field (EMF) Risks

The electromagnetic field (EMF) from power lines consist of electric field and magnetic field. The electric fields are produced by voltage. Electric fields are measured in volts per metre (v/m). Magnetic fields are produced by current, which is the flow of electricity. Generally, the higher the current, the higher the magnetic field. Magnetic fields are measured in microtesla (μT).

Alternating magnetic fields induces electric fields which will produce currents in a conductive medium. The human body is conductive and hence alternative magnetic fields will induce very weak voltages and currents in the human body. If these voltages and currents are high enough, it is possible to result in physiological effects on excitable tissues of the body, mainly nerve and muscle cells. Similar, direct exposure of alternating electric fields can induce very weak voltages and currents in the human body. Again, if these voltages and currents are high enough, it is possible to result in physiological effects on excitable tissues of the body, mainly nerve and muscle cells.

An active implantable medical device (AIMD) is any medical device which is intended to be totally or partially introduced, surgically or medically, into the human body, and which is intended to remain after the procedure. The commonest are pacemakers and defibrillators (together described as "implanted heart devices"). The electronic medical implants use electrical component in their construction. Under certain circumstances some implants may be susceptible to interference from electromagnetic field. This situation could lead to improper function of medical implants e.g.; a heart pacemaker disturbance can pose a health & safety threat. It should be noted that the Medicines and Healthcare products Regulatory Agency (MHRA) are aware of no instance of a patient having their implanted heart device interfered with by a high-voltage power line [2].

The two internationally recognised exposure guidelines are established by the Institute of Electrical and Electronics Engineers (IEEE) [3] and International Commission on Non-Ionising Radiation Protection (ICNIRP) and [4].

2.1 How EMF Strengths Decrease with Distance

EMF decreases with distance from the source. Generally, at a distance from the source d, the fields will decrease as follows [5]:

- Single-phase current – 1/d,
- Single circuit or double circuit un-transposed – $1/d^2$, and
- Double circuit transposed (assuming symmetrical geometry) or coil – $1/d^3$.

Figure 2 shows this rate of decrease from different sources. In practice, factors such as unequal currents, zero sequence currents, tapered towers, geometrical deviations on the structure, and very close proximity to sources will result in rates of decrease which are less than the above. Furthermore, magnetic field profiles are typically shown horizontally along the ground (at one metre above ground), perpendicular to the conductor and typically at midspan where the conductors are closest to the ground.

[2] https://www.emfs.info/

[3] IEEE (2019) Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz. IEEE Std C95.1, New York

[4] International Commission on Non-ionizing Radiation Protection (2010): Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz). Health Phys 99 (6), pp.818- 836. Erratum in Health Phys 100 (1), p.112 (2011). https://www.icnirp.org/cms/upload/publications/ICNIRPLFgdl.pdf and International Commission on Non-ionizing Radiation Protection (1998): Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic Fields and Electromagnetic Fields (up to 300 GHz). Health Phys 74 (4), pp.494-522. https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf

[5] CIGRE TB 806, Responsible management of electric and magnetic fields (EMF) – 2020.

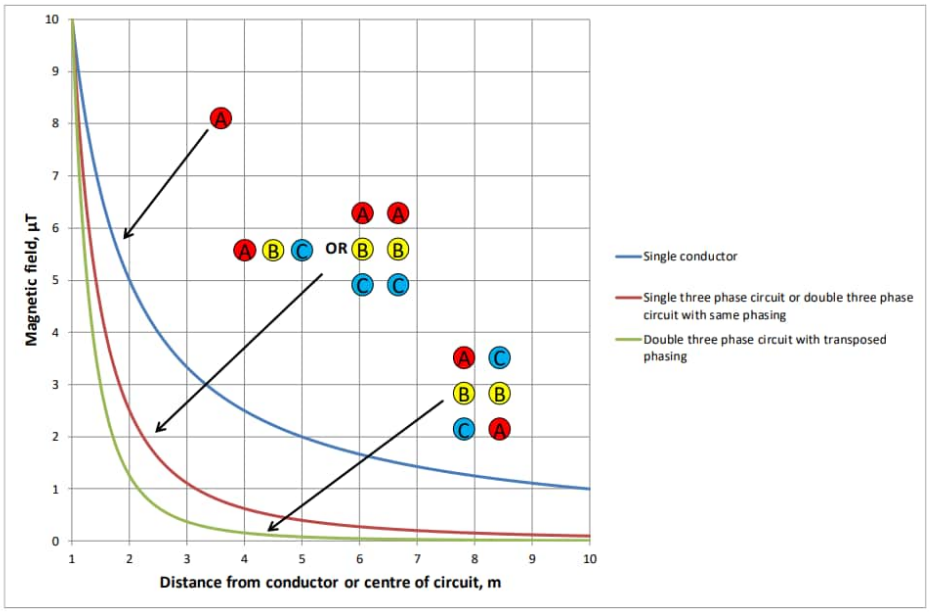


Figure 2: General Rate of Decrease of Magnetic Fields from Different Sources

2.2 EMF Limits

The EMF limits within the regulations [6], the EMF limits within the regulations are the exposure limits values (ELVs), and there are two levels: the Sensory ELVs and Health ELVs. The Sensory ELVs can be exceeded if are range of conditions are met, but the health ELVs must not be exceeded. For occupational exposure the first level of exposure limits for the unperturbed fields are the Sensory Action Levels which are.

- Magnetic field: 1 mT or 1000 µT (18 mT for exposure only to limbs)
- Electric field: 10 kV/m

The regulations allow for the sensory effects ELVs to be exceeded under the following conditions: i) They are only exceeded temporarily. ii) Hazardous spark discharges and contact currents in excess of 1 mA are prevented through the provision of information and training and the use of suitable technical and personal protection measures. iii) Adequate information is provided to the employee on the possibility of sensory effects related to time varying magnetic fields, including retinal phosphenes. iv) Where any of those sensory effects are reported to the employer, the risk assessment is updated where necessary. Providing the above conditions are complied with, the Regulations allow exposure up to a High Action Levels (which ensure the health ELV are not exceed), which are:

- Magnetic field: 6 mT or 6000 µT (18 mT for exposure only to limbs)
- Electric field: 20 kV/m

To ensure public exposure remains within safe limits, general public exposures in the UK should adhere to the ICNIRP 1998 guidelines, as outlined in the voluntary Code of Practice [7]. In practical terms, this mean:

- An electric field of 9 kV/m.
- A magnetic field of 360 µT.

[6] The Control of Electromagnetic Fields at Work Regulations 2016, see https://www.legislation.gov.uk/uksi/2016/588/contents

[7] Power Lines: Demonstrating compliance with EMF public exposure guidelines – A voluntary Code of Practice, published by DECC in February 2011.

3. Computation Software

The EMF was calculated using **HIFREQ (Electromagnetic Fields Analysis) module of the SES CDEGS software suite.** HIFREQ is an optimal computation tool for tackling complex electromagnetic problems involving any system of conductors, which can be comprised of various materials and assembled in various configurations, and which may include metallic plates, coaxial or multi-core cables, GIS/GIL, transformers, and assorted lumped components (e.g. resistors, inductors, and capacitors, etc.). HIFREQ is the only computation module that can provide accurate solutions to transient and steady state problems in the frequency range of zero to hundreds of megahertz, for the analysis of buried and aboveground conductors. It computes electric and magnetic fields in the air and soil, as well as conductor and soil potentials, and the current distribution in the soil and in the conductors.

More information on HIFREQ module https://sestech.com/en/Product/Module/HIFREQ

Limitations: This study acknowledges the limitation in accurately modelling insulator end fittings and conductor assembly hardware in CDEGS. Accurate modelling can be attained by applying 3D electric field design and analysis software featuring Boundary Element Method (BEM) technology.

Electric fields near the surface of a conductor are very sensitive to the shape of the conductor. HIFREQ can be used to compute electric fields by modelling the OHL tower and phase conductors, however, the conductors are represented as wire filaments and the exact shape of a conductor (for example the steel members of a tower), and insulators cannot be modelled. It is important to note that electric fields computed with HIFREQ at points located far away (i.e., several conductor radii away) from the conductors should nonetheless be accurate.

4. OHL Duck-Under Scenarios

The proposed Beauly Blackhillock New Deer Peterhead OHL involves the construction of approximately 158 kilometres (km) of new double circuit 400 kilovolts (kV) overhead transmission line (OHL) between the proposed Fanellan and Greens 400kV substations and 28km of new double circuit 400 kV OHL between the proposed Greens and Netherton 400kV substation.

Special arrangements are required to facilitate the crossing of the Proposed Development with existing 132 kV, 275 kV and 400kV OHLs. As part of the Proposed Development, six special arrangements are proposed. The location of these and each of the proposed arrangements that are part of the EMF assessment are shown in the figures below.

The circuit data for the proposed 400 kV OHL and crossing arrangement is shown in Section 5 and 6.

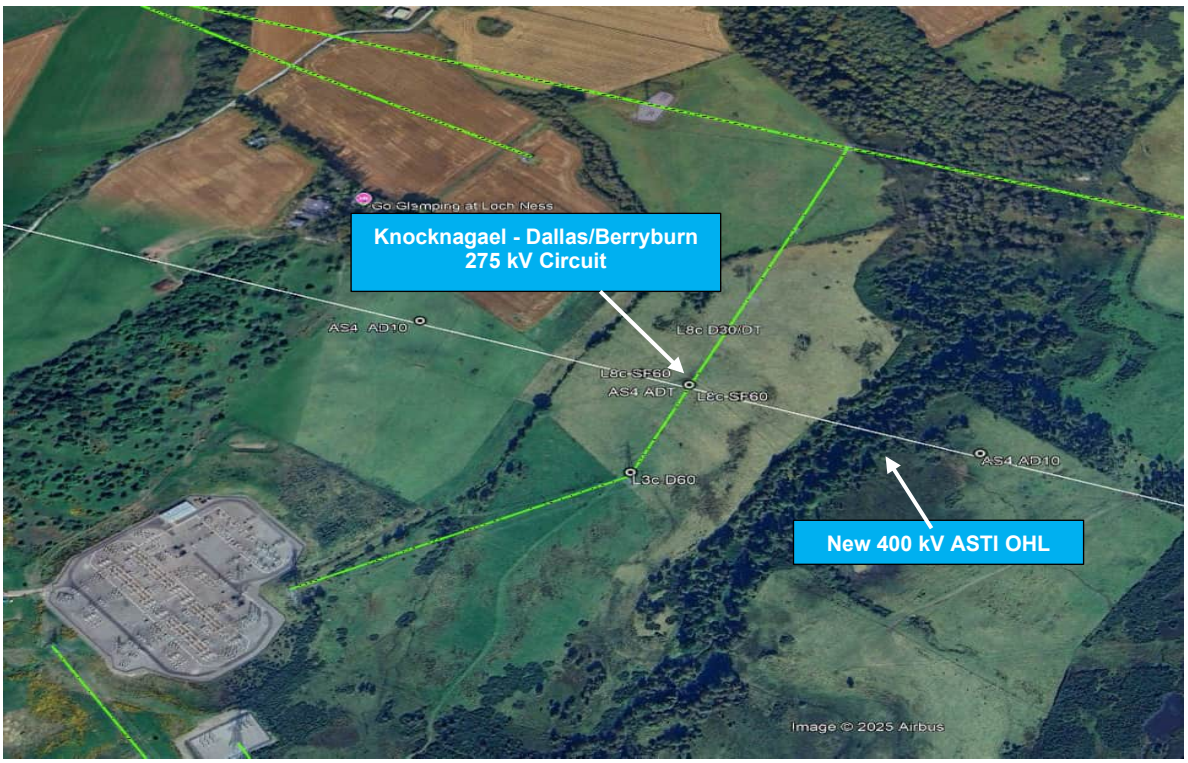


Figure 3: OHL Crossing 1

Figure 4: OHL Crossing 2 and 3

Figure 5: OHL Crossing 4

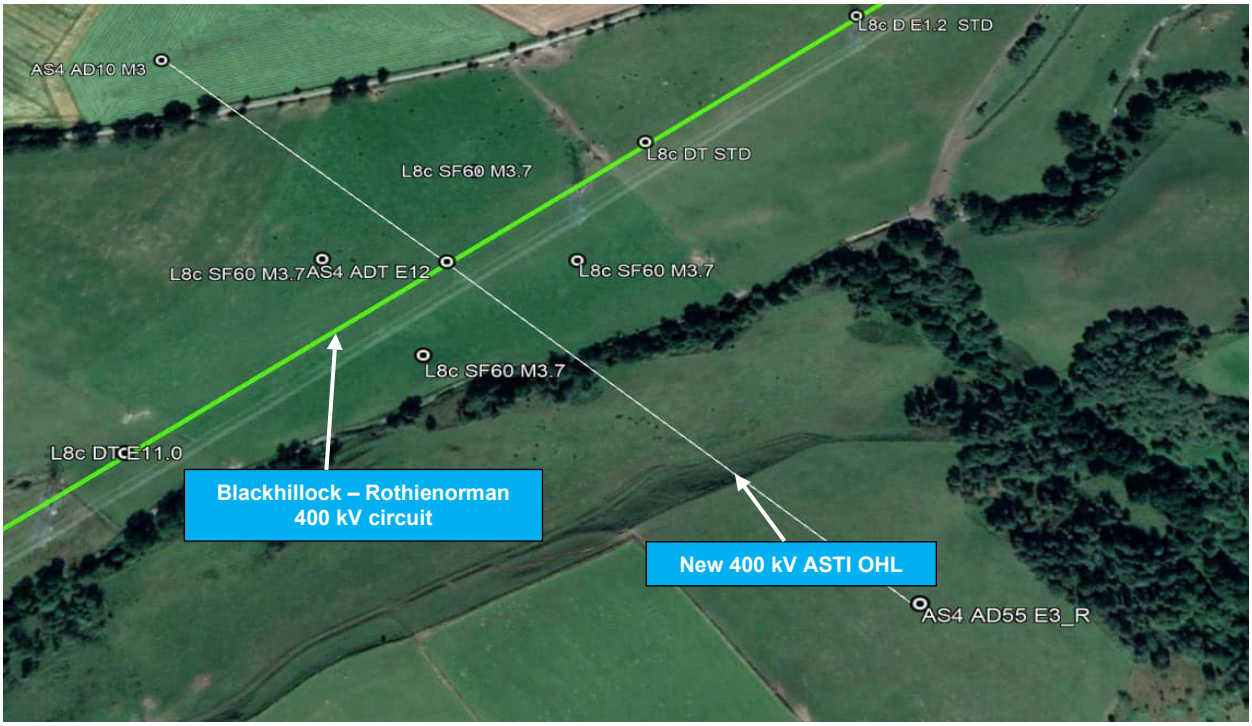


Figure 6: OHL Crossing 5

Figure 7: OHL Crossing 6

5. Data for CDEGS Model

This section details the input data for the proposed Beauly Blackhillock New Deer Peterhead 400 kV circuits that was used to develop a computer model to calculate EMF as requested by SSEN.

5.1 Soil Resistivity

The soil resistivity along the OHL route was considered 500 Ωm. The magnitude was chosen based on the Arcadis engineering experience within SSEN network area. The above soil model will be used in all future subsequent analysis to represent the soil conditions.

5.2 Conductor Data

The Beauly Blackhillock New Deer Peterhead 400 kV OHL route will consist of steel lattice towers using a new tower series known as the ASTI SSE400 or AS4 for short. A 400 kV tower drawing is detailed within the Appendix A of this report. For each crossing the tower type, span length and sag was designed in a PLSCAD model and information shared by SSEN [8]. The conductor system is proposed to be 3 x 700 mm^2 AAAC Araucaria with 500 mm bundle spacing. The phase and earth wire data sheets are attached in Appendix A.

At OHL duck-under scenarios, the existing OHL phase and earth wire data was based on the information attached in Appendix A of this report.

5.3 OHL Voltage Levels and Load Current

The steady state coupling in this report considers the proposed Beauly Blackhillock New Deer Peterhead 400 kV OHLs operating at maximum pre fault continuous winter rating of 5000 A and maximum 400 kV voltage.

At OHL duck-under scenarios, the duck under OHL rating was based on the information attached in Appendix A of this report. At the crossing location, the ground clearance of the oversailing ASTI 400 kV overhead lines was modelled using a conservative approach, bounded between a minimum clearance of 9 meters and the conductor sag profile derived from PLS-CADD simulations, as detailed in Appendix A. The sag of duck under OHL was modelled such that these phase approaching statutory clearance 6.7 m for 132 kV, 7.0 m for 275 kV as given in the Electricity Safety, Quality and Continuity Regulations 2002 (see https://www.legislation.gov.uk/uksi/2002/2665/contents). The exception was made for 400 kV OHL duck-under scenario where actual ground clearance from PLS CADD model were used.

The report does not consider fault conditions. As per CIGRE guidelines, in extreme cases, lightning and electrical faults can create very brief, large, fault currents in equipment and conductors/cables, and consequently elevated magnetic fields in the vicinity. Fault current events are of very short duration (typically a few cycles), rare (typically a few times per year or less) and have a low probability of coincidence with someone being in very close proximity at the time. This is a somewhat similar scenario to lightning strikes. ICNIRP 2010 does not provide specific guidance on fault currents. IEEE [3] states that the averaging time for assessing exposures is 200 ms or ten cycles. Faults currents that exceed ten cycles are typically on low-voltage distribution systems or remote from the protection. In these cases, the current is typically lower. In any case where such faults occur the electricity system is designed to immediately isolate the fault and thereby eliminate any exposure. Therefore, electrical networks are compliant with the general principle that when a danger is identified it is eliminated as soon as possible, and all reasonable attempts are made to avoid its occurrence.

[8] Email from SSEN, "RE: Special Arrangement Models - SF60s for EMFs" 20th February 2025.

5.4 OHL Phasing

Similar to the phase and earth wire, the phase arrangement of the OHL on a double circuit tower can impact EMF. SSEN have provided data on the proposed phasing for both the existing and proposed OHL which is shown within Appendix A. The Beauly Blackhillock New Deer Peterhead OHL will have optimal phasing with a "centre points symmetrical" phase arrangement, similar to that illustrated in Figure 8. The existing OHL phasing has been modelled as per the information provided in Appendix A.

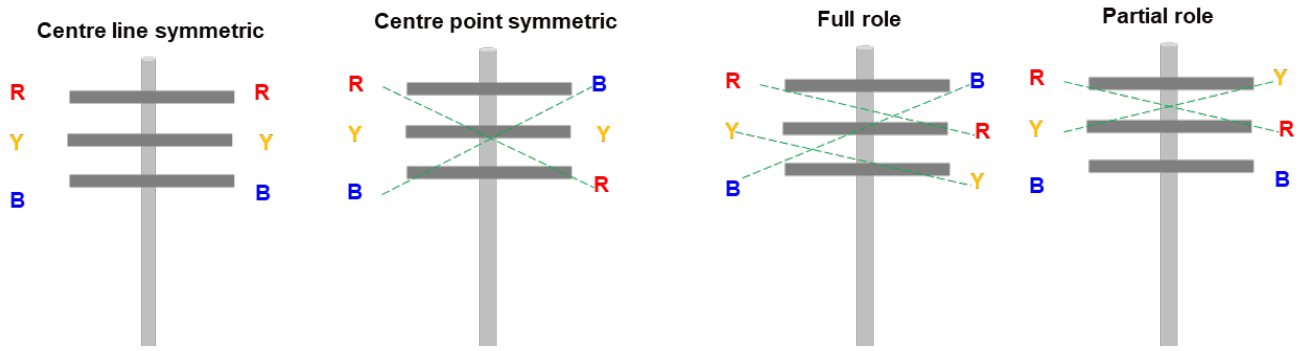


Figure 8: Possible Phase Arrangements -Double Circuit OHL

6. EMF Calculations

This section details the calculations and interpretations of EMF using HIFREQ along the CDEGS model at the proposed crossing. The OHL tower, phase, and earth wires were modelled using the data, in Section 4. Two spans were modelled, and calculation profile were placed at OHL duck-under 1 m above ground. The power flow on both circuit was considered in same direction. As stated before, this study acknowledges the limitation in accurately modelling insulator end fittings and conductor assembly hardware in HIFREQ. The insulators were omitted, and conductors were modelled at respective locations at the tower crossarm, it should be noted however that as the conductor is sagged to achieve 9m clearance to ground or to the designed ground clearance for the 400kV crossing the insulator length has negligible impact.

Special Arrangement 1 Knocknagael - Dallas/Berryburn 275 kV Circuit: According to the CDEGS model, the maximum electric and magnetic field values are presented below, with the corresponding CDEGS plot provided in Appendix B.

- An electric field 6.98 kV < safe threshold of 9 kV/m
- A magnetic field 60.16 µT < safe threshold 360 µT

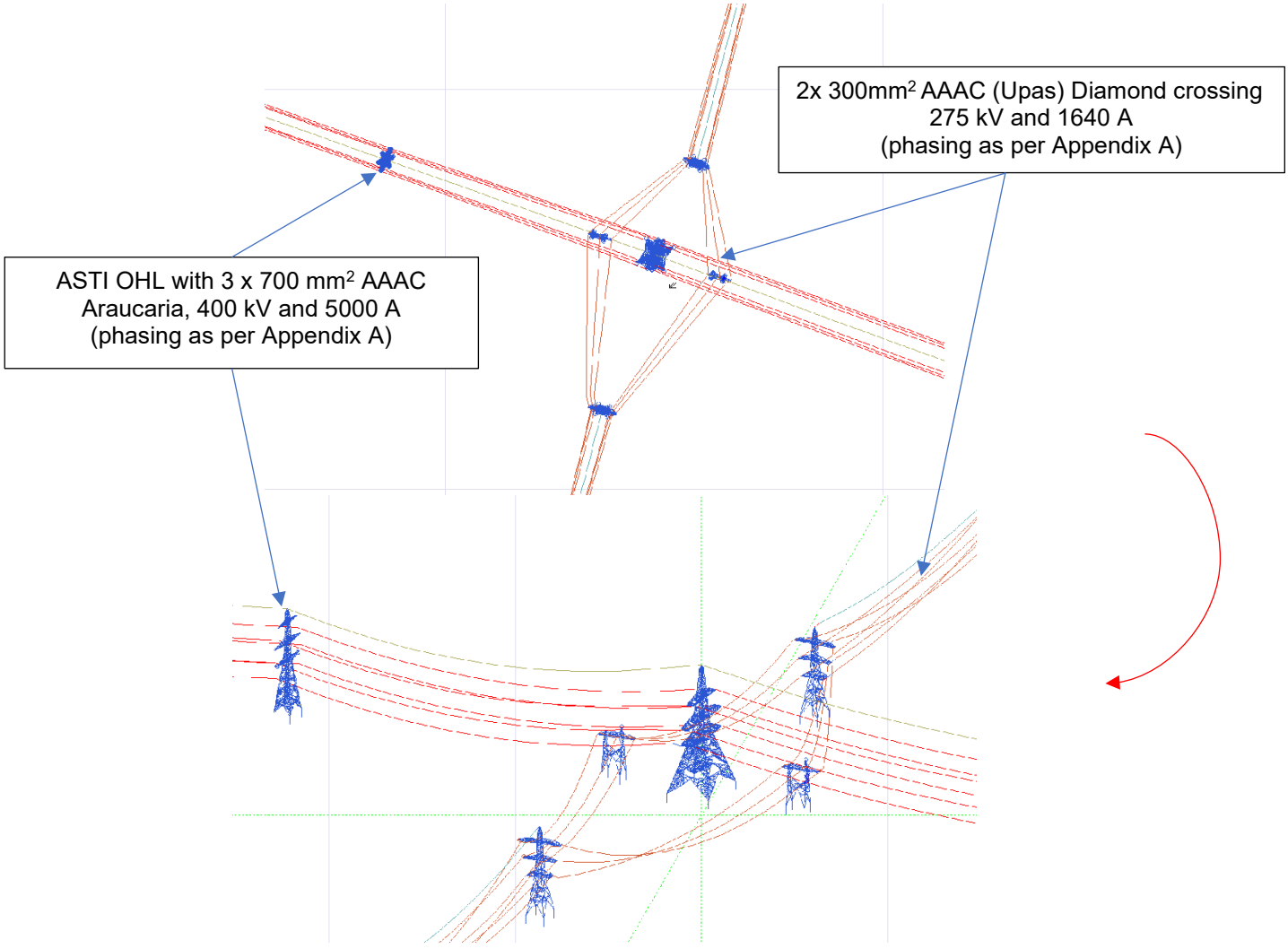


Figure 9: Crossing 1

Special Arrangement 2 Blackhillock-Dallas/Berryburn 275 kV Circuit: According to the CDEGS model, the maximum electric and magnetic field values are presented below, with the corresponding CDEGS plot provided in Appendix B.

- An electric field 7.44 kV < safe threshold of 9 kV/m
- A magnetic field 65.97 µT < safe threshold 360 µT

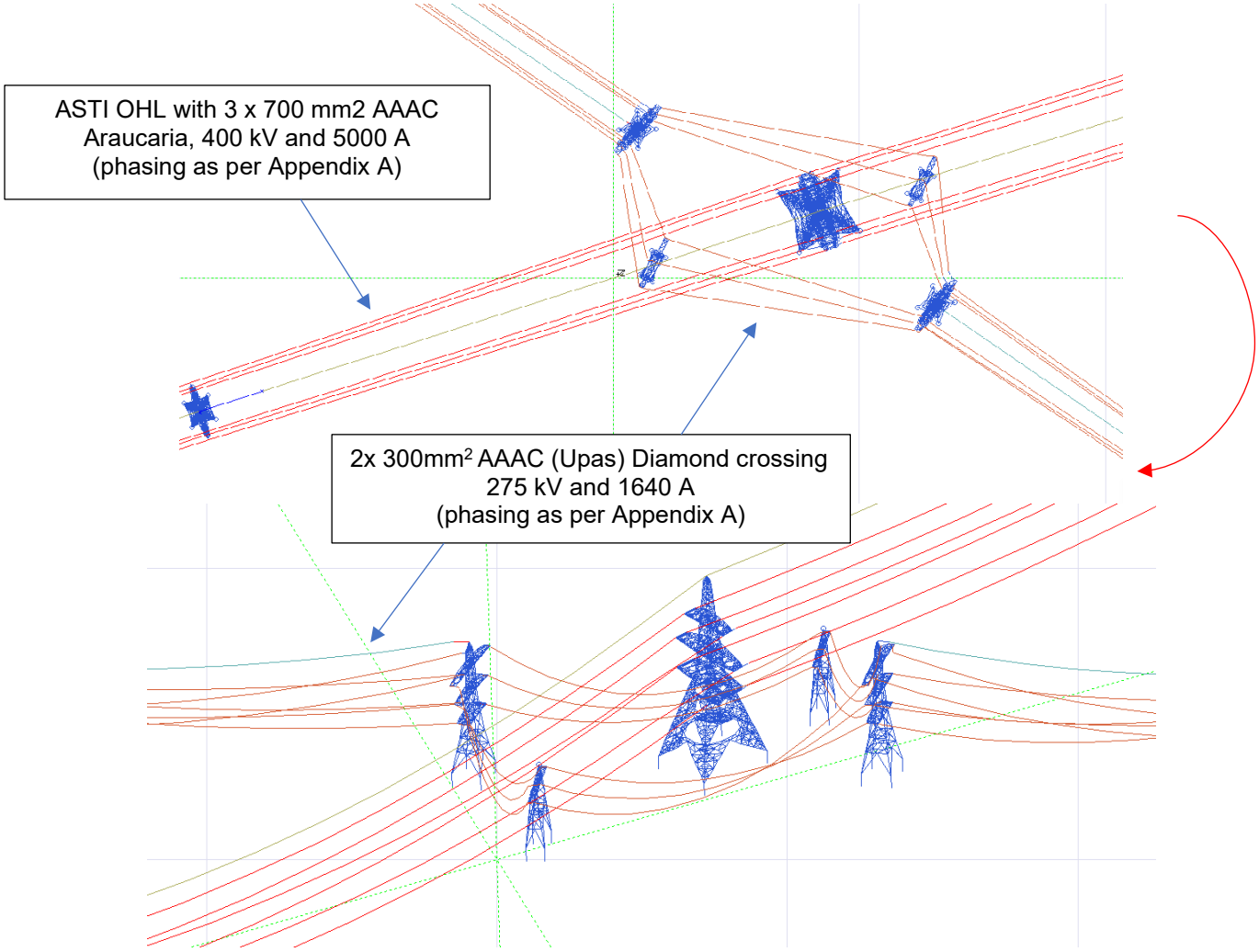


Figure 10: Crossing 2

Special Arrangement 3 Elgin - Keith 132 kV Circuit: According to the CDEGS model, the maximum electric and magnetic field values are presented below, with the corresponding CDEGS plot provided in Appendix B.

- An electric field 4.11 kV < safe threshold of 9 kV/m
- A magnetic field 46.99 µT < safe threshold 360 µT

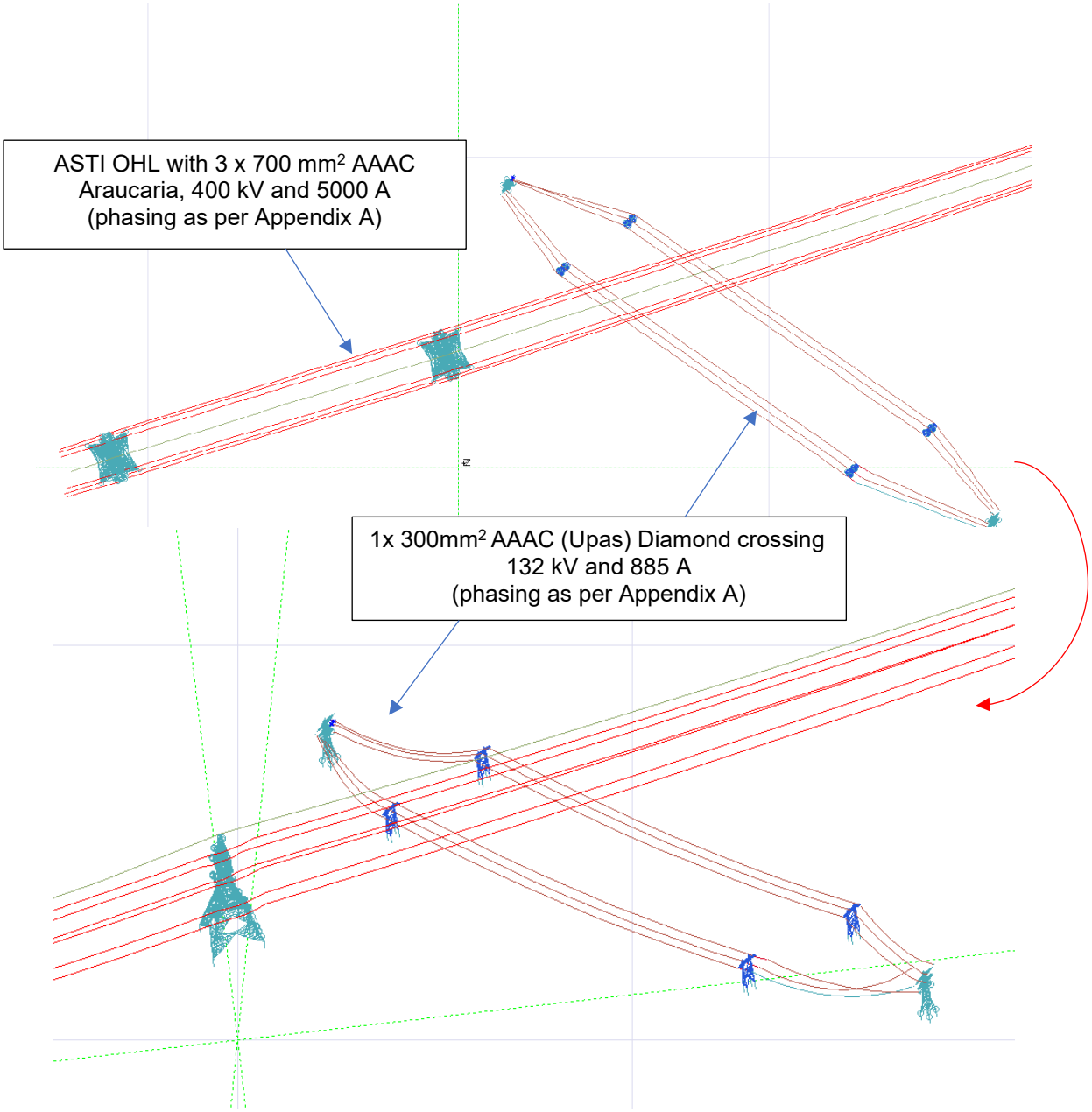


Figure 11: Crossing 3

Special Arrangement 4 Keith - Macduff 132 kV Circuit: According to the CDEGS model, the maximum electric and magnetic field values are presented below, with the corresponding CDEGS plot provided in Appendix B.

- An electric field 3.70 kV < safe threshold of 9 kV/m
- A magnetic field 34.03 µT < safe threshold 360 µT

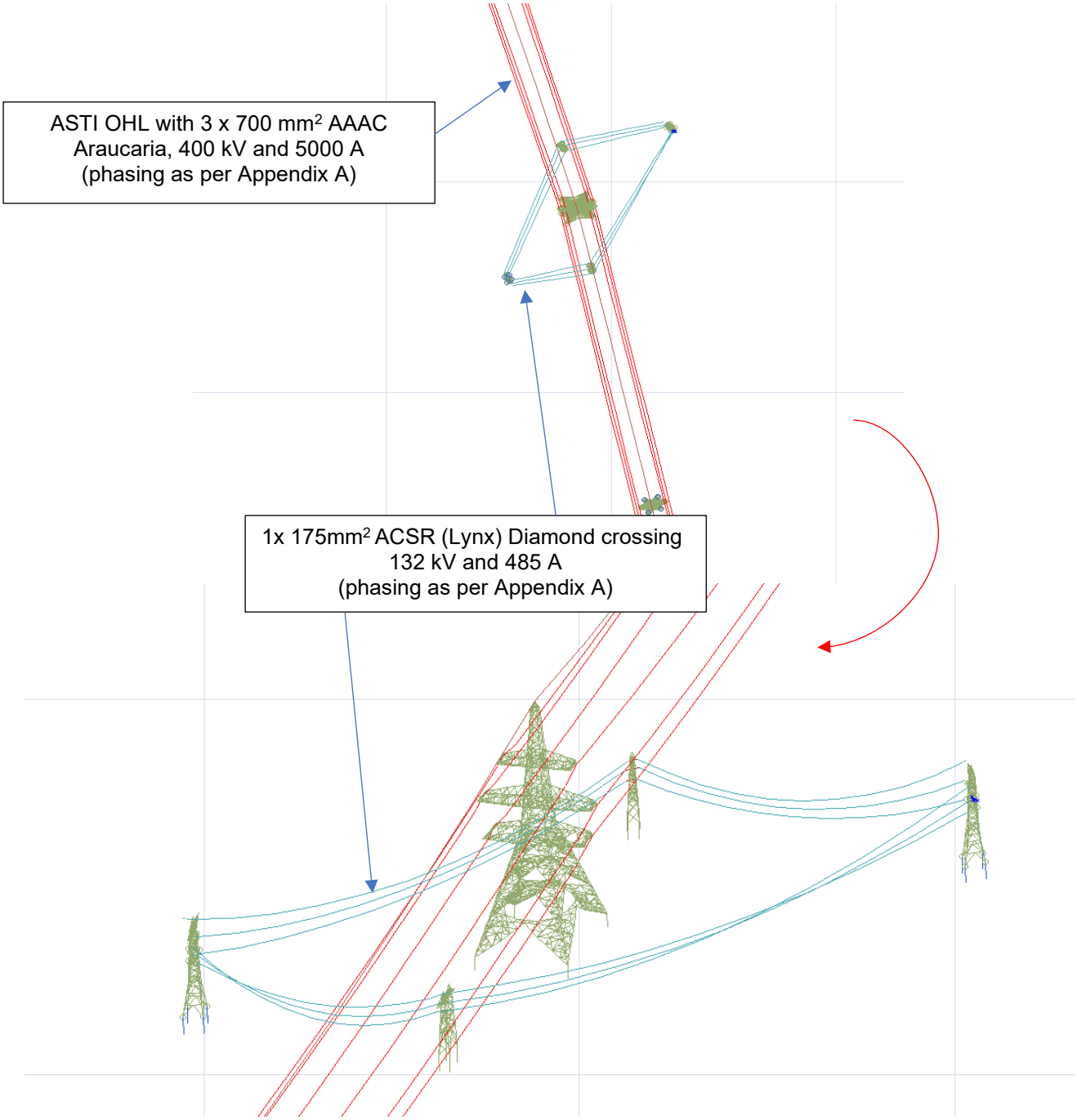


Figure 12: Crossing 4

Special Arrangement 5 Blackhillock – Rothienorman 400 kV circuit: According to the CDEGS model, the maximum electric and magnetic field values are presented below, with the corresponding CDEGS plot provided in Appendix B.

- An electric field 9.52 kV > safe threshold of 9 kV/m
- A magnetic field 78.42 µT < safe threshold 360 µT

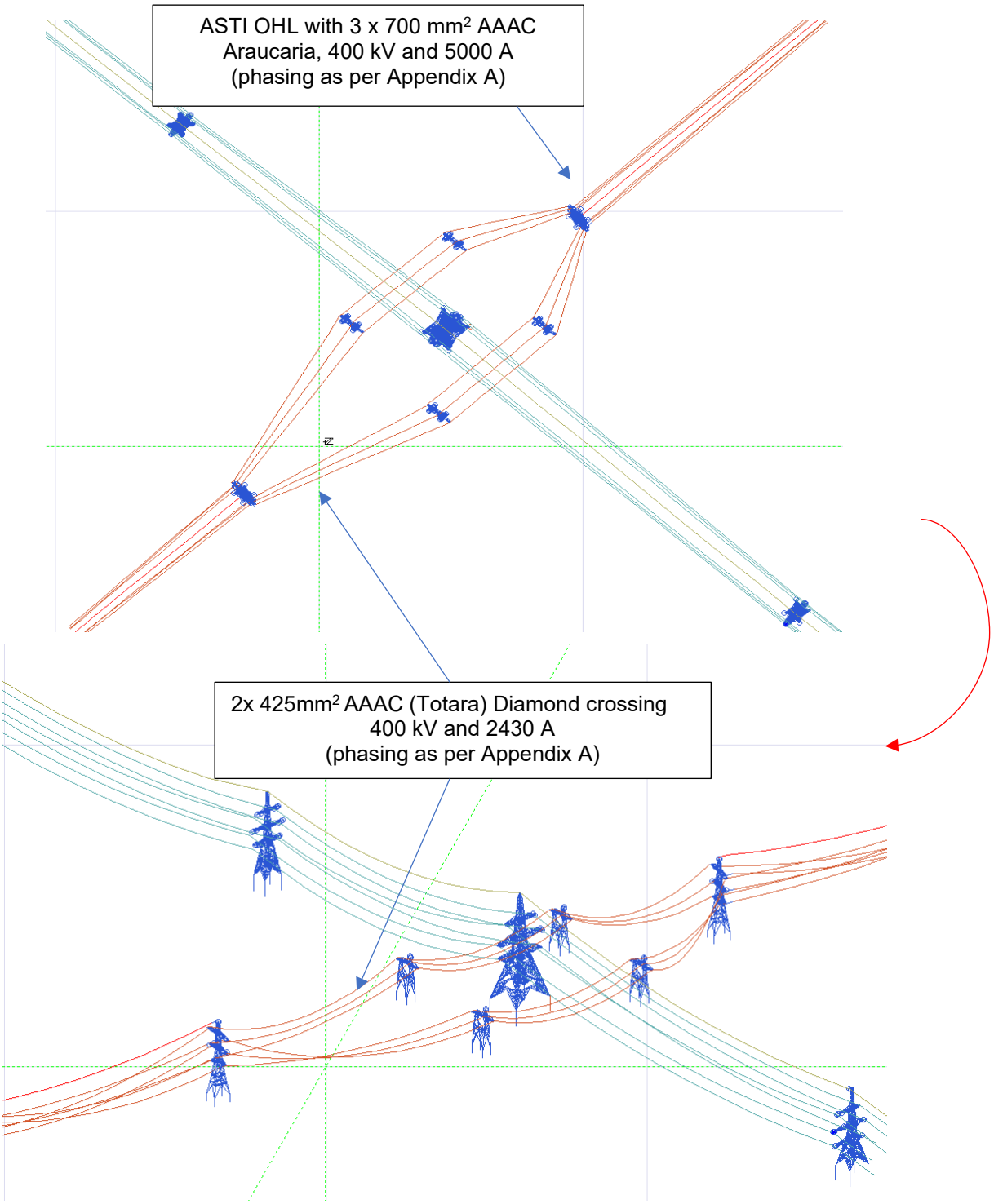


Figure 13: Crossing 5

Special Arrangement 6 Blackhillock – Rothienorman 400 kV circuit: According to the CDEGS model, the maximum electric and magnetic field values are presented below, with the corresponding CDEGS plot provided in Appendix B.

- An electric field 7.50 kV < safe threshold of 9 kV/m
- A magnetic field 78.89 µT < safe threshold 360 µT

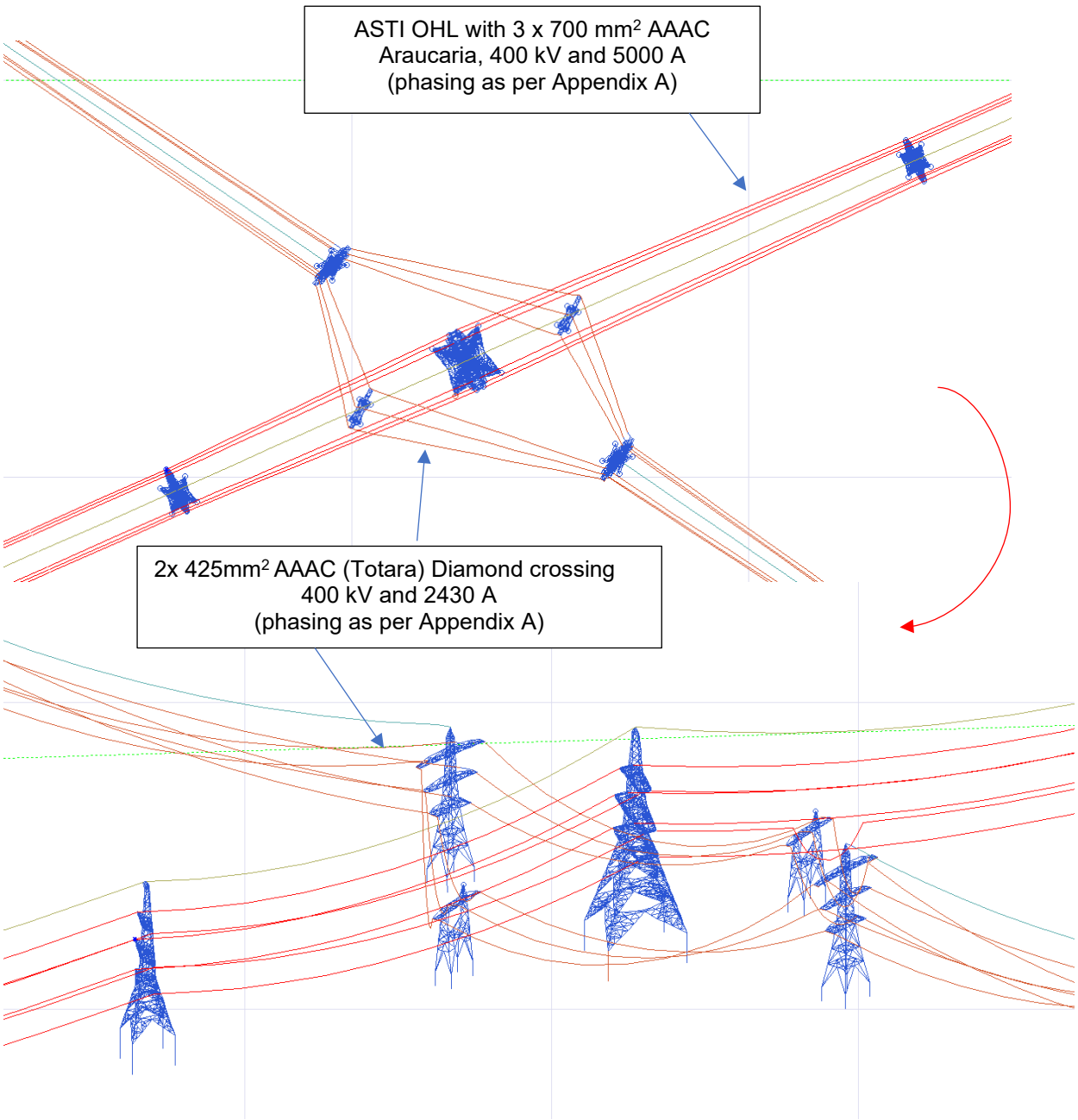


Figure 14: Crossing 6

7. Conclusions

a) Arcadis carried out an EMF assessment of the proposed Beauly Blackhillock New Deer Peterhead 400 kV OHL duck under scenario with existing SSEN 400 kV, 275 kV and 132 kV using CDEGS (HIFREQ). The calculation profile was placed at OHL duck-under 1 m above ground. The power flow on both circuits was considered in same direction. The study acknowledges the limitation in accurately modelling insulator end fittings and conductor assembly hardware in HIFREQ however this does not impact EMF calculation at ground level itself.

b) To ensure public exposure remains within safe limits, set exposure thresholds at 9 kV/m for electric fields and 360 µT for magnetic fields were used.

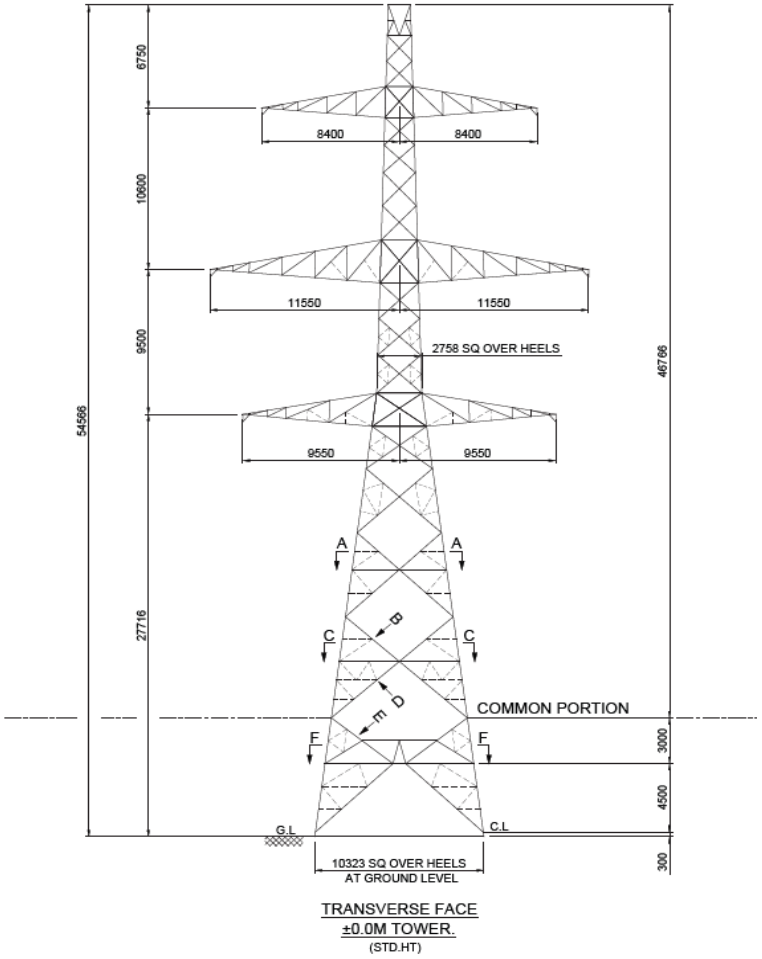
c) The EMF was assessed using CDEGS (HIFREQ), with all calculated values for various duck-under scenarios remaining within the safe threshold except for crossing 5. Crossing 5 exceeds the UK exposure limit for electric field with a value of 9.52 kV/m. Although this crossing exceeds this limit, it does however still comply with the EMF public exposure guidelines as the location in which this crossing occurs is not deemed by SSEN to be an area where members of the public spend significant time. As exposure can be deemed not to be for a significant period of time, the ICNIRP occupational guidelines apply in which this crossing remains in compliance with. The corresponding graphs are shown in Appendix B.

8. Recommendations

a) It is advisable for SSEN to review all input data and assumptions outlined in the report during the detailed design stage to ensure compliance with public EMF exposure limits. Crossing 5 ground clearance should be increased to meet the required EMF exposure thresholds. Alternatively, the overhead line (OHL) phasing should be reassessed.

Appendix A

ASTI 400 kV OHL Tower (Information Only)



TRANSVERSE FACE
±0.0M TOWER.
(STD.HT)

ASTI 400 kV OHL Phase and Earth Wire

data sheet

LF AAAC Araucaria EHC

LAMIFIL

Version 1, 23-02-2008

Conductor	AAAC 820mm²
Code name	LF AAAC Araucaria EHC

Mechanical specifications	Metric (SI)		Imperial	
Nominal aluminium equivalent area	mm²	761	in²	1,179
Nominal cross sectional area of aluminium alloy	mm²	821,1	in²	1,273
Number, diameter and type of central wire	#, mm	1 4,14 R Alloy	#, in	1 0,163 R Alloy
Number, (eq.) diameter and type of wire in layer	#, mm	6 4,14 R Alloy	#, in	6 0,163 R Alloy
Number, (eq.) diameter and type of wire in layer	#, mm	12 4,14 R Alloy	#, in	12 0,163 R Alloy
Number, (eq.) diameter and type of wire in layer	#, mm	18 4,14 R Alloy	#, in	18 0,163 R Alloy
Number, (eq.) diameter and type of wire in layer	#, mm	24 4,14 R Alloy	#, in	24 0,163 R Alloy
Diameter tolerance of aluminium wires (Al or Alloy)	mm	± 0,03	in	± 0,001
Lay ratio of inner layer(s)		10-16		10-16
Lay ratio of outer layer		10-14		10-14
Overall diameter	mm	37,26	in	1,467
Rated tensile strength of conductor (RTS)	kN	242,2	klbf	54,5
Nominal mass per unit length - total	kg/km	2350,5	lb/kft	1579,5
Nominal mass per unit length - total bare	kg/km	2271,5	lb/kft	1526,4
Nominal mass per unit length - grease	kg/km	79,0	lb/kft	53,1
Coefficient of linear expansion below thermal kneepoint	/ K	0,00002300	/ °F	0,00001278
Modulus of elasticity below thermal kneepoint	GPa	56,6	Msi	8,20
Geometric mean radius	mm	14,5	ft	0,0476

Electrical specifications	Metric (SI)		Imperial	
Nominal DC resistance at 20 °C (tolerance ± 2%)	Ohm/km	0,0381	Ohm/mile	0,0612
Temperature coefficient		0,00403		0,00403
Frequency	Hz	50	Hz	60
Nominal AC resistance at 20 °C (tolerance ± 2%)	Ohm/km	0,0401	Ohm/mile	0,0659
Nominal AC resistance at 25 °C (tolerance ± 2%)	Ohm/km	0,0408	Ohm/mile	0,0671
Nominal AC resistance at 50 °C (tolerance ± 2%)	Ohm/km	0,0445	Ohm/mile	0,0729
Nominal AC resistance at 75 °C (tolerance ± 2%)	Ohm/km	0,0482	Ohm/mile	0,0787
Nominal AC resistance at 100 °C (tolerance ± 2%)	Ohm/km	0,0519	Ohm/mile	0,0846
Maximum allowable continuous operating temperature (surface)	°C	90	°F	194
Inductive reactance: Xa (conductor part)	Ohm/km	0,1914	Ohm/mile	0,3696
Shunt capacitive reactance: X'a (conductor part)	MOhmkm	0,1204	MOhmmile	0,1003

Individual wires	Metric (SI)		Imperial	
Maximum resistivity of aluminium alloy at 20 °C, minimum IACS	nOhmm, %	30,50 57%	nOhmft, %	100,07 57%
Minimum tensile strength, aluminium alloy wire	MPa	295	psi	42786
Minimum elongation for aluminium alloy wire.	%	3,5	%	3,5

Standard applied for conductor manufacturer: TS 3.4.2 - Issue 5 - juni 2004

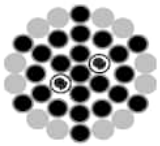
Page 1

AFL

08.04.2024, Ja
TK 14988-10 Rev. 00

ASLH-V(2S)bbb 96 SMF (AL3/A20SA 109/209)

Optical Ground Wire (OPGW) according to IEC 60794-4-10



- Stranding direction of outer layer: right hand (Z-stranding)
- Greasing acc. to EN 50182 A.2 / Grease acc. to EN 50326, type A
- Entire conductor greased except outer layer
- Wires acc. to EN 50183 / EN 61232
- Maximum fibre capacity per steel tube: 48 x 250µm Ø / 66 x 200µm Ø
- Fibres coloured acc. to colour code 048 F TIA-598-D
- Fibres acc. to G.652.D
- Tube marking: #1: none #2: ▌▌2 2▌▌

Configuration

Center	1 A20SA - Wire	3,50 mm
Layer 1	4 A20SA - Wires	3,40 mm
+	2 Stainless Steel Tubes with 48 SMF	3,00 / 3,40 mm
Layer 2		
	12 A20SA - Wires	3,40 mm
Layer 3	12 AL3 - Wires	3,40 mm
	6 A20SA - Wires	3,40 mm

Mechanical Data

Cable Diameter	23,9 mm
Cable Weight	1798 kg/km
Supporting Cross Section	318,3 mm²
Rated Tensile Strength (RTS)	278,6 kN
Modulus of Elasticity	126,1 kN/mm²
Thermal Elongation Coefficient	14,5 10^{-6}/K
Permissible Maximum Working Stress (50% RTS)	437,7 N/mm² (139,3kN)
Recommended Everyday Stress (20% RTS)	175,1 N/mm² (55,7kN)
Ultimate Exceptional Stress (80% RTS)	700,3 N/mm² (222,9kN)

Electrical Data

DC Resistance (20°C)		0,176 Ω/km
Conductivity		30,8% IACS
Short Time Current	(1,0s; 20-200°C)	25,8 kA
Short Time Current	(0,5s; 20-200°C)	36,5 kA
Short Time Current Capacity I²t	(20-200°C)	665,4 kA²s

Application

Maximum Permissible Installation Force		83,6 kN
Minimum Bending Radius	static	299 mm
	dynamic	359 mm
Normal Delivery Length		3000 m
Temperature Range	Installation	-10 to +50°C
	Transportation and Operation	-40 to +85°C

All Sizes and Values are Nominal Values. The latest edition of referenced documents applies. opgw_pro8.xlsm, Ver. 23.02

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Duck-under Parameters and Phasing

LT37 Special Arrangement 1

Conductor type:

- Existing conductor: 2x 300mm² AAAC (Upas)
- New conductor: 2x 300mm² AAAC (Upas)

Circuit rating:

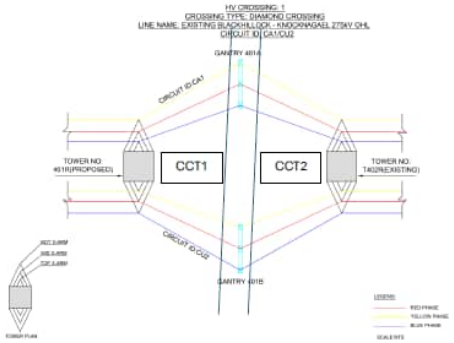
- Voltage: 275kV
- For 2x Upas @ 65ºC: Winter Pre Fault 1640A

Table G5: Circuit Thermal Overload Ratings for 275 kV, 2x300mm² Upas AAAC Resistivity 30.5 nΩ.m (strung from 1997 onwards)

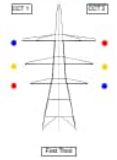
Rated Temperature: 65 °C

ALL RATINGS ARE	Winter		SPRING / AUTUMN		Summer	
PER CIRCUIT	Amps	MVA	Amps	MVA	Amps	MVA
Pre-Fault Continuous	1640	785	1550	740	1390	665
Post-Fault Continuous	1960	935	1850	880	1660	790

Phasing: CA1/CU2



ASTI Phasing:



Min Clearance AS4 to ground CB1-10 to CB1-11 – 14.65m

Min clearance AS4 to ground CB1-11 to CB1-12 – 18.06m

LT37 Special Arrangement 1

Conductor type:

- Existing conductor: 2x 300mm² AAAC (Upas)
- New conductor: 2x 300mm² AAAC (Upas)

Circuit rating:

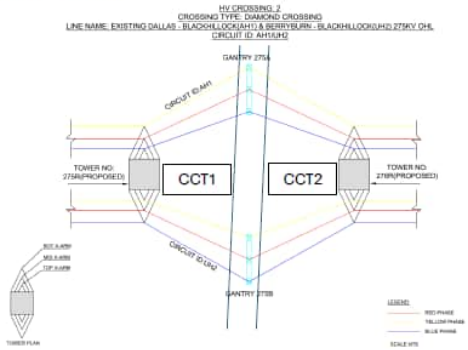
- Voltage: 275kV
- For 2x Upas @ 65ºC: Winter Pre Fault 1640A

Table G5: Circuit Thermal Overload Ratings for 275 kV, 2x300mm² Upas AAAC Resistivity 30.5 nΩ.m (strung from 1997 onwards)

Rated Temperature: 65 °C

ALL RATINGS ARE	Winter		SPRING / AUTUMN		Summer	
PER CIRCUIT	Amps	MVA	Amps	MVA	Amps	MVA
Pre-Fault Continuous	1640	785	1550	740	1390	665
Post-Fault Continuous	1960	935	1850	880	1660	790

Phasing: AH1/UH2



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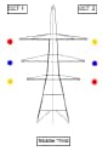


Min Clearance AS4 to ground CB12-5 to CB12-6 – 10.20m

Min clearance AS4 to ground CB12-6 to CB12-7 – 25.66m

LT37 Special Arrangement 3

Conductor type:

- Existing conductor: 1x 300mm² Upas AAAC
- New conductor: 1x 300mm² Upas AAAC

Circuit rating:

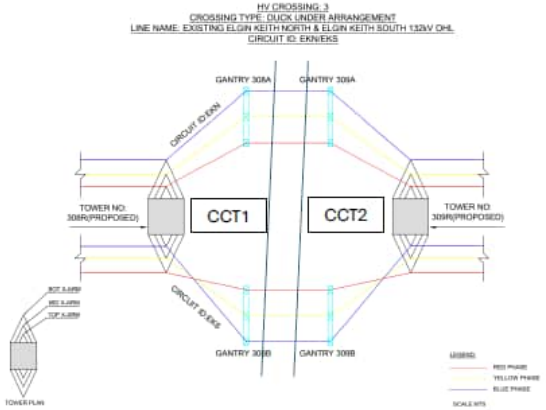
- Voltage: 132kV
- For Upas @ 75°C: Winter Pre Fault 885A

Circuit Thermal Overload Ratings for 132kV, 1 x 300 mm² Upas AAAC
O/H Circuit ID –BNN, BNS, NEN, NES, EKS,EKN
(Beauly Inverness Nairn Elgin Keith)

Rated Temperature: 75°C

ALL RATINGS ARE PER CIRCUIT	Winter		Spring / Autumn		Summer	
	Amps	MVA	Amps	MVA	Amps	MVA
Pre-Fault Continuous	885	203	845	193	770	176
Post-Fault Continuous	1060	241	1000	230	915	210

Phasing: EKN/EKS



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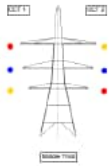


Min Clearance AS4 to ground CB12-7 to CB12-8A – 18.98m

LT37 Special Arrangement 4

Conductor type:

- Existing conductor: 1x 175mm² ACSR (Lynx)
- New conductor: 1x 175mm² ACSR (Lynx)

Circuit rating:

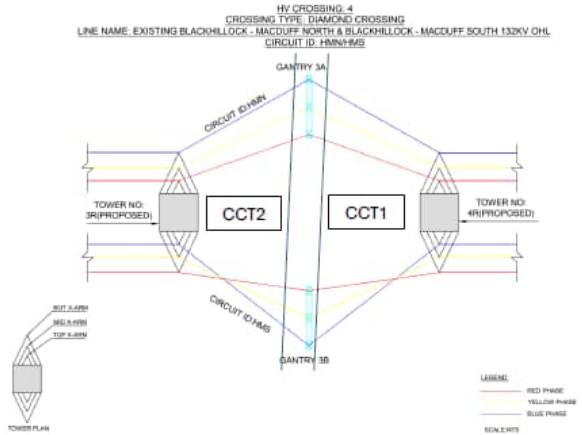
- Voltage: 132kV
- For Lynx @ 50°C: Winter Pre Fault 485A

Table C1: Circuit Thermal Overload Ratings for 132 kV, 1x175mm² Lynx ACSR

Rated Temperature: 50 °C

ALL RATINGS ARE PER CIRCUIT	Winter		Spring/Autumn		Summer	
	Amps	MVA	Amps	MVA	Amps	MVA
Pre-Fault Continuous	485	111	450	103	390	89
Post-Fault Continuous	580	132	540	123	465	106

Phasing: HMN/HMS



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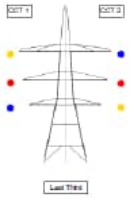


Min Clearance AS4 to ground CB15-14A to CB15-15 – 12.65m

Min clearance AS4 to ground CB15-15 to CB16-1 – 16.22m

LT37 Special Arrangement 5

Conductor type:

- Existing conductor: 2x 425mm² AAAC (Totara)
- New conductor: 2x 425mm² AAAC (Totara)

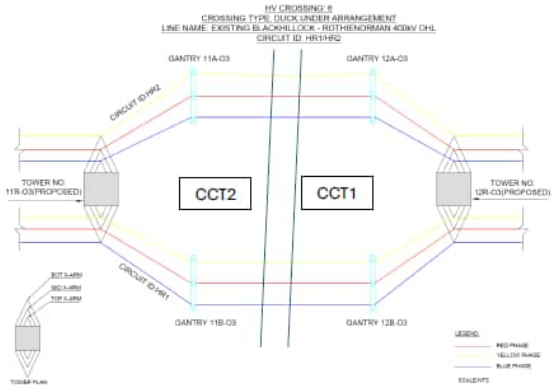
Circuit rating:

- Voltage: 400kV
- For 2x Totara @90°C: Winter Pre Fault = 2430A

Table G35: Circuit Thermal Overload Ratings for 400 kV, 2x425mm² Totara AAAC Resistivity 30.5 nΩ.m (strung from 1997 onwards)

	Rated Temperature:	90 °C				
ALL RATINGS ARE PER CIRCUIT	Winter Amps	MVA	Spring / Autumn Amps	MVA	Summer Amps	MVA
Pre-Fault Continuous	2430	1680	2330	1610	2170	1500
Post-Fault Continuous	2890	2000	2770	1920	2580	1790

Phasing: HR1/HR2



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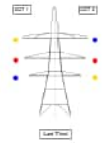


Min Clearance AS4 to ground CB16-2 to CB16-3 – 11.46m

Min clearance AS4 to ground CB16-3 to CB16-4 – 15.07m

Min clearance undersailing line 11R-O3 to 11A-O3 to 12A-O3 to 12R-03 – 11.97m, 7.98m, 10.74m

Min clearance undersailing line 11R-O3 to 11B-O3 to 12B-O3 to 12R-03 – 14.22m, 10.39m, 13.81m

LT37/359 – BBNP

LT359 Special Arrangement 1

Conductor type:

- Existing conductor: 2x 425mm² AAAC (Totara)
- New conductor: 2x 425mm² AAAC (Totara)

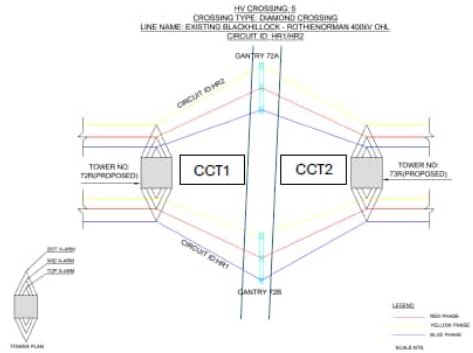
Circuit rating:

- Voltage: 400kV
- For 2x Totara @90°C: Winter Pre Fault = 2430A

Table G35: Circuit Thermal Overload Ratings for 400 kV, 2x425mm² Totara AAAC Resistivity 30.5 nΩ.m (strung from 1997 onwards)

	Rated Temperature:	90 °C				
ALL RATINGS ARE PER CIRCUIT	Winter Amps	MVA	Spring / Autumn Amps	MVA	Summer Amps	MVA
Pre-Fault Continuous	2430	1680	2330	1610	2170	1500
Post-Fault Continuous	2890	2000	2770	1920	2580	1790

Phasing: HR1/HR2



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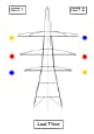
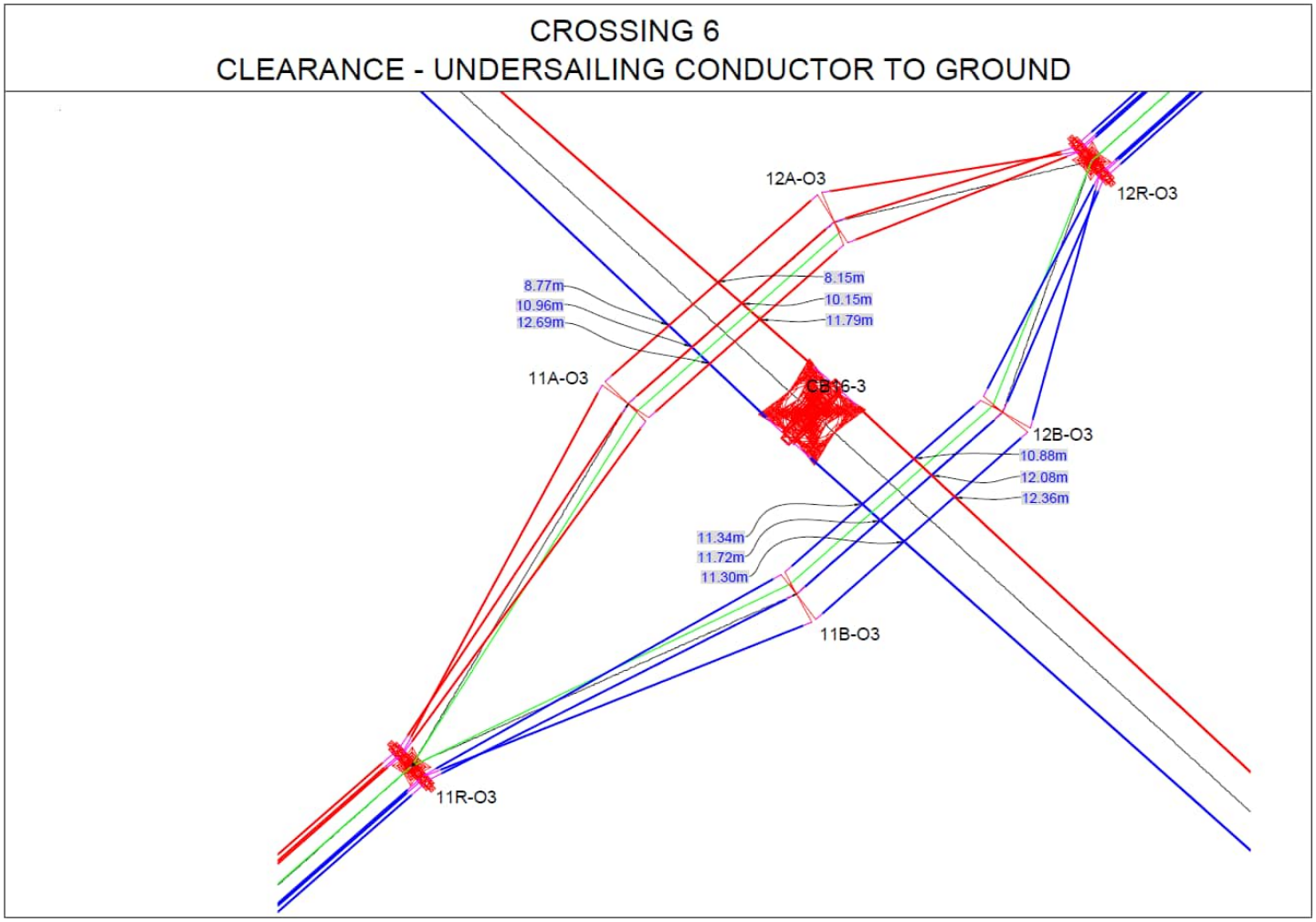


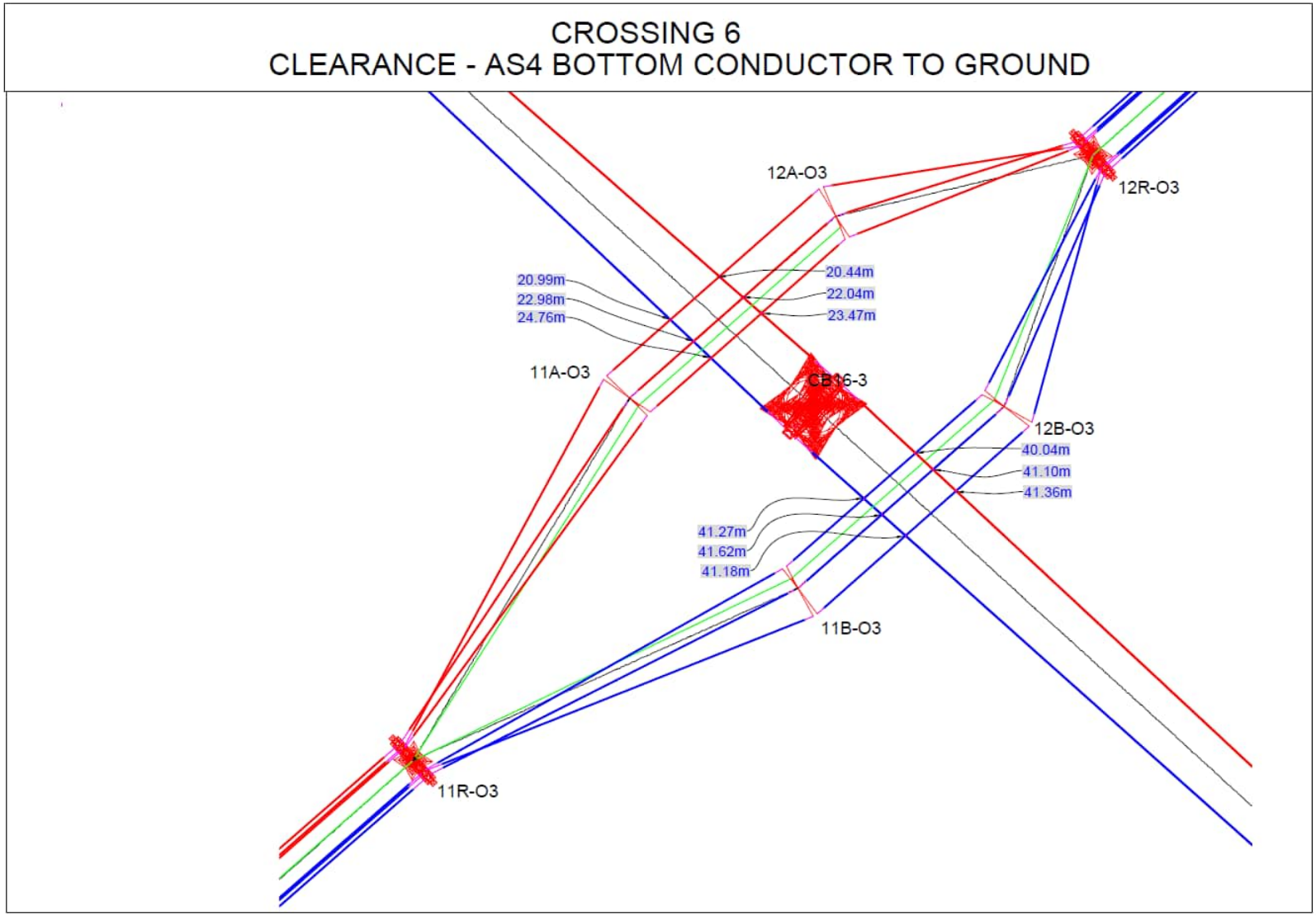
Min Clearance AS4 to ground BN4-1 to BN4-2 – 24.13m

Min clearance AS4 to ground BN4-2 to BN4-3 – 19.7m

Min clearance undersailing line 72R to 72B to 73R – 10.1m and 8.68m

Min clearance undersailing line 72R to 72A to 73R – 8.32m and 8.12m

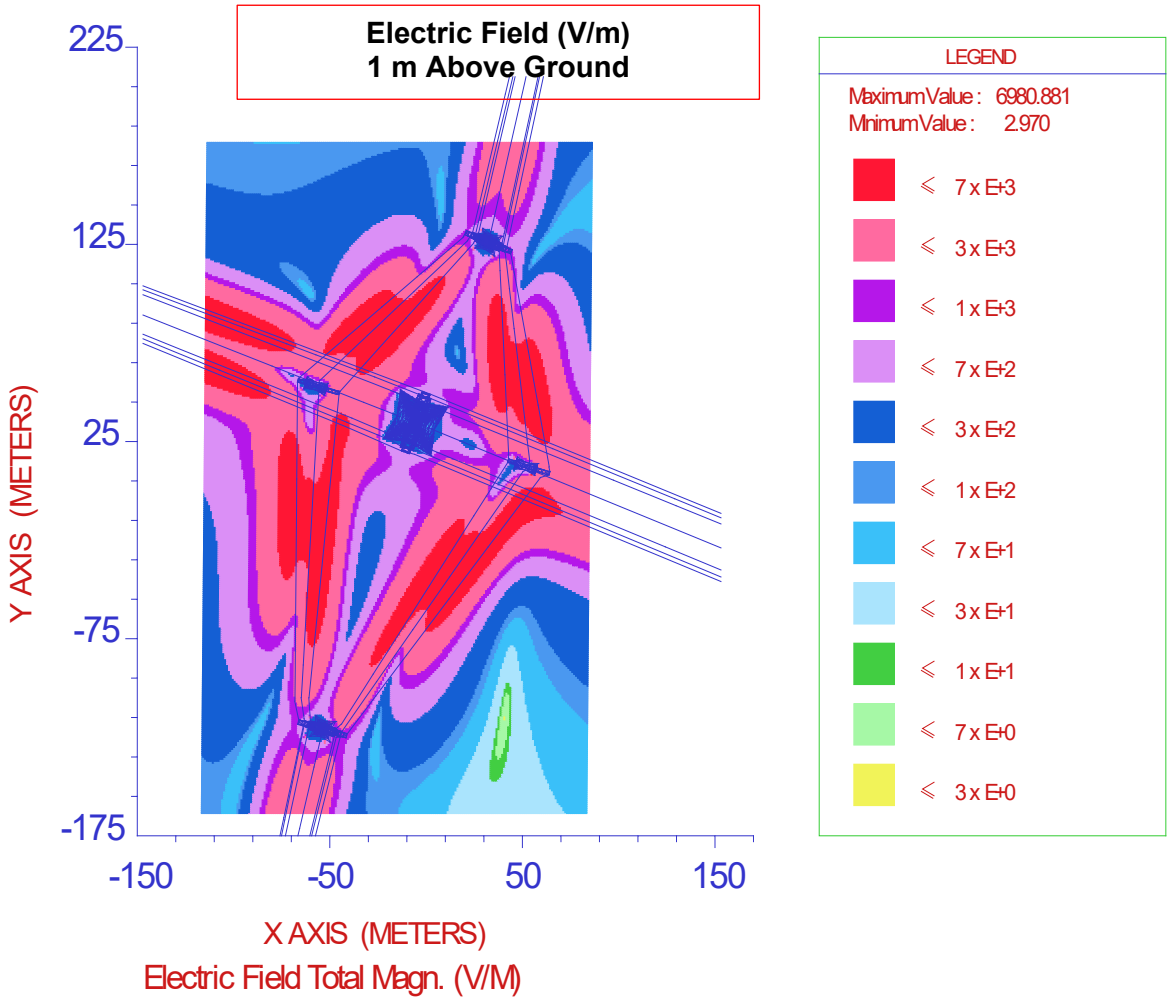

CROSSING 6
CLEARANCE - UNDERSAILING CONDUCTOR TO GROUND
12A-O3
12R-O3
8.77m
10.96m
12.69m
8.15m
10.15m
11.79m
11A-O3
CB16-3
12B-O3
10.88m
12.08m
12.36m
11.34m
11.72m
11.30m
11B-O3
11R-O3

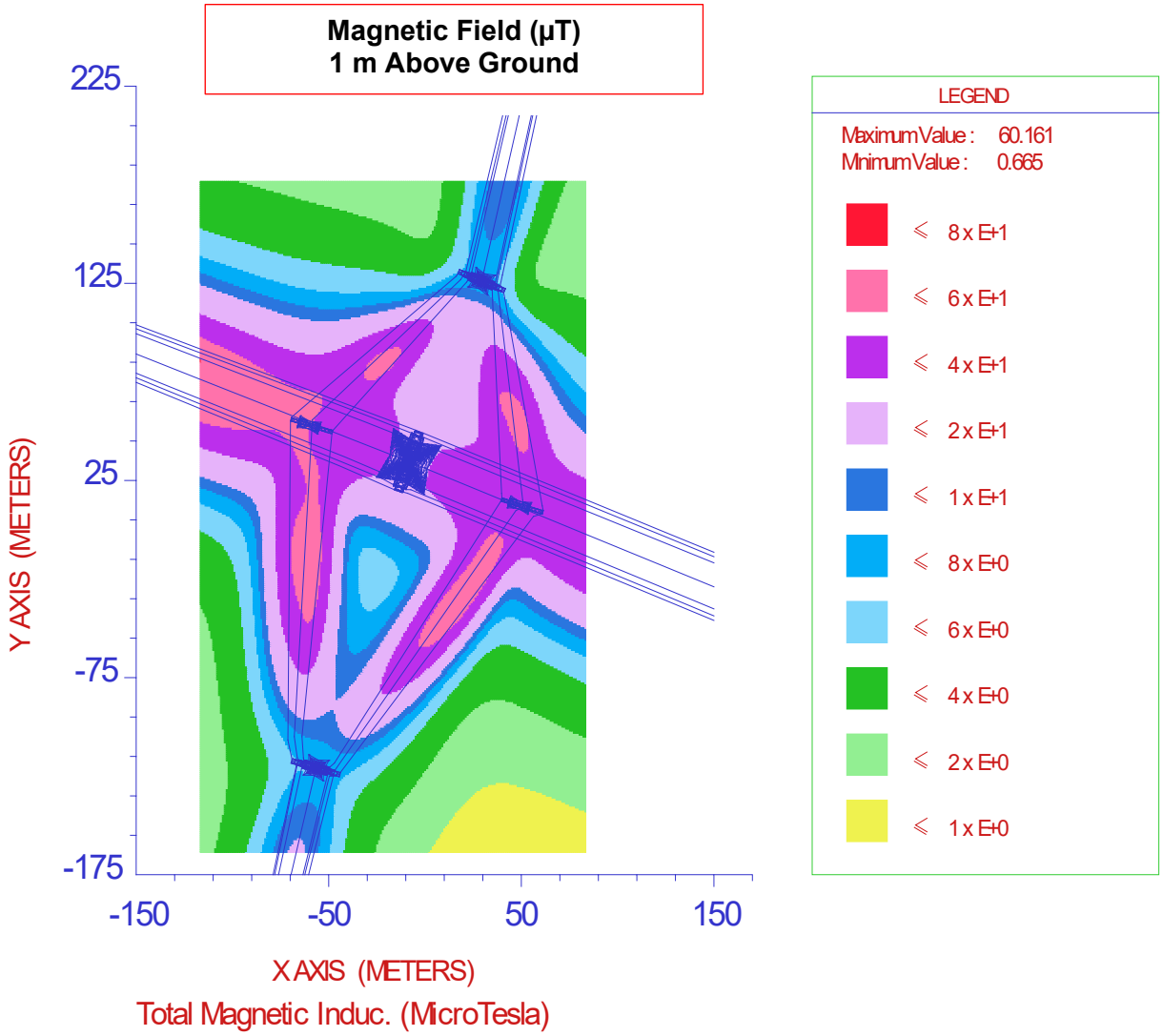

CROSSING 6
CLEARANCE - AS4 BOTTOM CONDUCTOR TO GROUND
12A-O3
12R-O3
20.99m
22.98m
24.76m
20.44m
22.04m
23.47m
11A-O3
CB16-3
12B-O3
40.04m
41.10m
41.36m
41.27m
41.62m
41.18m
11B-O3
11R-O3

Appendix B

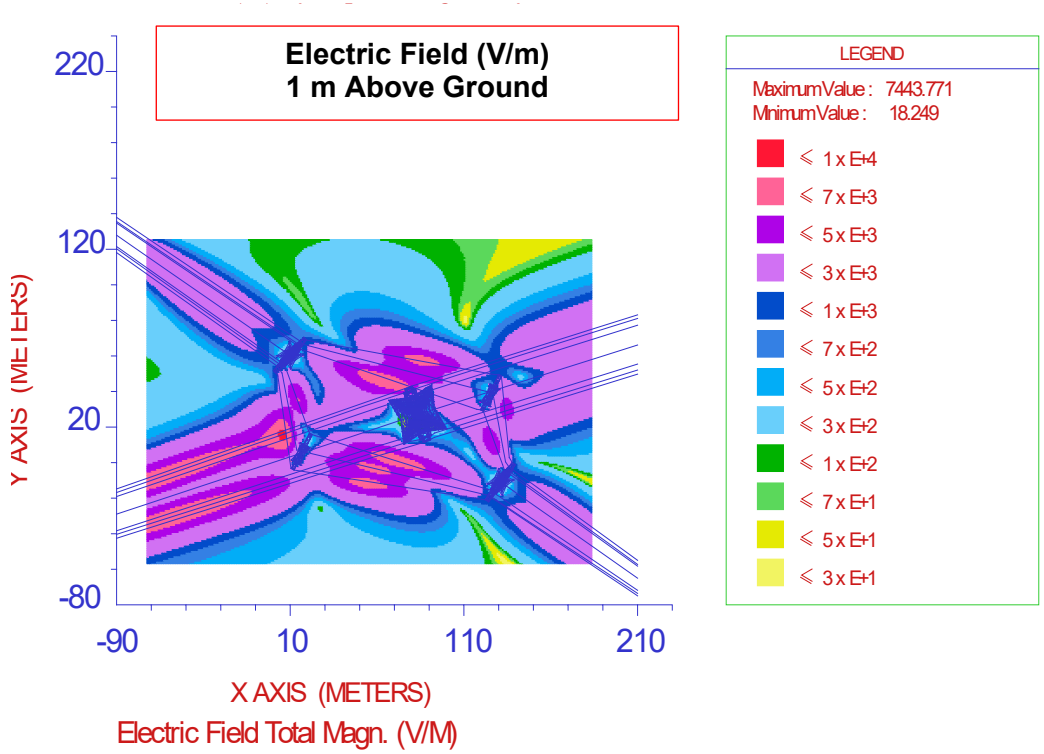
CDEGS (HIFREQ) Results

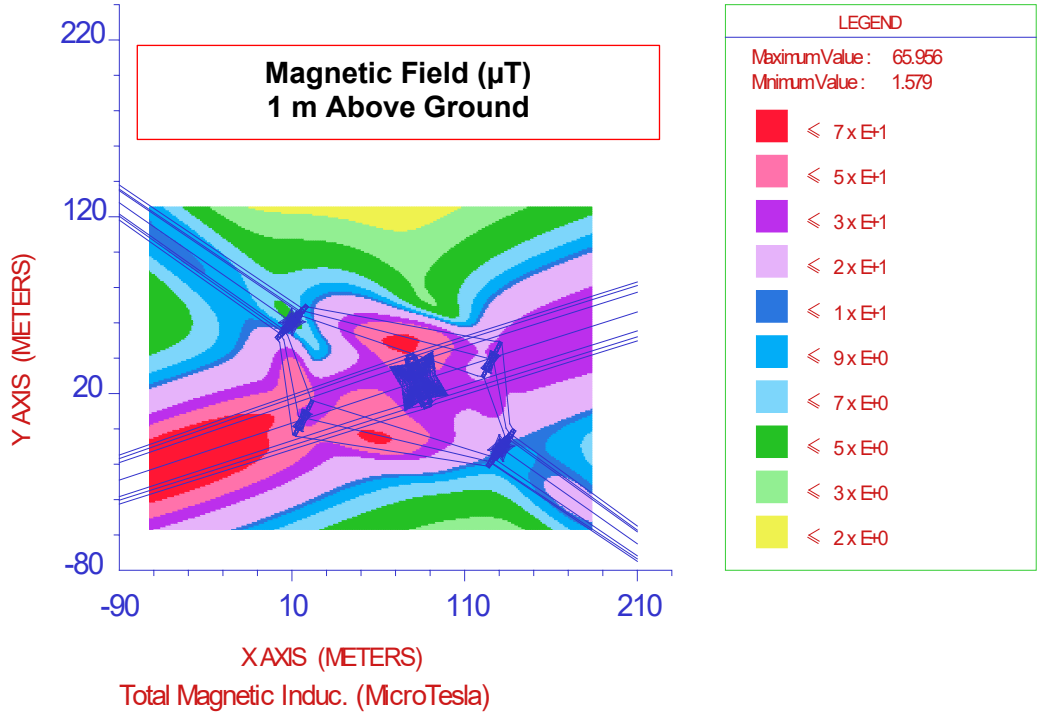
i) Crossing 1 Knocknagael - Dallas/Berryburn 275 kV Circuit



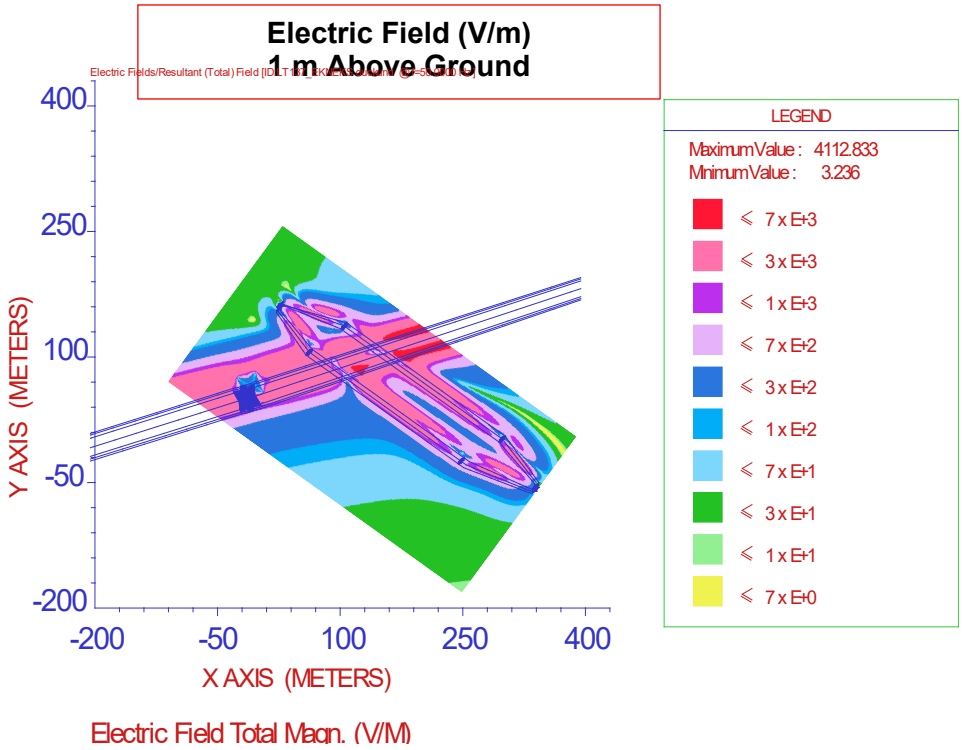

Magnetic Field (µT)
1 m Above Ground
225
125
25
-75
-175
Y AXIS (METERS)
-150
-50
50
150
X AXIS (METERS)
Total Magnetic Induc. (MicroTesla)
LEGEND
Maximum Value : 60.161
Minimum Value : 0.665
⩽ 8 x E+1
⩽ 6 x E+1
⩽ 4 x E+1
⩽ 2 x E+1
⩽ 1 x E+1
⩽ 8 x E+0
⩽ 6 x E+0
⩽ 4 x E+0
⩽ 2 x E+0
⩽ 1 x E+0

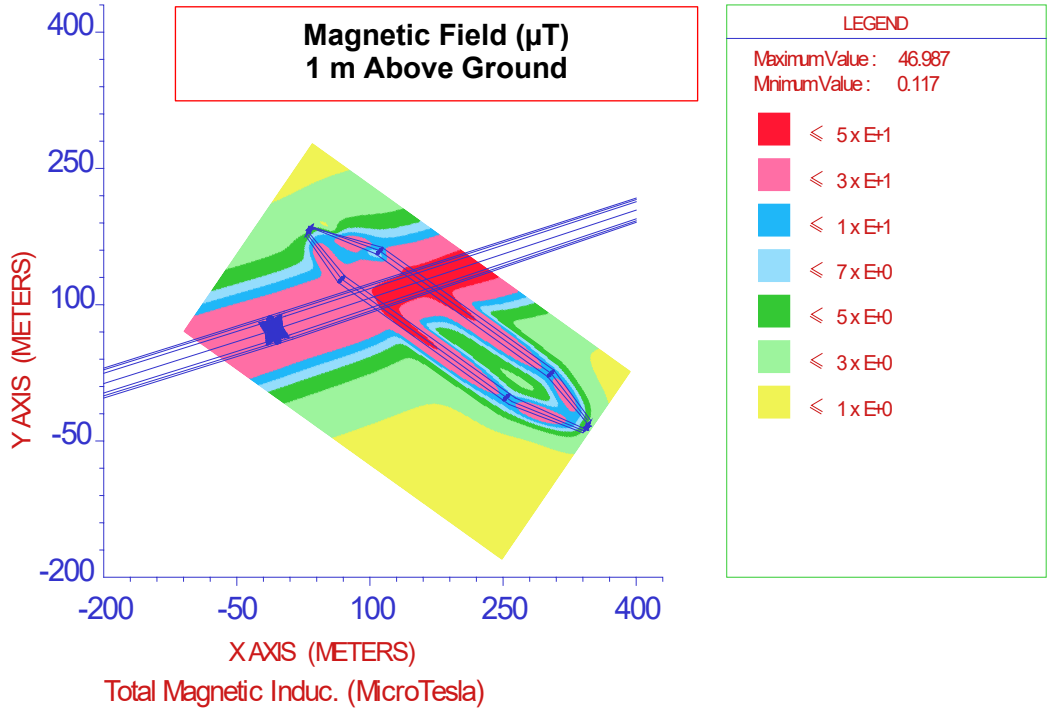
ii) Crossing 2 Blackhillock-Dallas/Berryburn 275 kV Circuit



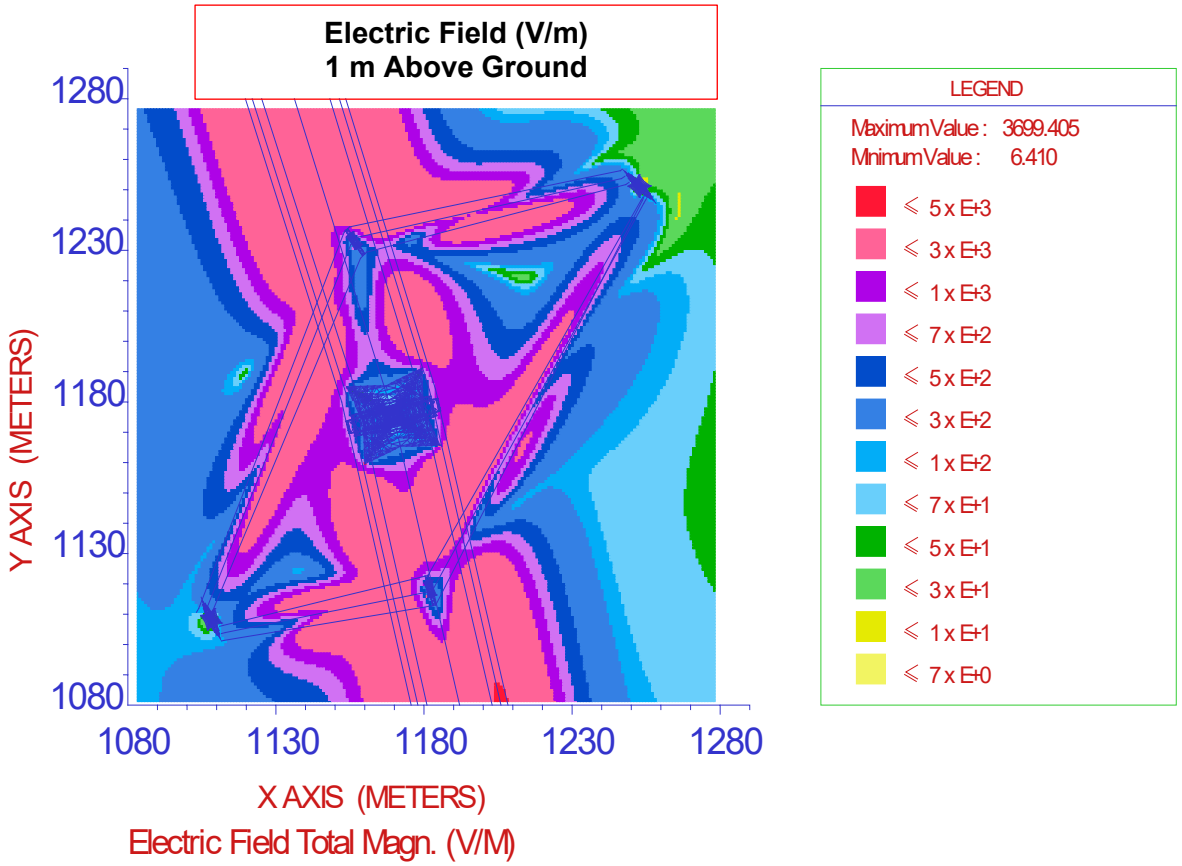

Magnetic Field (µT)
1 m Above Ground
220
120
20
-80
Y AXIS (METERS)
-90
10
110
210
X AXIS (METERS)
Total Magnetic Induc. (MicroTesla)
LEGEND
Maximum Value : 65.956
Minimum Value : 1.579
⩽ 7 x E+1
⩽ 5 x E+1
⩽ 3 x E+1
⩽ 2 x E+1
⩽ 1 x E+1
⩽ 9 x E+0
⩽ 7 x E+0
⩽ 5 x E+0
⩽ 3 x E+0
⩽ 2 x E+0

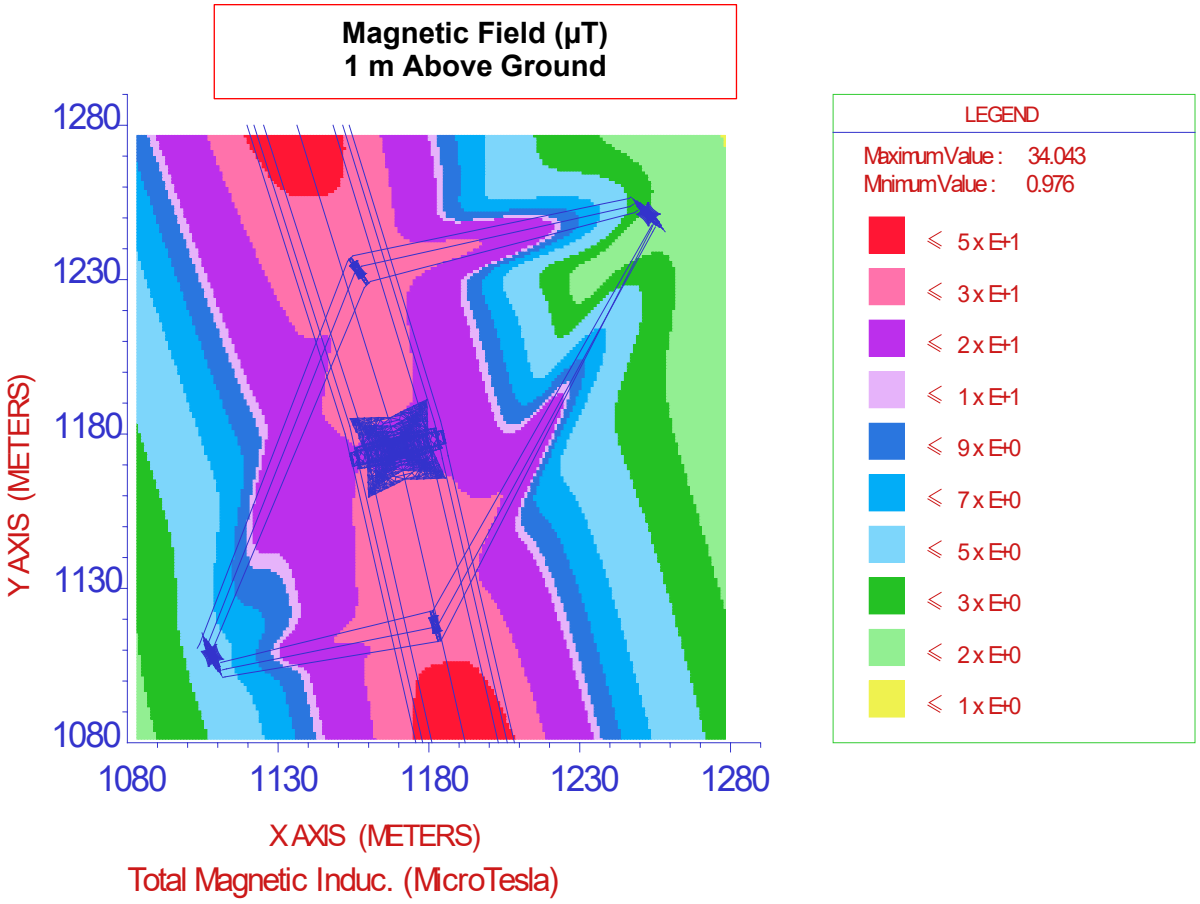
iii) Crossing 3 Elgin - Keith 132 kV Circuit



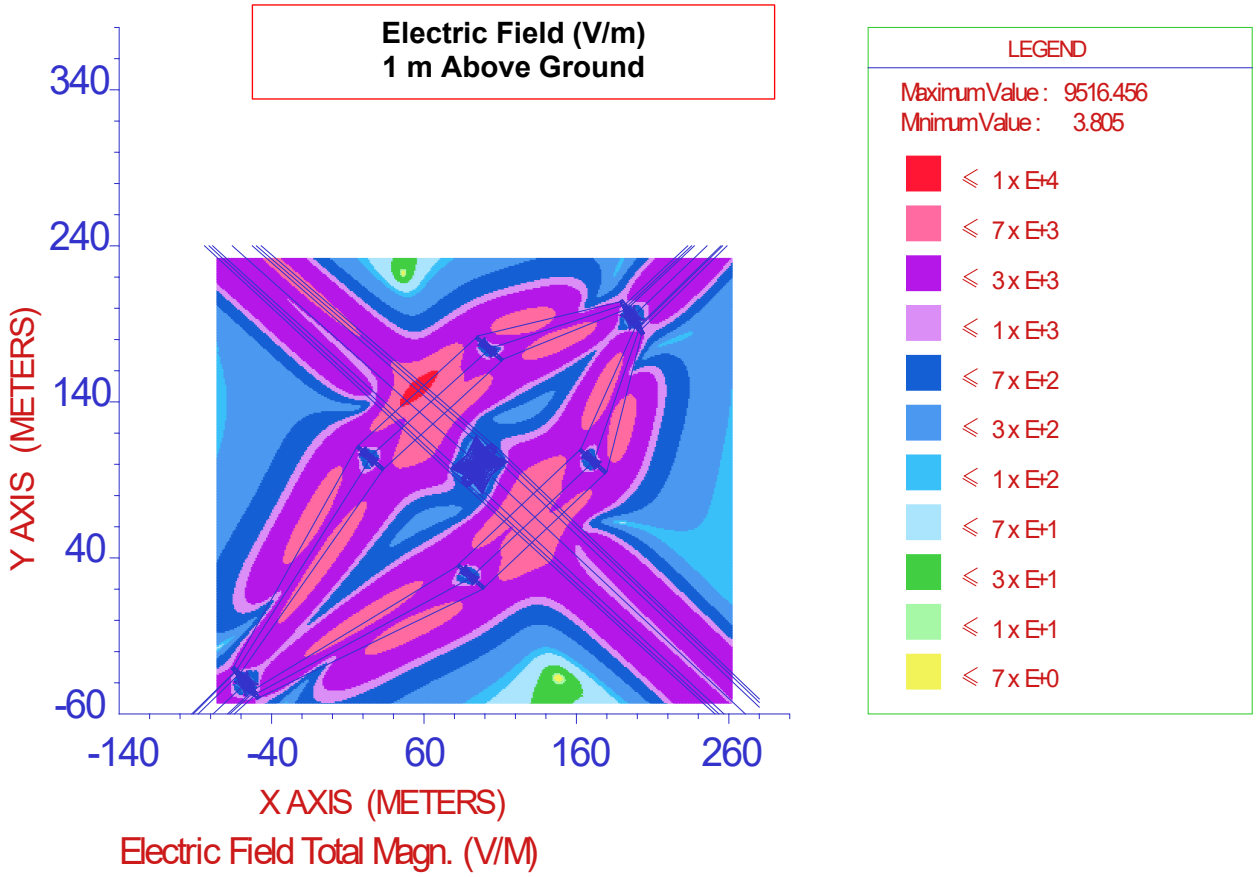

Magnetic Field (μT)
1 m Above Ground
400
250
100
-50
-200
Y AXIS (METERS)
-200
-50
100
250
400
X AXIS (METERS)
Total Magnetic Induc. (MicroTesla)
LEGEND
Maximum Value : 46.987
Mnimum Value : 0.117
⩽ 5 x E+1
⩽ 3 x E+1
⩽ 1 x E+1
⩽ 7 x E+0
⩽ 5 x E+0
⩽ 3 x E+0
⩽ 1 x E+0

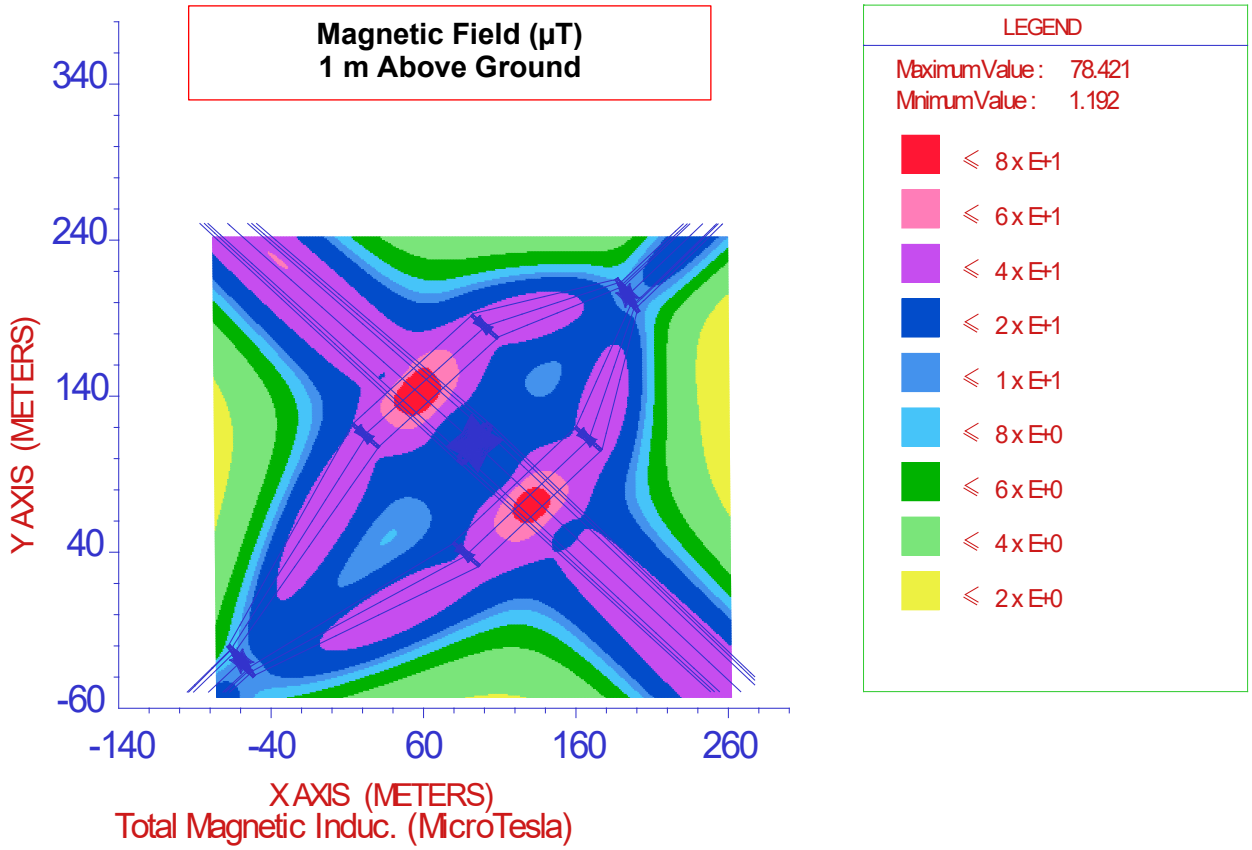
iv) Crossing 4 Keith - Macduff 132 kV Circuit



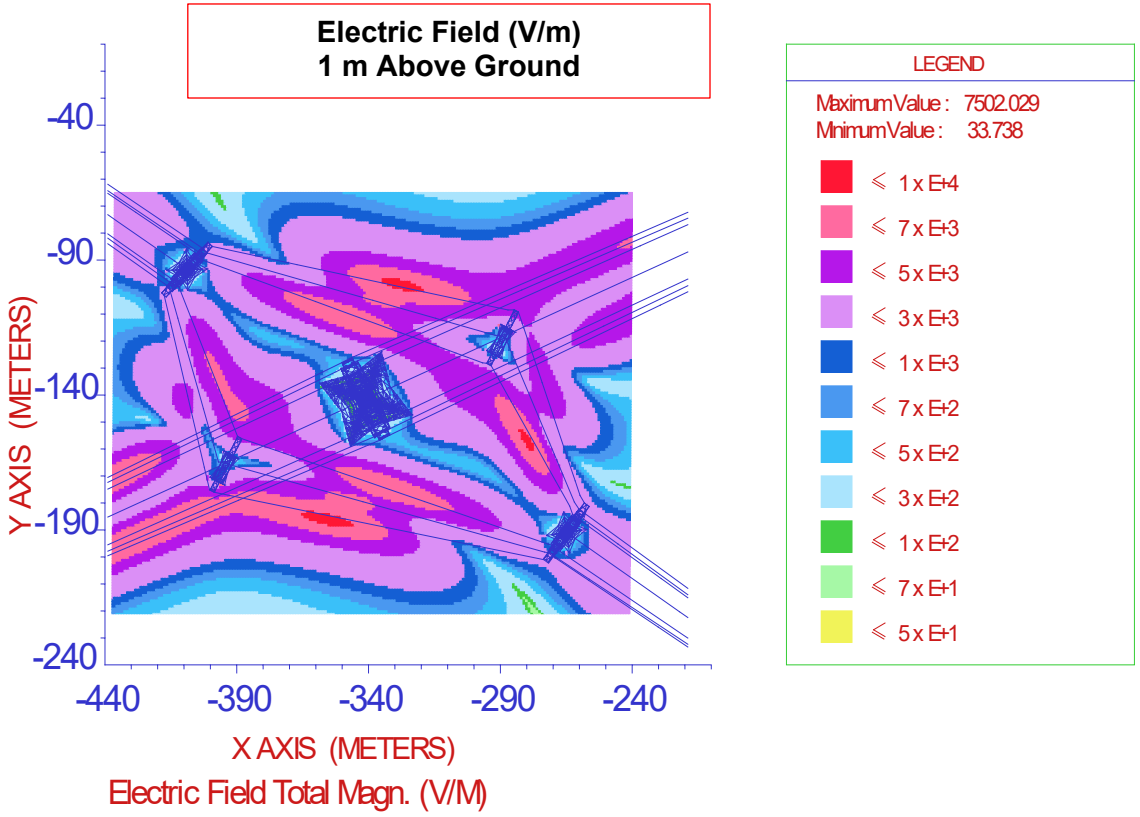

Magnetic Field (µT)
1 m Above Ground
1280
1230
1180
1130
1080
Y AXIS (METERS)
1080
1130
1180
1230
1280
X AXIS (METERS)
Total Magnetic Induc. (MicroTesla)
LEGEND
Maximum Value : 34.043
Minimum Value : 0.976
⩽ 5 x E+1
⩽ 3 x E+1
⩽ 2 x E+1
⩽ 1 x E+1
⩽ 9 x E+0
⩽ 7 x E+0
⩽ 5 x E+0
⩽ 3 x E+0
⩽ 2 x E+0
⩽ 1 x E+0

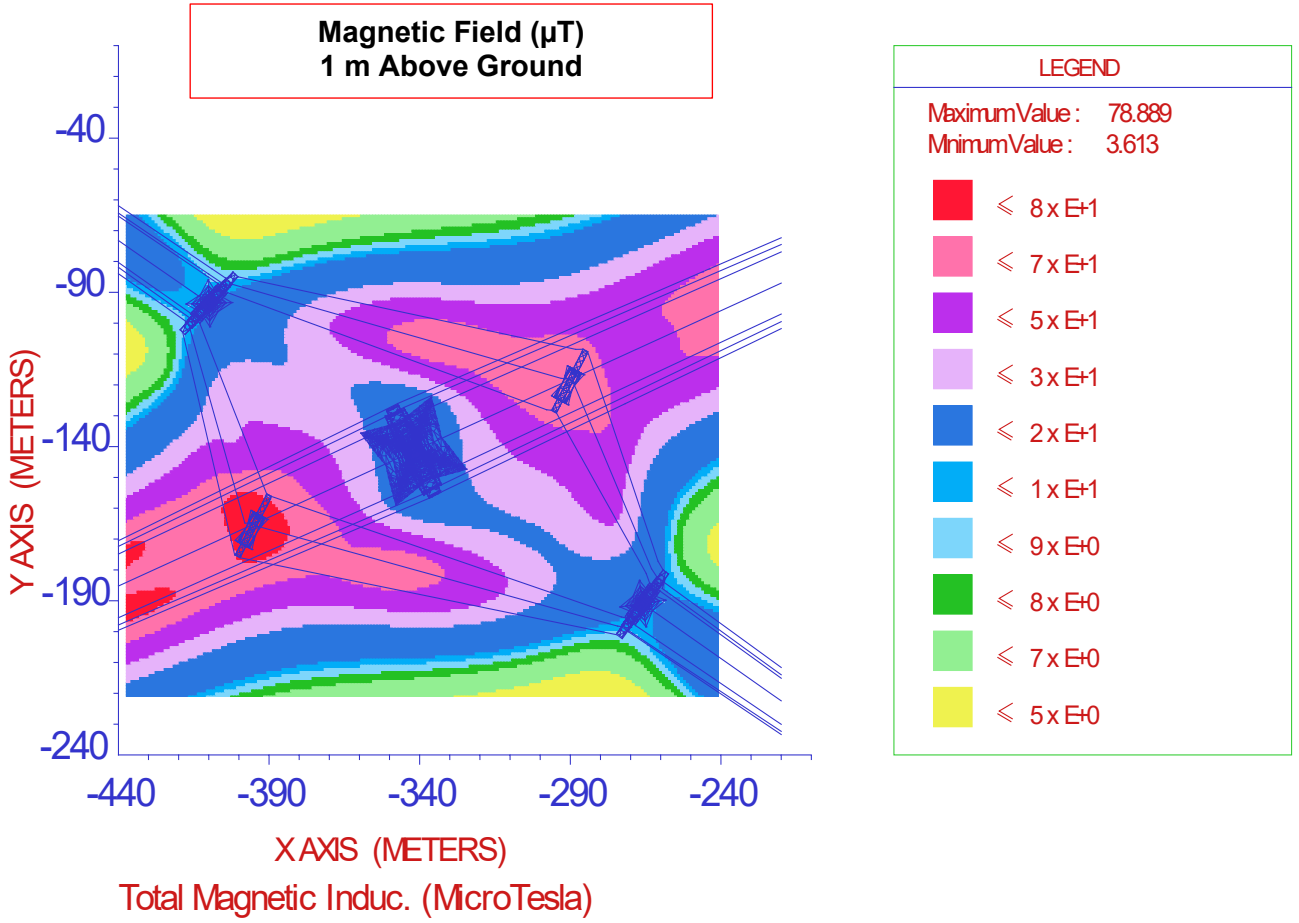
v) **Crossing 5 Blackhillock – Rothienorman 400 kV circuit**




Magnetic Field (μT)
1 m Above Ground
340
240
140
40
-60
Y AXIS (METERS)
-140
-40
60
160
260
X AXIS (METERS)
Total Magnetic Induc. (MicroTesla)
LEGEND
Maximum Value : 78.421
Minimum Value : 1.192
⩽ 8 x E+1
⩽ 6 x E+1
⩽ 4 x E+1
⩽ 2 x E+1
⩽ 1 x E+1
⩽ 8 x E+0
⩽ 6 x E+0
⩽ 4 x E+0
⩽ 2 x E+0

vi) Crossing 6 Blackhillock – Rothienorman 400 kV circuit




Magnetic Field (μT)
1 m Above Ground
-40
-90
-140
-190
-240
Y AXIS (METERS)
-440
-390
-340
-290
-240
X AXIS (METERS)
Total Magnetic Induc. (MicroTesla)
LEGEND
Maximum Value : 78.889
Minimum Value : 3.613
⩽ 8 x E+1
⩽ 7 x E+1
⩽ 5 x E+1
⩽ 3 x E+1
⩽ 2 x E+1
⩽ 1 x E+1
⩽ 9 x E+0
⩽ 8 x E+0
⩽ 7 x E+0
⩽ 5 x E+0

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