NORTH FALLS

Offshore Wind Farm

Electro-Magnetic Fields Technical Statement

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NORTH FALLS
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North Falls Offshore Wind

EMF Assessment

Client: RWE

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Contents

List of Abbreviations

AC	Alternating Current
DC	Direct Current
TR	Thermal Resistivity
HDD	Horizontal Directional Drilling
XLPE	Cross Link Polyethylene
HV	High Voltage
LV	Low Voltage
P	Active Power
PF	Power Factor
POC	Point of Connection
POS	Point of Supply
p.u.	Per Unit
EMF	Electromagnetic Field Intensity
NF	North Fall
VE	Five Estuaries

Units

kV	Kilovolts
MV	Megavolt
MVA	Megavolt-Amperes
MVAr	Megavar
MW	Megawatt
µT	Micro Tesla

1. Introduction

1.1. Scope

Blake Clough has been contracted by RWE to conduct an Electromagnetic Field Assessment (EMF) of the proposed onshore cables for the North Falls Offshore Wind farm. This project involves conducting simulations to assess the electromagnetic field (EMF) impacts of underground cable systems installed at different depths below the surface. The objective is to evaluate the compliance of the cable scenarios with UK guidance notes and provide necessary recommendations for achieving compliance where required.

The objectives of the project are as follows:

- Perform simulations to analyse the EMF emissions from various underground cable configurations.
- Assess the compliance of the EMF levels with regulations and standards.
- Generate results and reports, including necessary graphs, to present findings.
- Provide recommendations on modifications, if necessary, to meet compliance.

The primary objective of this study is to assess the potential EMF levels to ensure they remain within acceptable limits while also meeting the project's operational needs and environmental guidelines.

1.2. Project Description

The North Falls Offshore Wind Farm project involves the installation of onshore export cables (underground cables) to connect the offshore wind farm to the national grid at 400 kV. The onshore cable length from the offshore wind cable to the national grid is around 21.6 km. The onshore export cable consists of two circuits of 220 kV with 800 MW capacity or 275 kV with 1000 MW capacity.

An Electromagnetic Field (EMF) study is required to assess the impact of the cables on the surrounding environment, especially considering the proximity of residential and commercial areas. This report will evaluate different burial methods, including open trench and Horizontal Directional Drilling (HDD), with varying depths to ensure minimal disruption and compliance with health and safety standards.

Figure 1-1 shows the onshore cable route of the export cable. The 400 kV onshore substation is located at point 31 on the map, with the PoC into the National Grid located at point 32.

The North fall onshore cable (NF) route is shared with another project – Five Estuaries (VE). So, this project will also be considered when assessing the EMF values.

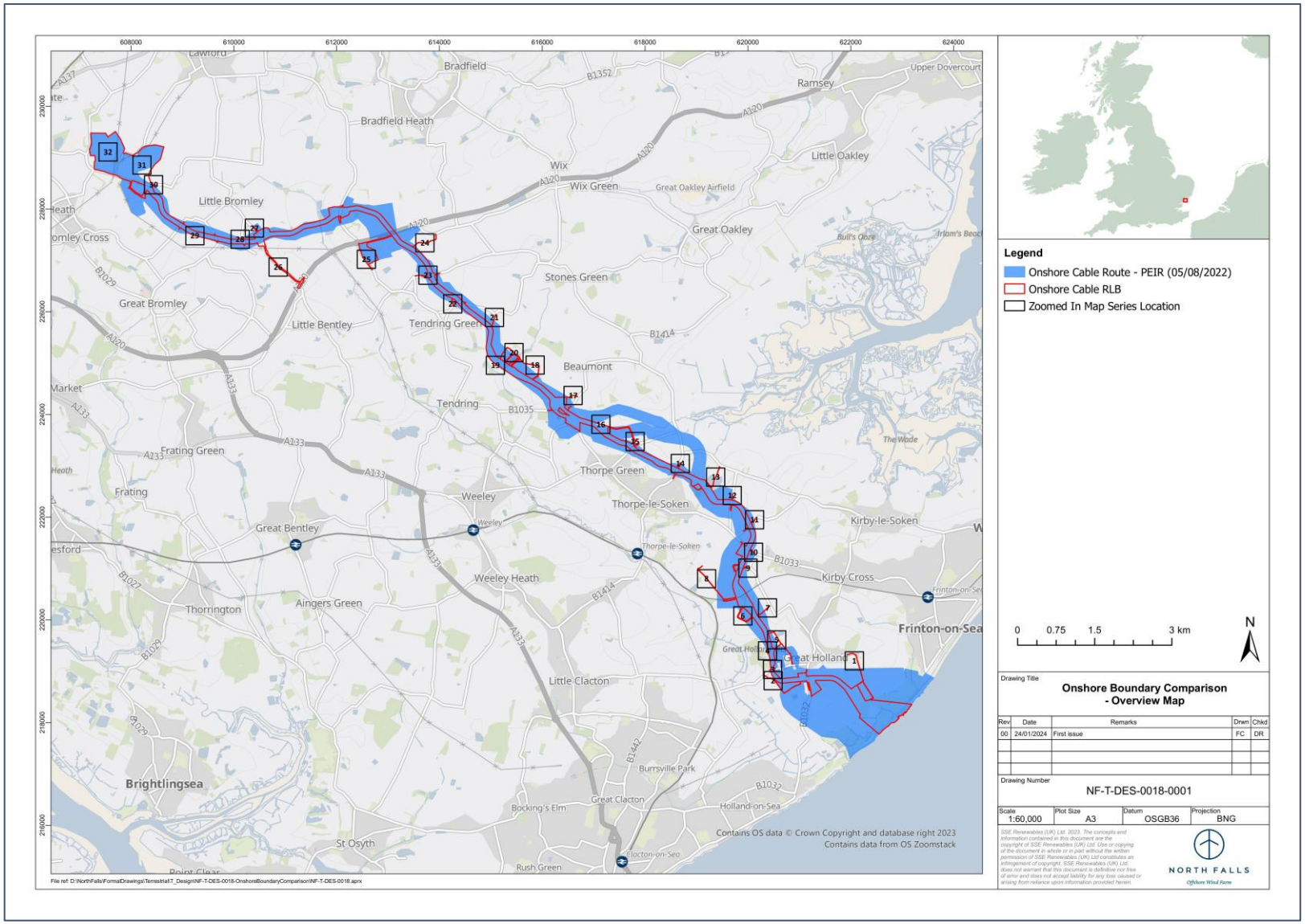

Figure 1-1: Onshore boundary overview map of North falls offshore wind.

Figure 1-2 shows the single line diagram of the North fall offshore wind.

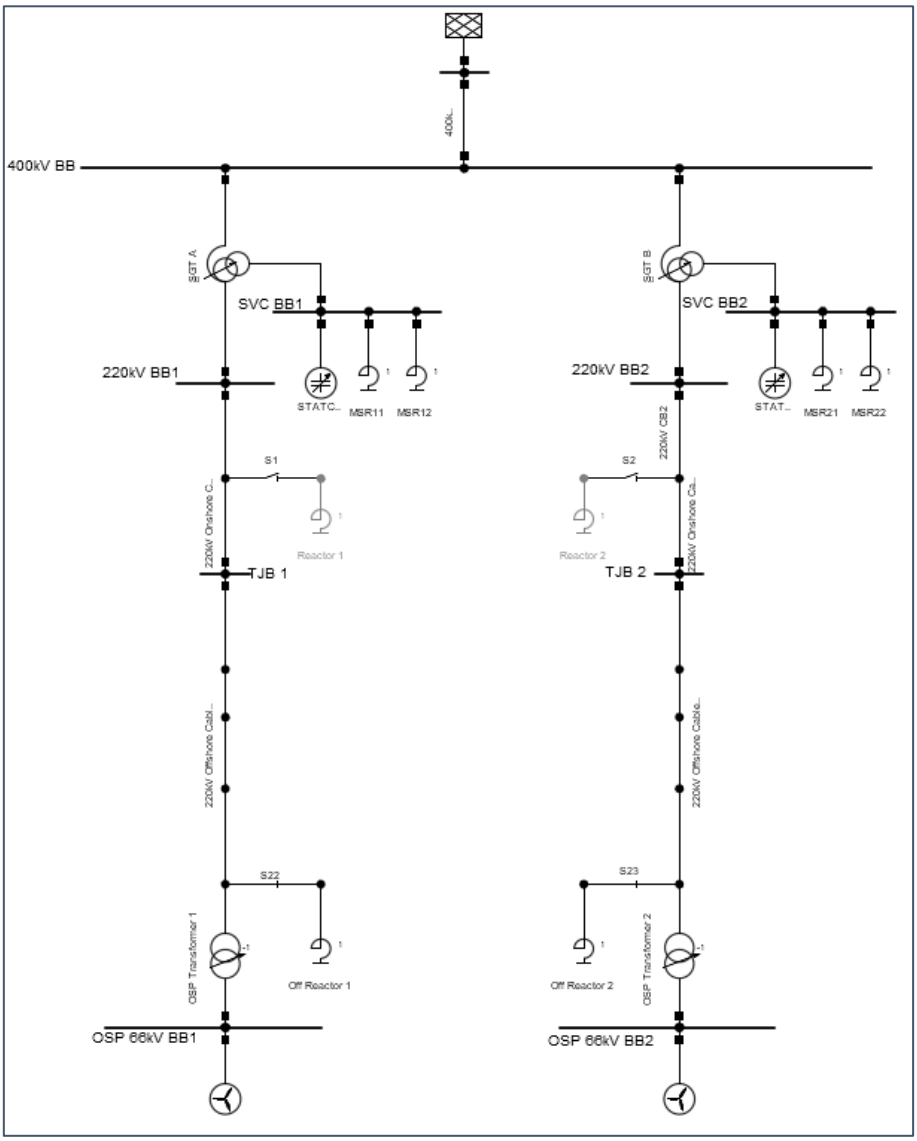

Figure 1-2: Project single line diagram.

1.3. Computation Tool

The current rating study was conducted using ELEK Cable HV V7.0 by Electrotechnik [1], which complies with IEC 60287 [3] and CIGRE TB 880 [4].

ELEK Software for cable calculation is a robust and versatile tool that supports electrical professionals in the design and analysis of cable systems. Its advanced features, compliance with standards, and user-friendly interface make it an essential resource for ensuring the safety, efficiency, and reliability of electrical installations. Some key features are given below:

Load Calculation: Determines the appropriate cable size based on current-carrying capacity and load requirements.

Temperature Effects: Assesses the impact of operating temperatures on cable performance and selects the right cable size to handle heat dissipation effectively.

Heat Dissipation: Simulates thermal conditions to evaluate heat dissipation and ensure cables operate within safe temperature ranges.

Ambient Conditions: Takes into account ambient temperature and installation conditions to adjust calculations accordingly.

Short-Circuit Rating: Analysis the cable's ability to withstand short-circuit conditions, providing information on the required protection measures.

Electromagnetic Field (EMF) Analysis: Evaluates the electromagnetic field exposure from cables to ensure compliance with health and safety standards. The software helps in determining cable burial depths and configurations to minimize EMF impact, ensuring the safety of personnel and the surrounding environment.

1.4. Standards and Technical Specifications

As a minimum, the following Table 1-1 shows the standards and technical specifications that have been considered as the basis of the underground cable EMF assessment.

Table 1-1: Applicable standards and technical specifications.

STANDARD / TECHNICAL DOCUMENT	DOCUMENT TITLE
IEC 60287	Calculation of the Continuous Current Rating of Cables
SPTS 2.5	General Requirements for 132, 275, 400kV Cables
ENA TS 12-24	Technical specification for plastic ducts for buried electric cables
ENA EREC C55	Insulated sheath power cable systems
ICNIRP	International Commission on Non-Ionizing Radiation Protection

2. Design Data

2.1. Environmental Parameters Assumptions

Table 2-1 presents the environmental parameters used for the cable EMF assessment The environmental parameters are assumed in accordance with IEC 60287-3-1, and a soil thermal resistivity value is considered 1.2 K.m/W. For accurate cable sizing, it is essential to obtain the site-specific soil thermal resistivity values. In some cases, the actual value may exceed the assumed value of 1.2 K.m/W, potentially leading to significant under sizing of the cable. The Relative Soil Permeability value is assumed to be 1. No Solar radiation is assumed.

Table 2-1: Environmental parameters.

Parameter	Value
Ground temperature for cable ducted installation	15 ^{0}C
Maximum ambient temperature	30 ^{0}C
Thermal resistivity of soil	1.2 Km/W
Relative soil permeability	1
Solar Radiation	No solar radiation (trench layout)

2.2. Cable Installation Assumptions

The following cable installation parameters are assumed for the simulation of all scenarios.

- The thermal resistivity of the soil is considered to be 1.2 K·m/W.
- The relative permeability of the soil is considered to be 1.
- The ground temperature of soil is considered to be 15 0C.
- The maximum temperature of the conductor is considered to be 90 0C.
- All ducts are ID/OD 237/250 mm PVC ducts.
- Cable arrangement is considered flat with spacing.
- Cross bonded – regularly transposed.

2.3. General Assumptions

- For the worst case, the open trench depth of laying is considered as 1100 mm.
- EMF values will be measured at ground level and 1 m above ground level.
- A 0.95 pf is considered while calculating the load current as per the Grid code [7] for export conditions, as a connection agreement is not available.
- General cable datasheets are used as the cable brand is not finalized. Datasheets are attached in the appendix.
- Due to the unavailability of a similar datasheet for 275 kV as for 220 kV and 400 kV cables, a 330 kV datasheet is used for 275 kV (parameters are compared to another datasheet of 275 kV to make sure all values are within limits).

2.4. Load Rating

As per the provided information about export capacities, Table 2-2 summarises the current requirements in different scenarios, which is calculated using:

$$I_R = \frac{S}{\sqrt{3} * V_{L-L} * PF}$$

I_R: Rated Current (A)
S: Apparent Power (VA)
V_{LL}: Line to Line Voltage (V)

Table 2-2: Required current rating of the circuits.

Circuits	Voltage (kV)	Capacity (MW)	Total Current (A)
North Fall Export cable	220	850	2349
North Fall Export cable	275	1000	2210
Five Estuaries Cable	275	1080	2387
North Fall 400kV Cable	400	850	1292
North Fall 400kV Cable	400	1000	1520

2.5. Scenarios

As per the provided information, Table 2-3 presents all scenarios which will be considered for the EMF assessment. As the total export capacity of North Fall wind farm is still not finalised, both 850 MW with 220 kV and 1000 MW with 275 kV are being considered along with Five Estuaries 275 kV circuit.

Table 2-3: Project study scenarios.

Scenarios	Installation Condition	NF Voltage (kV)	NF Wind Farm capacity (MW)	VE Voltage (kV)	VE Wind Farm capacity (MW)
Scenario 1	Open Cut Trench	220	850	-	-
Scenario 1a		220	850	275	1080
Scenario 2		275	1000	-	-
Scenario 2a		275	1000	275	1080
Scenario 3	Shallow HDD	220	850	-	-
Scenario 3a		220	850	275	1080
Scenario 4		275	1000	-	-
Scenario 4a		275	1000	275	1080
Scenario 5	Deep HDD	220	850	-	-
Scenario 5a		220	850	275	1080
Scenario 6		275	1000	-	-
Scenario 6a		275	1000	275	1080
Scenario 7	Open Cut Trench	400	850	-	-
Scenario 8		400	1000	-	-
Scenario 9	Shallow HDD	400	850	-	-
Scenario 10		400	1000	-	-

2.6. Cable Details

As per the provided information, Table 2-4 presents the cable size and required current rating per cable run in all scenarios.

Table 2-4: Cable details and required current per cable run.

Circuits	Voltage (kV)	Capacity (MW)	Cable Size	No. of Cables / Cores	Required Current (A) per Cable Run
North Fall Export cable	220	850	2500 mm^2 Al.	2 runs of 3 x 1c	1174
North Fall Export cable	275	1000	2500 mm^2 Al.	2 runs of 3 x 1c	1105
Five Estuaries Cable	275	1080	2500 mm^2 Al.	2 runs of 3 x 1c	1194
North Fall 400kV Cable	400	850	2000 mm^2 Al.	2 runs of 3 x 1c	646
North Fall 400kV Cable	400	1000	2000 mm^2 Al.	2 runs of 3 x 1c	760

Table 2-5 presents the design parameters of the power cable. The cable's metallic screens are cross-bonded, and a detailed cable model design for the 220 kV, 275 kV and 400 kV power cables are provided in the Appendices.

Table 2-5: Power cable design parameters.

Parameter	Cable Details		
System Voltage	220 kV	275 kV	400 kV
Conductor Material	Aluminium	Aluminium	Aluminium
Conductor Screen	Semi-conducting	Semi-conducting	Semi-conducting
Insulation	XLPE	XLPE	XLPE
Insulation Screen	Semi-conducting	Semi-conducting	Semi-conducting
Screen	Cu. wire screen	Cu. wire screen	Cu. wire screen
Tape	Aluminium Laminated Tape	Aluminium Laminated Tape	Aluminium Laminated Tape
Over Sheath	PVC	PVC	PVC
Maximum Conductor Temperature	90 ^{0}C	90 ^{0}C	90 ^{0}C

2.7. Cable Trench and HDD Details

(a) Open cut trench

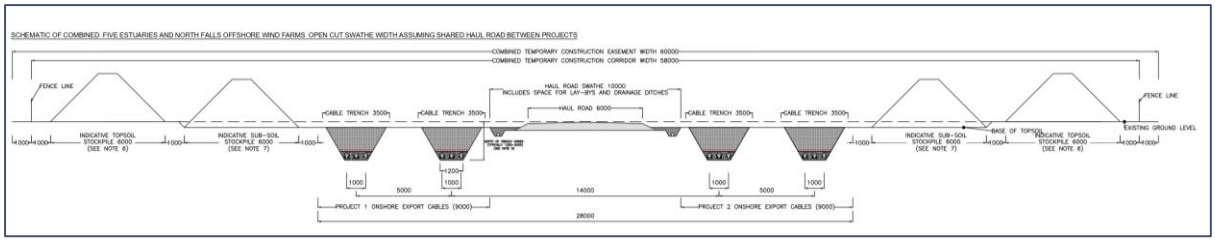

Figure 2-1: Open cut trench cross section.

(b) Typical cable **trench**

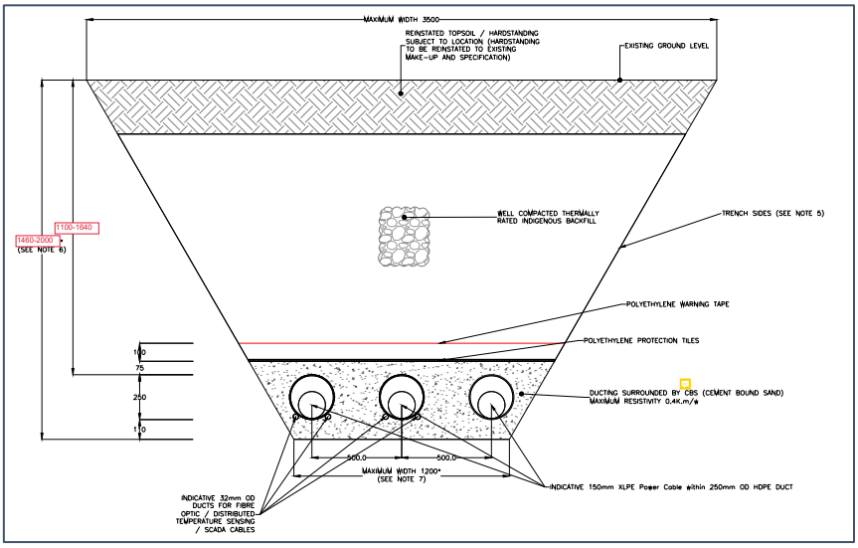

Figure 2-2: Typical cable trench cross section.

(c) Shallow HDD (5 m below surface)

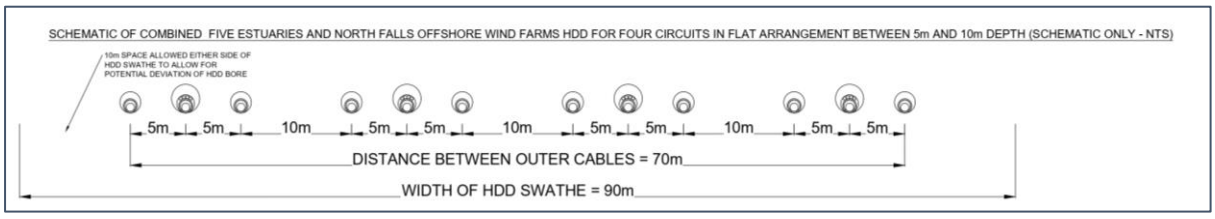

Figure 2-3: Typical Shallow HDD cross section.

(d) Deep HDD (20 m below surface)

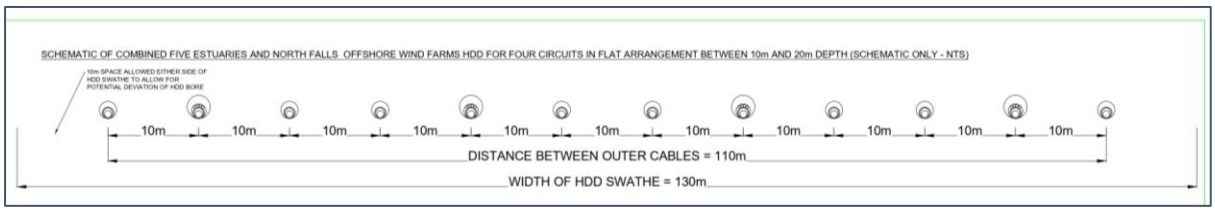

Figure 2-4: Typical Deep HDD cross section.

3. EMF Assessment Study

According to the provided information, the following 16 scenarios are simulated to evaluate the electromagnetic field (EMF) values at depths of ground level and 1m above ground level.

3.1. Scenario 1

In Scenario 1, the EMF assessment will be conducted for 850 MW 220 kV NF cable in Open cut trench.

3.1.1. Simulation Parameters and Cables Details

- Cable laying in open cut trench.
- Depth of the cable is 1100 mm.
- Cable size is 2500 mm^2 220 kV Al.
- Flat arrangement with 500 mm spacing among phases.

3.1.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	220kV NF1	57.861 °C	1175 A	1	2350 A
2	220kV NF2	57.861 °C	1175 A	1	2350 A

Installation Image

Figure 3-1-1: Cable installation arrangement (Scenario 1).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-1.

Table 3-1: Summary of the EMF study results (Scenario 1).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	104.22
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	34.57

Based on the results presented in Table 3-1, the maximum electromagnetic field intensity of the cables is 104.22 µT at 0 m above the ground.

Figure 3-2-1 shows the graphical representation of the magnetic field with respect to lateral distance.

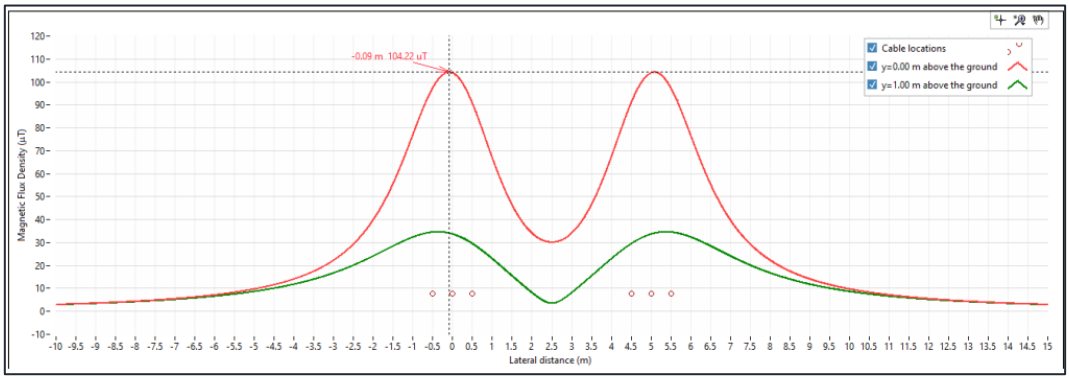

Figure 3-2-1: Magnetic field (µT) with respect to lateral distance (m) (Scenario 1).

3.2. Scenario 1a

In Scenario 1a, the EMF assessment will be conducted for 850 MW 220 kV NF cable in Open cut trench along with Five Estuaries 1080 MW 275 kV cables.

3.2.1. Simulation Parameters and Cables Details

- Cable laying in open cut trench.
- The depth of the cables is 1100 mm.
- Cable sizes are 2500 mm^2 220 kV Al. and 2500 mm^2 275 kV Al.
- Flat arrangement with 500 mm spacing among phases.
- 14m separation between NF and VE cables.

3.2.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	275kV VE1	61.644 °C	1194 A	2	2380 A
2	275kV VE2	61.781 °C	1194 A	2	2380 A
3	220kV NF1a	58.207 °C	1175 A	1	2350 A
4	220kV NF2b	58.061 °C	1175 A	1	2350 A

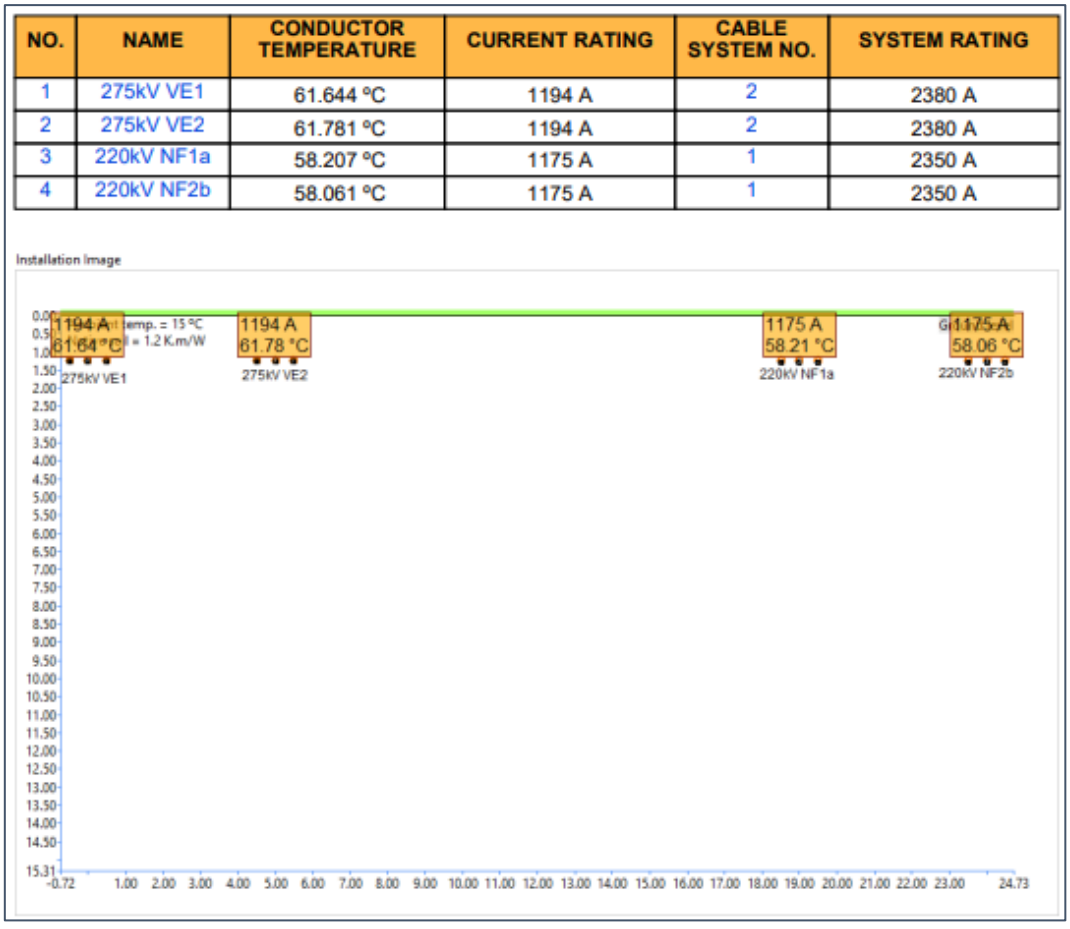

Figure 3-1-2: Cable installation arrangement (Scenario 1a).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-2.

Table 3-2: Summary of the EMF study results (Scenario 1a).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	106.14
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	34.67

Based on the results presented in Table 3-2, the maximum electromagnetic field intensity of the cables is 106.14 µT at 0 m above the ground.

Figure 3-2-2 shows the graphical representation of the magnetic field with respect to lateral distance.

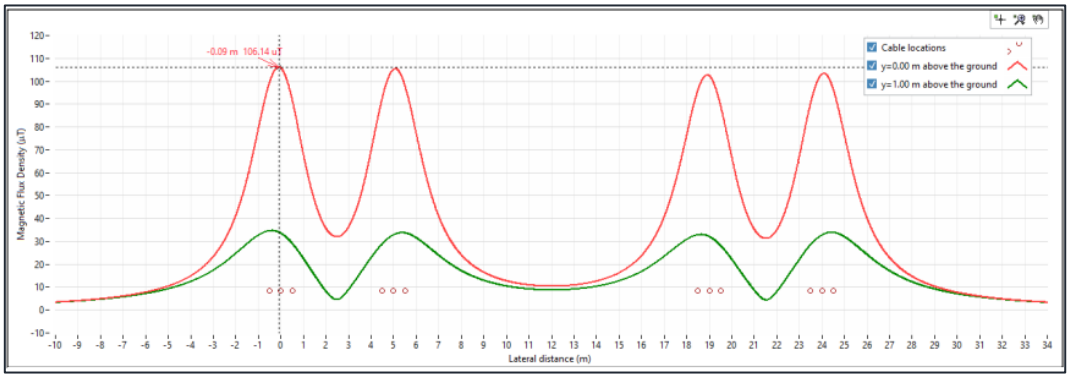

Figure 3-2-2: Magnetic field (µT) with respect to lateral distance (m) (Scenario 1a).

3.3. Scenario 2

In Scenario 2, the EMF assessment will be conducted for 1000 MW 275 kV NF cable in Open cut trench.

3.3.1. Simulation Parameters and Cables Details

- Cable laying in open cut trench.
- The depth of the cables is 1100 mm.
- Cable size is 2500 mm^2 275 kV Al.
- Flat arrangement with 500 mm spacing among phases.

3.3.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	275kV NF1	54.596 °C	1105 A	2	2210 A
2	275kV NF2	54.596 °C	1105 A	2	2210 A

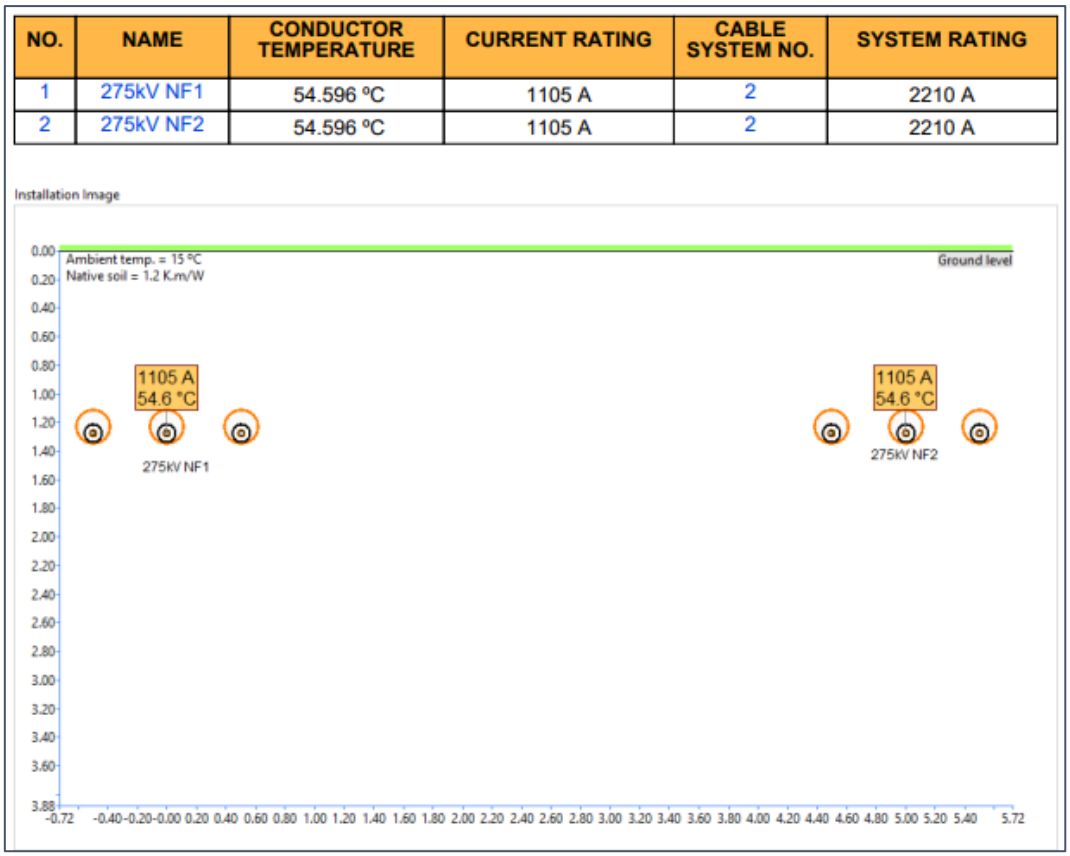

Figure 3-1-3: Cable installation arrangement (Scenario 2).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-3.

Table 3-3: Summary of the EMF study results (Scenario 2).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	99.02
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	32.7

Based on the results presented in Table 3-3, the maximum electromagnetic field intensity of the cables is 99.02 µT at 0 m above the ground.

Figure 3-2-3 shows the graphical representation of the magnetic field with respect to lateral distance.

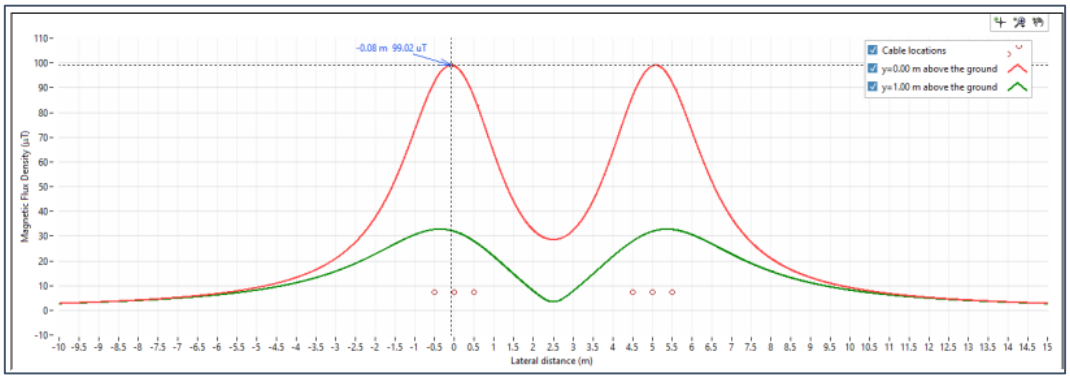

Figure 3-2-3: Magnetic field (µT) with respect to lateral distance (m) (Scenario 2).

3.4. Scenario 2a

In Scenario 2a, the EMF assessment will be conducted for 1000 MW 275 kV NF cable in Open cut trench along with Five Estuaries 1080 MW 275 kV cables.

3.4.1. Simulation Parameters and Cables Details

- Cable laying in open cut trench.
- The depth of the cables is 1100 mm.
- Cable sizes are 2500 mm^2 220 kV Al. and 2500 mm^2 275 kV Al.
- Flat arrangement with 500 mm spacing among phases.
- 14m separation between NF and VE cables.

3.4.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	275kV VE1	61.627 °C	1194 A	3	2380 A
2	275kV VE2	61.752 °C	1194 A	3	2380 A
3	220kV NF1a	54.938 °C	1105 A	2	2210 A
4	220kV NF2b	54.794 °C	1105 A	2	2210 A

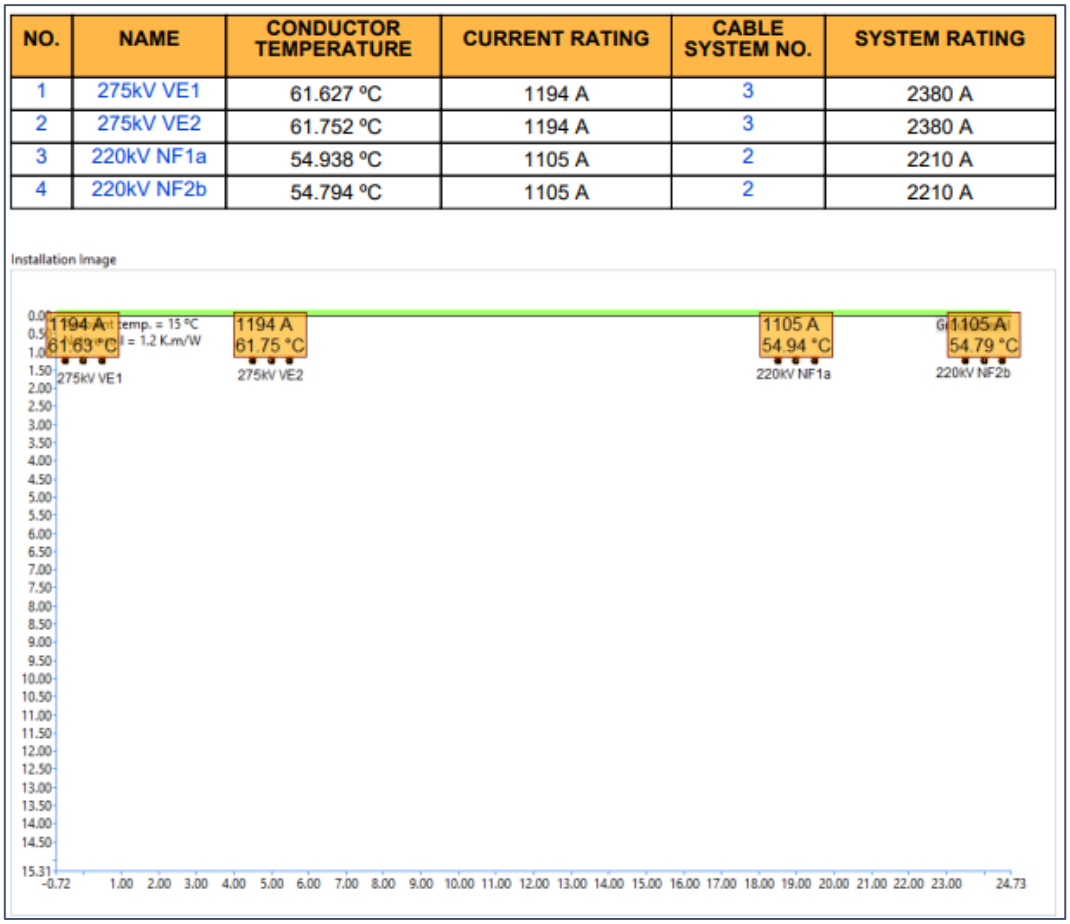

Figure 3-1-4: Cable installation arrangement (Scenario 2a).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-4.

Table 3-4: Summary of the EMF study results (Scenario 2a).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	106.2
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	34.71

Based on the results presented in Table 3-4, the maximum electromagnetic field intensity of the cables is 106.2 µT at 0 m above the ground.

Figure 3-2-4 shows the graphical representation of the magnetic field with respect to lateral distance.

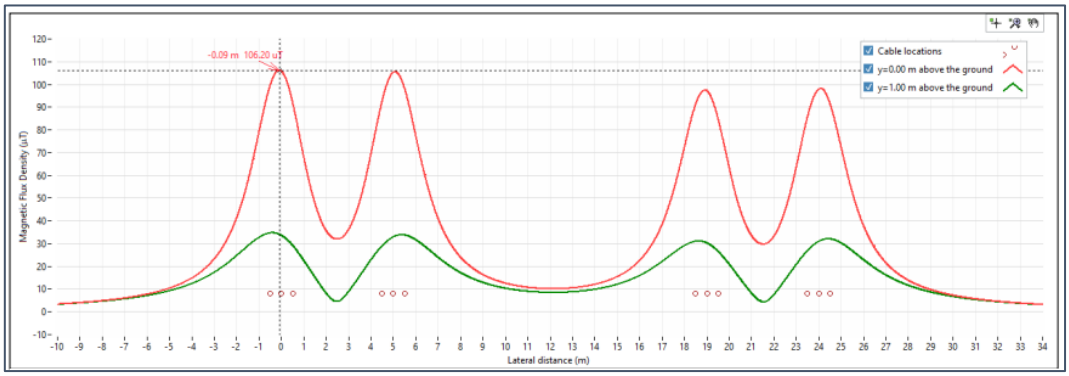

Figure 3-2-4: Magnetic field (µT) with respect to lateral distance (m) (Scenario 2a).

3.5. Scenario 3

In Scenario 3, the EMF assessment will be conducted for 850 MW 220 kV NF cable in Shallow HDD at 5 m depth.

3.5.1. Simulation Parameters and Cables Details

- Cable laying in Shallow HDD.
- The depth of the cable is 5m.
- Cable size is 2500 mm^2 220 kV Al.
- Flat arrangement with 5m spacing among phases.

3.5.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	220kV NF1	57.56 ºC	1175 A	1	2350 A
2	220kV NF2	57.56 ºC	1175 A	1	2350 A

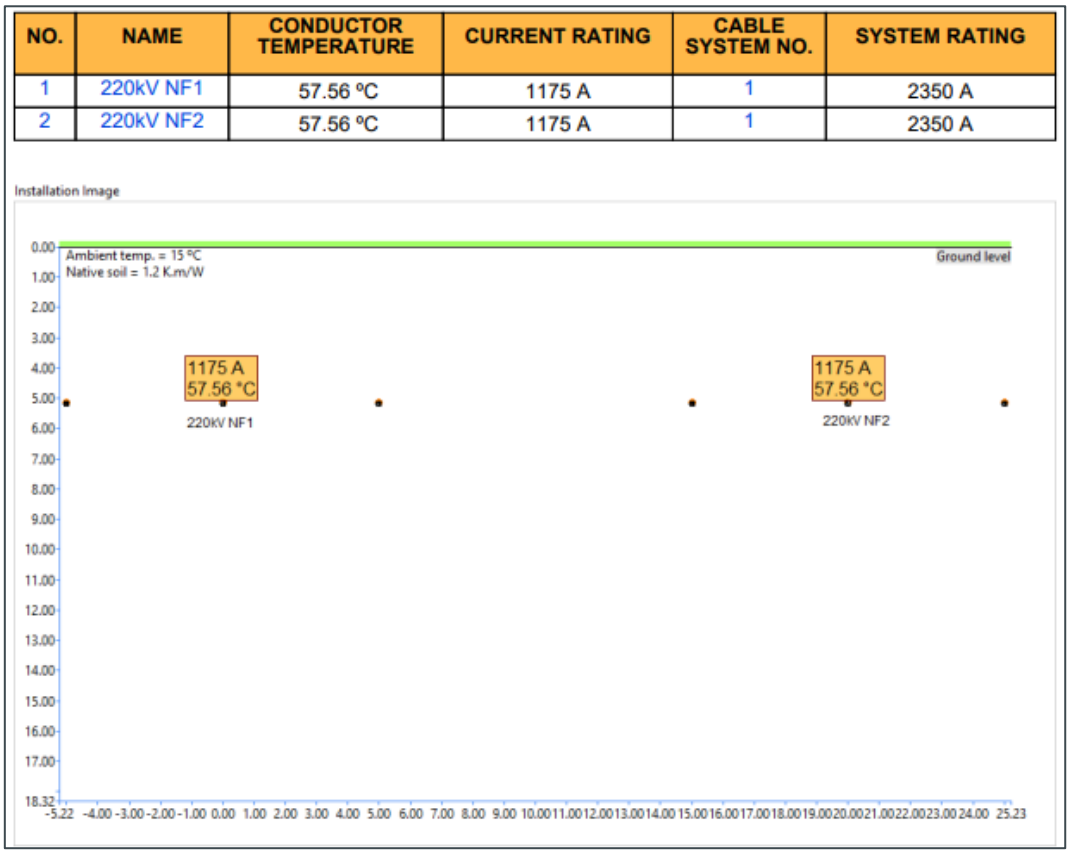

Figure 3-1-5: Cable installation arrangement (Scenario 3).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions, Table 3-5 presents the results of the EMF study. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-5.

Table 3-5: Summary of the EMF study results (Scenario 3).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	41.63
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	32.61

Based on the results presented in Table 3-5, the maximum electromagnetic field intensity of the cables is 41.63 µT at 0 m above the ground.

Figure 3-2-5 shows the graphical representation of the magnetic field with respect to lateral distance.

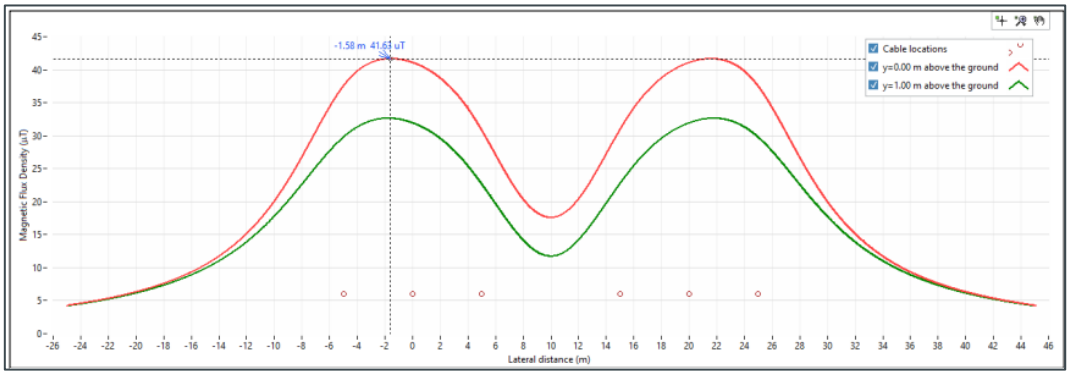

Figure 3-2-5: Magnetic field (µT) with respect to lateral distance (m) (Scenario 3).

3.6. Scenario 3a

In Scenario 3a, the EMF assessment will be conducted for 850 MW 220 kV NF cable along with Five Estuaries 1080 MW 275 kV cables in Shallow HDD at 5 m depth.

3.6.1. Simulation Parameters and Cables Details

- Cable laying in Shallow HDD.
- The depth of the cable is 5m.
- Cable sizes are 2500 mm^2 220 kV Al. and 2500 mm^2 275 kV Al.
- Flat arrangement with 5m spacing among phases.
- 10m separation between NF and VE cables.

3.6.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	275kV VE1	61.807 °C	1194 A	2	2380 A
2	275kV VE2	63.399 °C	1194 A	2	2380 A
3	220kV NF1	59.965 °C	1175 A	1	2350 A
4	220kV NF2	58.274 °C	1175 A	1	2350 A

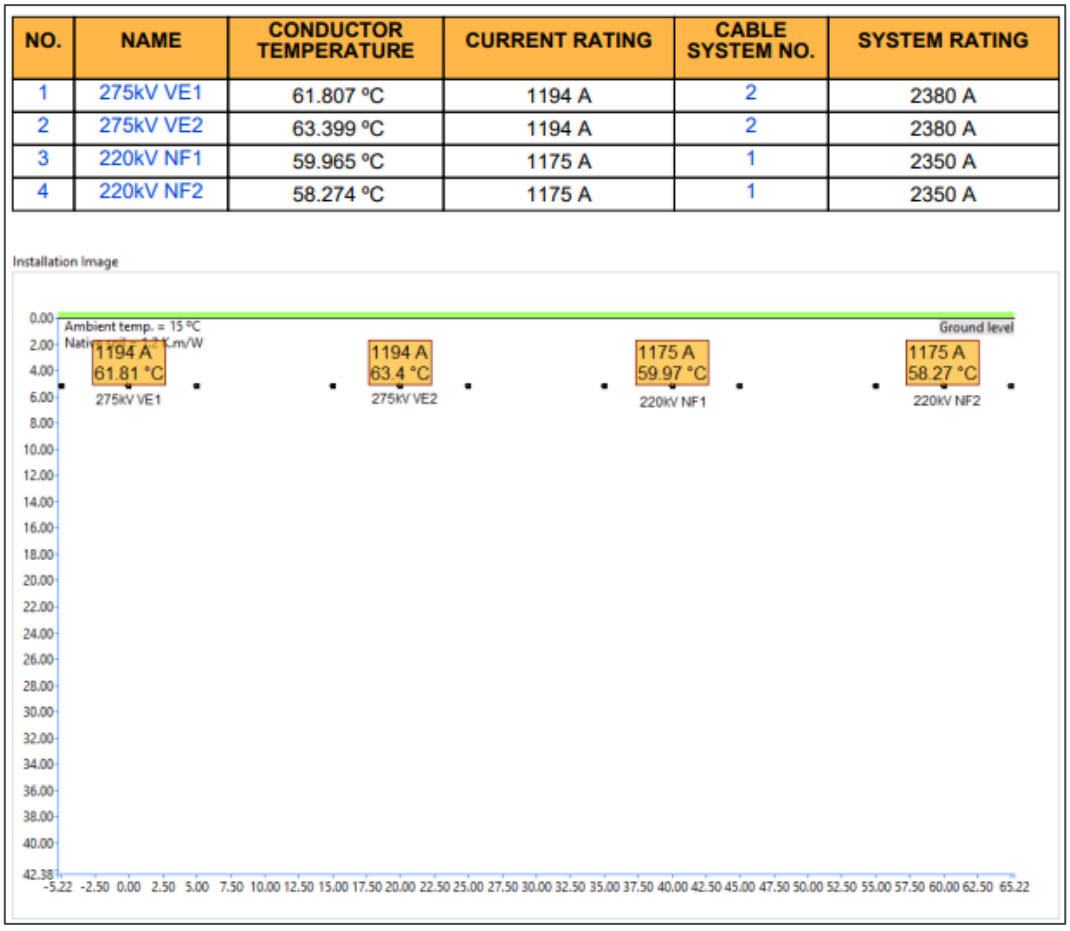

Figure 3-1-6: Cable installation arrangement (Scenario 3a).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-6.

Table 3-6: Summary of the EMF study results (Scenario 3a).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	41.19
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	32.09

Based on the results presented in Table 3-6, the maximum electromagnetic field intensity of the cables is 41.19 µT at 0 m above the ground.

Figure 3-2-6 shows the graphical representation of the magnetic field with respect to lateral distance.

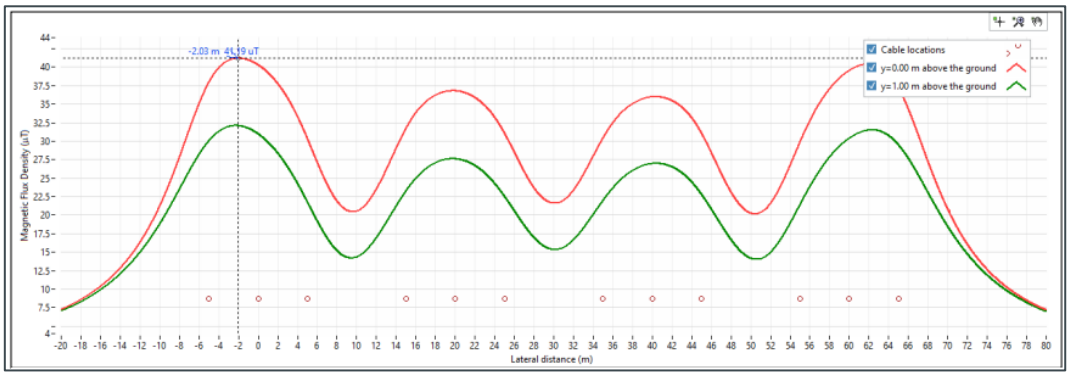

Figure 3-2-6: Magnetic field (µT) with respect to lateral distance (m) (Scenario 3a).

3.7. Scenario 4

In Scenario 4, the EMF assessment will be conducted for 1000 MW 275 kV NF cable in Shallow HDD at 5 m depth.

3.7.1. Simulation Parameters and Cables Details

- Cable laying in Shallow HDD.
- The depth of the cable is 5m.
- Cable size is 2500 mm^2 275 kV Al.
- Flat arrangement with 5m spacing among phases.

3.7.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	275kV NF1	54.315 °C	1105 A	2	2210 A
2	275kV NF2	54.315 °C	1105 A	2	2210 A

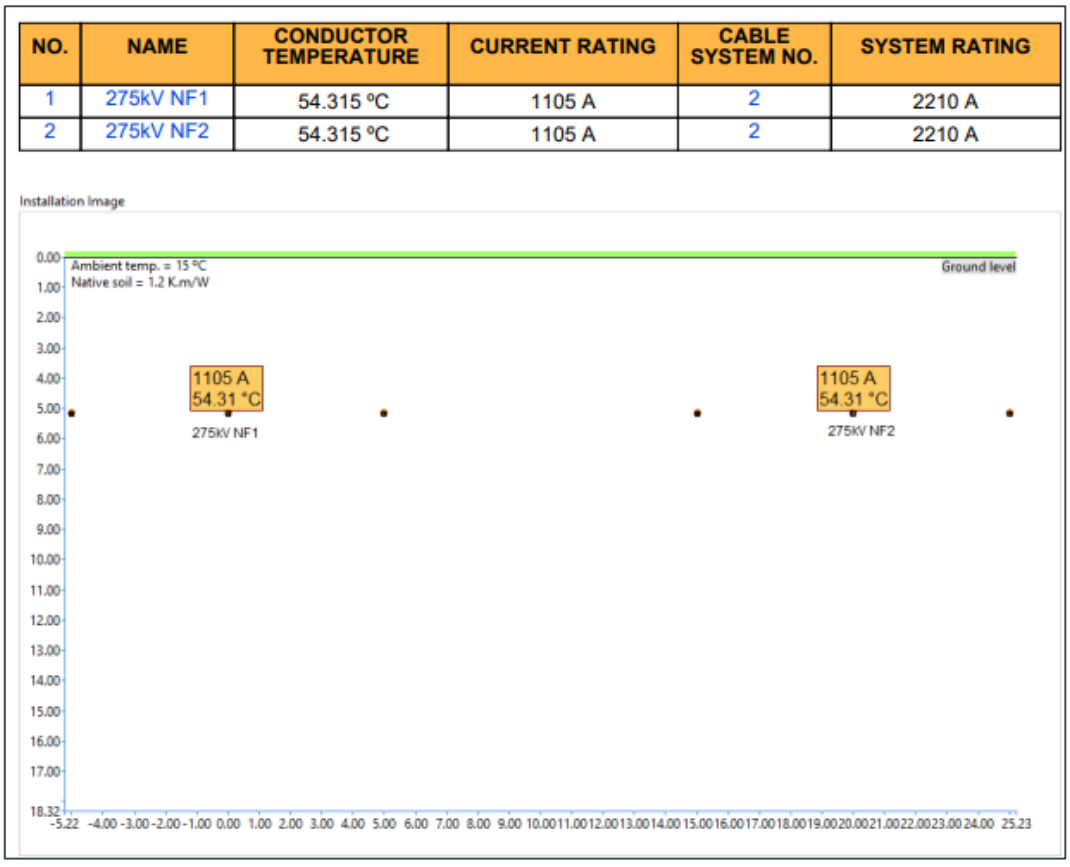

Figure 3-1-7: Cable installation arrangement (Scenario 4).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-7.

Table 3-7: Summary of the EMF study results (Scenario 4).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	39.21
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	30.71

Based on the results presented in Table 3-7, the maximum electromagnetic field intensity of the cables is 39.21 µT at 0 m above the ground.

Figure 3-2-7 shows the graphical representation of the magnetic field with respect to lateral distance.

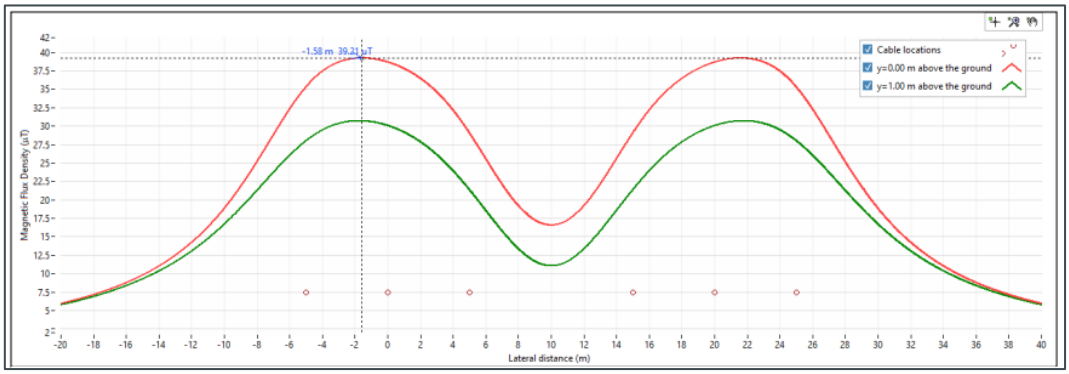

Figure 3-2-7: Magnetic field (µT) with respect to lateral distance (m) (Scenario 4).

3.8. Scenario 4a

In Scenario 4a, the EMF assessment will be conducted for 1000 MW 275 kV NF cable along with Five Estuaries 1080 MW 275 kV cables in Shallow HDD at 5 m depth.

3.8.1. Simulation Parameters and Cables Details

- Cable laying in Shallow HDD.
- The depth of the cable is 5m.
- Cable sizes are 2500 mm^2 220 kV Al. and 2500 mm^2 275 kV Al.
- Flat arrangement with 5m spacing among phases.
- 10m separation between NF and VE cables.

3.8.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	275kV VE1	61.748 °C	1194 A	3	2380 A
2	275kV VE2	63.198 °C	1194 A	3	2380 A
3	220kV NF1	56.695 °C	1105 A	2	2210 A
4	220kV NF2	55.021 °C	1105 A	2	2210 A

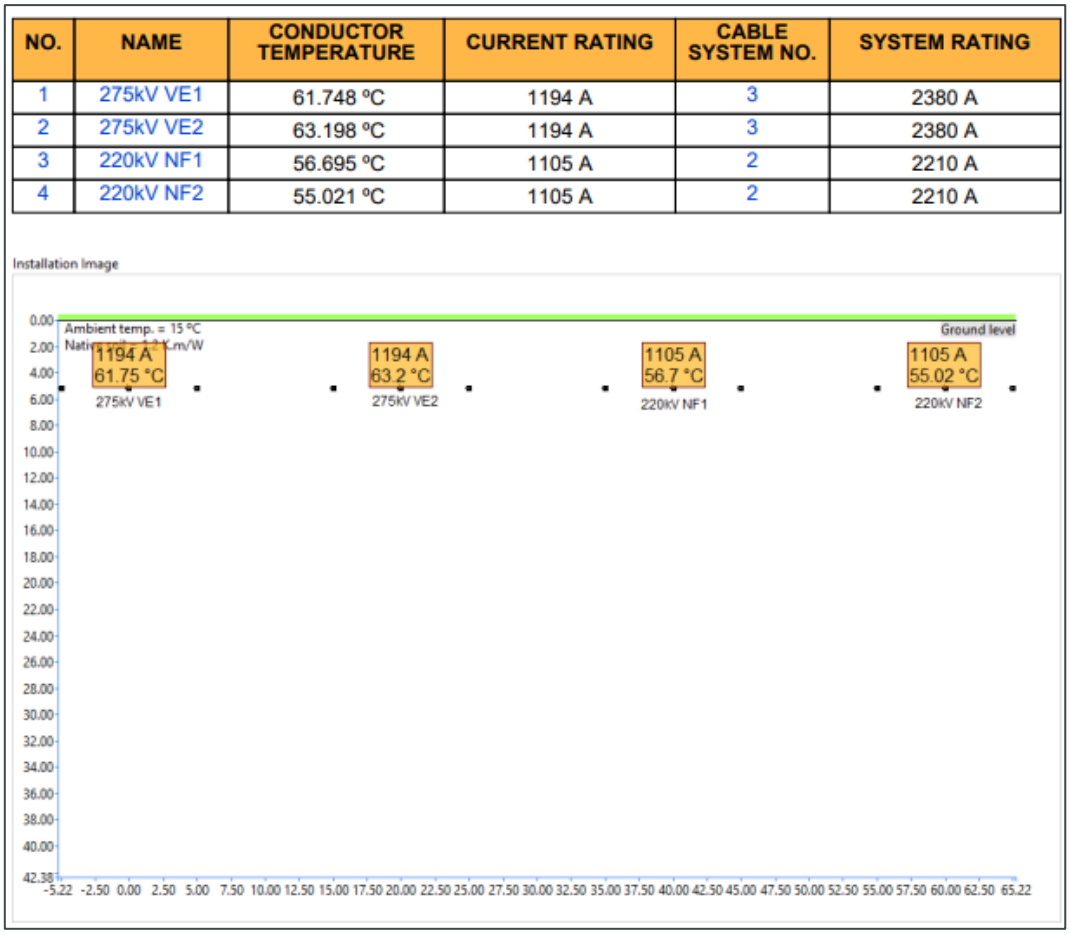

Figure 3-1-8: Cable installation arrangement (Scenario 4a).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-8.

Table 3-8: Summary of the EMF study results (Scenario 4a).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	41.26
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	32.15

Based on the results presented in Table 3-8, the maximum electromagnetic field intensity of the cables is 41.26 µT at 0 m above the ground.

Figure 3-2-8 shows the graphical representation of the magnetic field with respect to lateral distance.

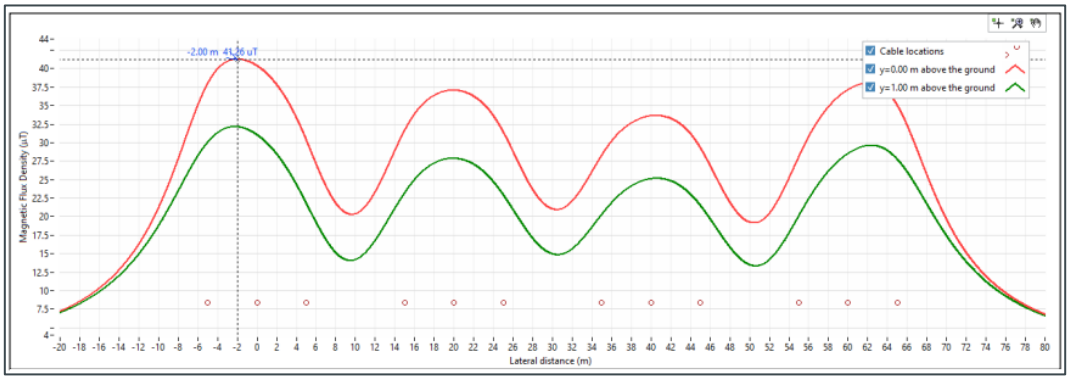

Figure 3-2-8: Magnetic field (µT) with respect to lateral distance (m) (Scenario 4a).

3.9. Scenario 5

In Scenario 5, the EMF assessment will be conducted for 850 MW 220 kV NF cable in Deep HDD at 20 m depth.

3.9.1. Simulation Parameters and Cables Details

- Cable laying in open cut trench.
- The depth of the cable is 20m.
- Cable size is 2500 mm^2 220 kV Al.
- Flat arrangement with 10m spacing among phases.

3.9.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	220kV NF1	78.702 °C	1175 A	1	2350 A
2	220kV NF2	78.702 °C	1175 A	1	2350 A

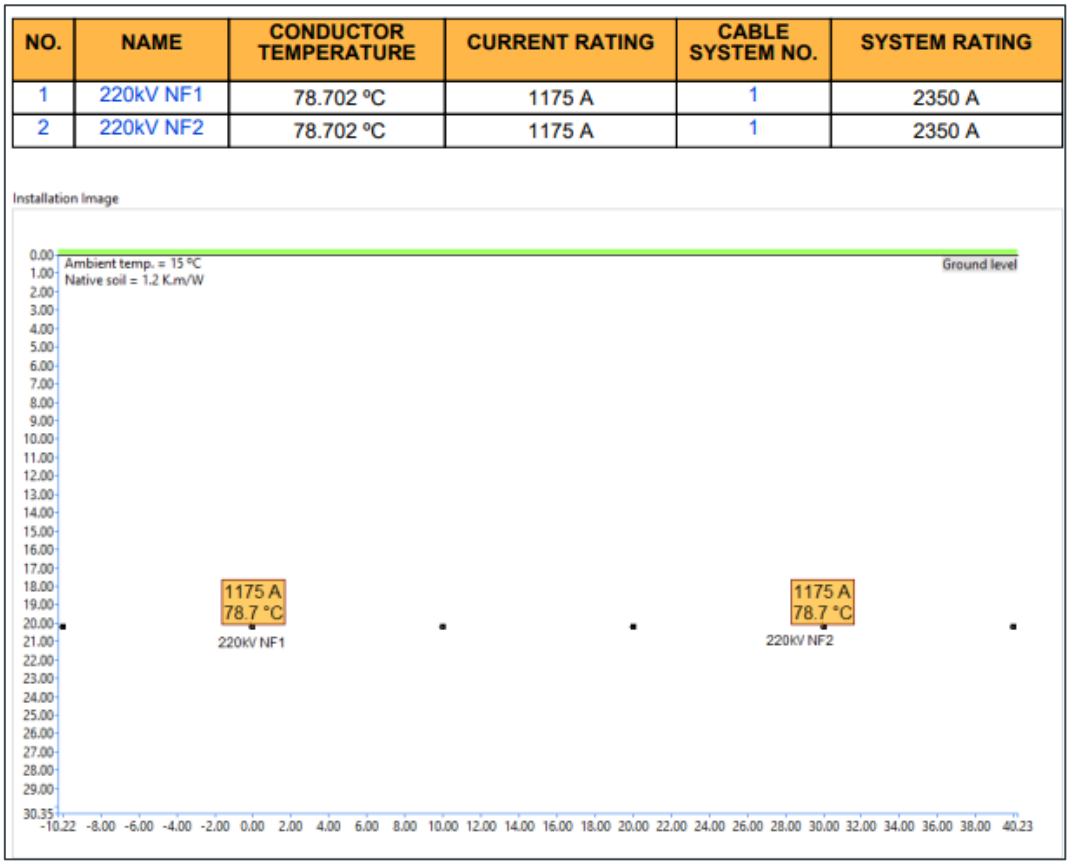

Figure 3-1-9: Cable installation arrangement (Scenario 5).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-9.

Table 3-9: Summary of the EMF study results (Scenario 5).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	8.24
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	7.71

Based on the results presented in Table 3-9, the maximum electromagnetic field intensity of the cables is 8.24 µT at 0 m above the ground.

Figure 3-2-9 shows the graphical representation of the magnetic field with respect to lateral distance.

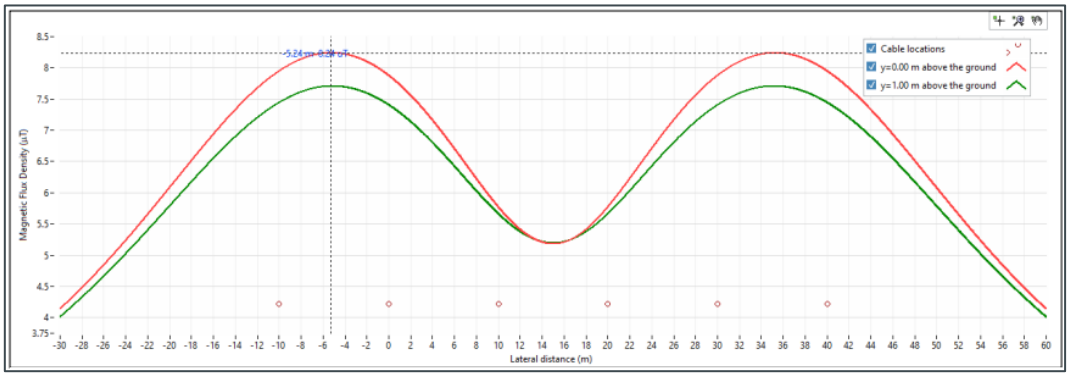

Figure 3-2-9: Magnetic field (µT) with respect to lateral distance (m) (Scenario 5).

3.10. Scenario 5a

In Scenario 5a, the EMF assessment will be conducted for 850 MW 220 kV NF cable along with Five Estuaries 1080 MW 275 kV cables in Deep HDD at 20 m depth.

3.10.1. Simulation Parameters and Cables Details

- Cable laying in Deep HDD.
- The depth of the cable is 20m.
- Cable sizes are 2500 mm^2 220 kV Al. and 2500 mm^2 275 kV Al.
- Flat arrangement with 10m spacing among phases.
- 10m separation between NF and VE cables.

3.10.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	275kV VE1	90.436 °C	1194 A	2	2380 A
2	275kV VE2	93.954 °C	1194 A	2	2380 A
3	220kV NF1	90.379 °C	1175 A	1	2350 A
4	220kV NF2	85.45 °C	1175 A	1	2350 A

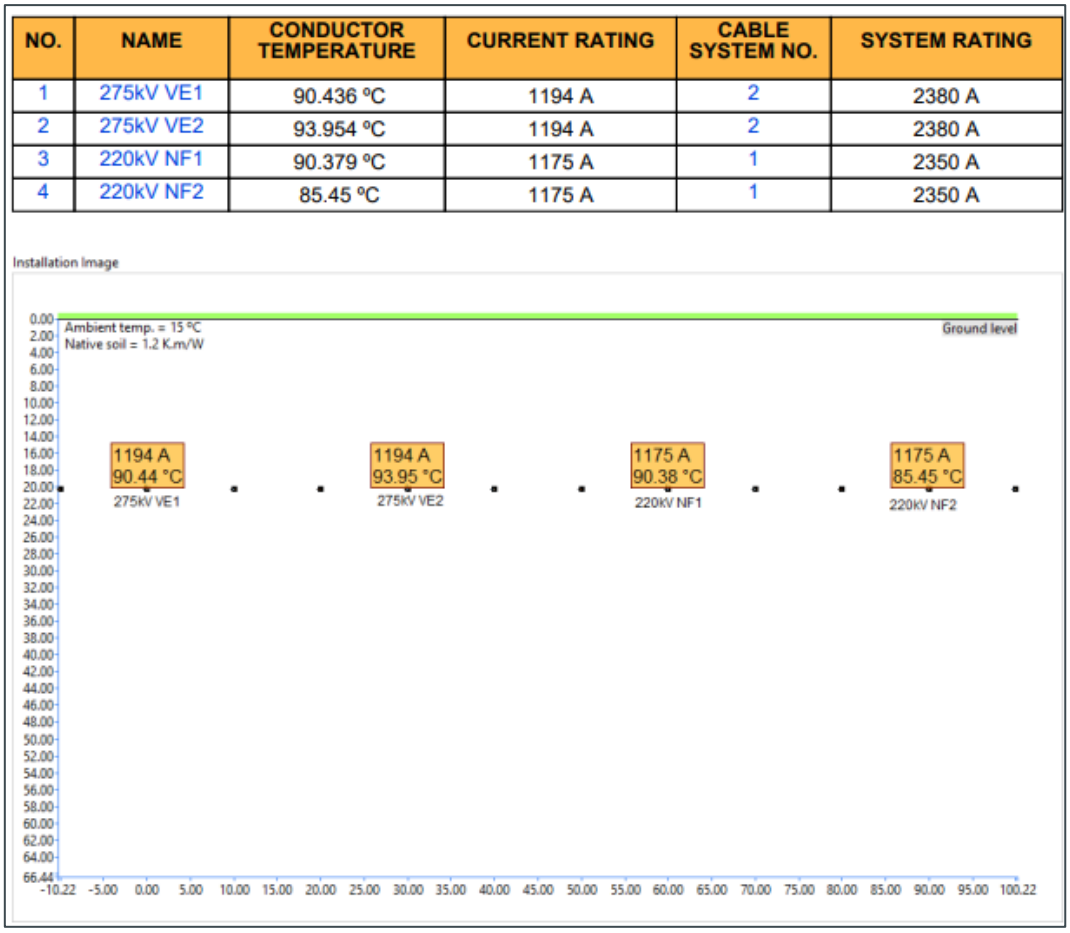

Figure 3-1-10: Cable installation arrangement (Scenario 5a).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-10.

Table 3-10: Summary of the EMF study results (Scenario 5a).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	8.2
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	7.69

Based on the results presented in Table 3-10, the maximum electromagnetic field intensity of the cables is 8.2 µT at 0 m above the ground.

Figure 3-2-10 shows the graphical representation of the magnetic field with respect to lateral distance.

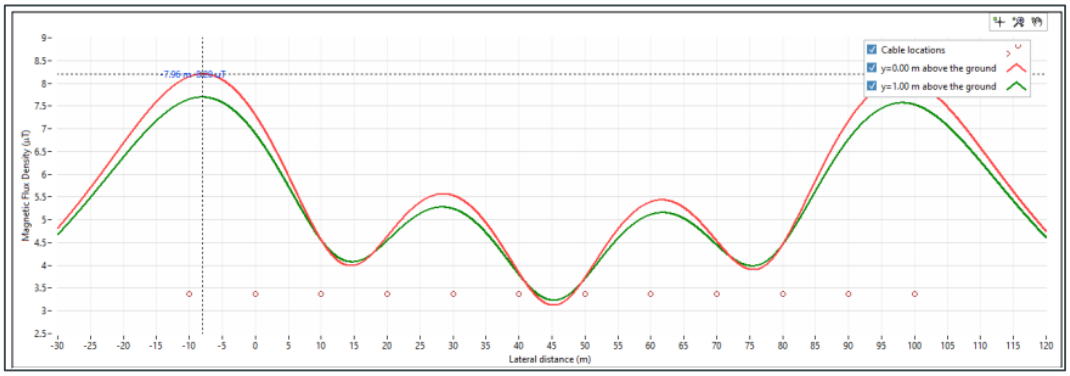

Figure 3-2-10: Magnetic field (µT) with respect to lateral distance (m) (Scenario 5a).

3.11. Scenario 6

In Scenario 6, the EMF assessment will be conducted for 1000 MW 275 kV NF cable in Deep HDD at 20 m depth.

3.11.1. Simulation Parameters and Cables Details

- Cable laying in open cut trench.
- The depth of the cable is 20m.
- Cable size is 2500 mm^2 275 kV Al.
- Flat arrangement with 10m spacing among phases.

3.11.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	275kV NF1	73.238 °C	1105 A	2	2210 A
2	275kV NF2	73.237 °C	1105 A	2	2210 A

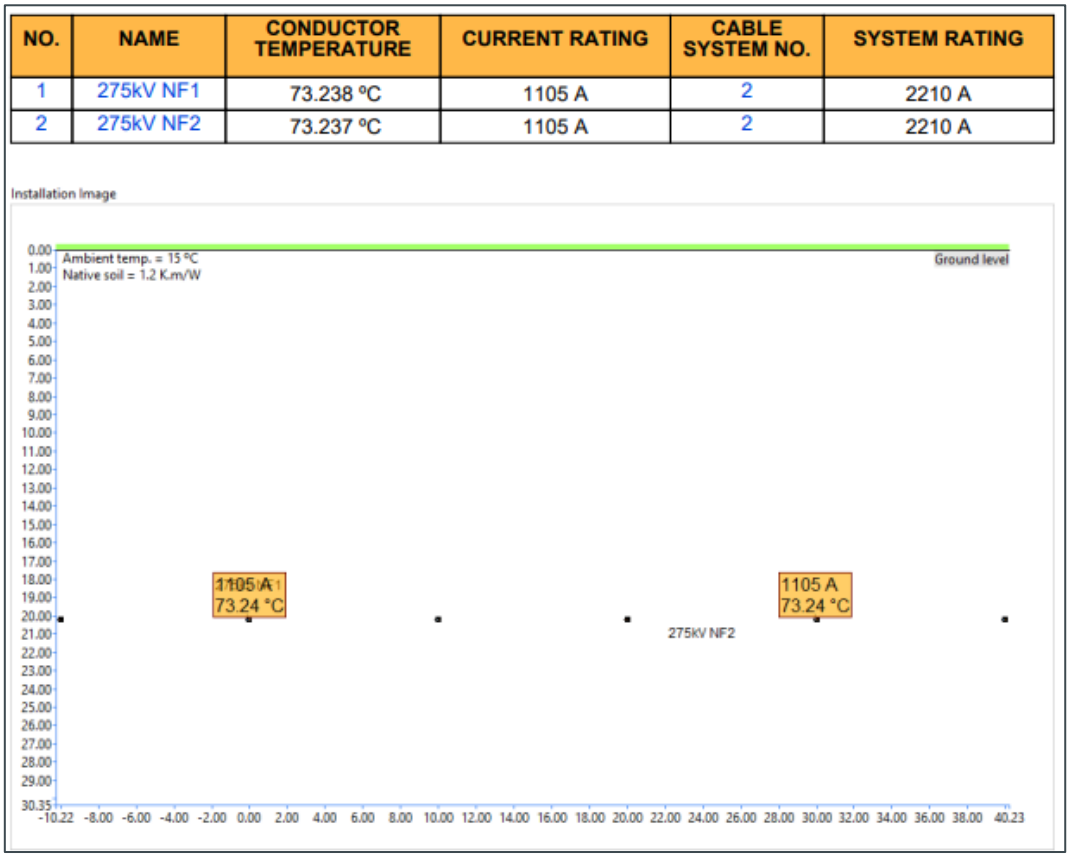

Figure 3-1-11: Cable installation arrangement (Scenario 6).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-11.

Table 3-11: Summary of the EMF study results (Scenario 6).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	7.75
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	7.25

Based on the results presented in Table 3-11, the maximum electromagnetic field intensity of the cables is 7.75 µT at 0 m above the ground.

Figure 3-2-11 shows the graphical representation of the magnetic field with respect to lateral distance.

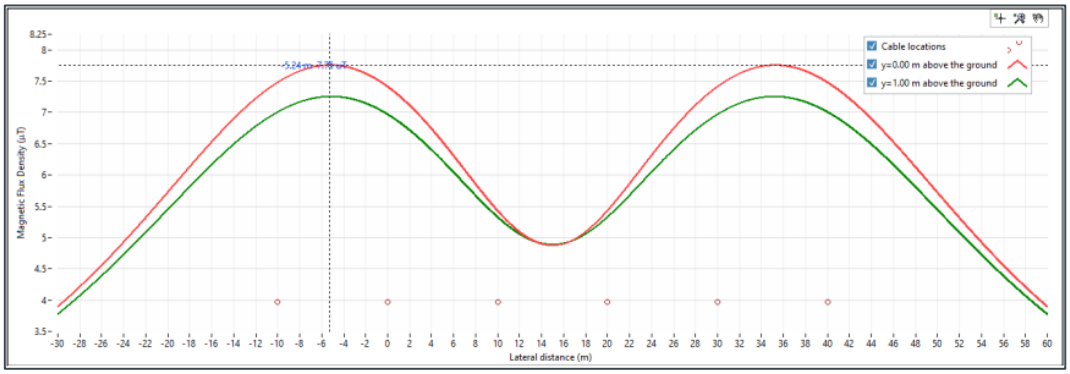

Figure 3-2-11: Magnetic field (µT) with respect to lateral distance (m) (Scenario 6).

3.12. Scenario 6a

In Scenario 6a, the EMF assessment will be conducted for 1000 MW 275 kV NF cable along with Five Estuaries 1080 MW 275 kV cables in Deep HDD at 20 m depth.

3.12.1. Simulation Parameters and Cables Details

- Cable laying in Deep HDD.
- The depth of the cable is 20m.
- Cable sizes are 2500 mm^2 220 kV Al. and 2500 mm^2 275 kV Al.
- Flat arrangement with 10m spacing among phases.
- 10m separation between NF and VE cables.

3.12.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	275kV VE1	89.82 °C	1194 A	3	2380 A
2	275kV VE2	92.613 °C	1194 A	3	2380 A
3	220kV NF1	85.413 °C	1105 A	2	2210 A
4	220kV NF2	79.815 °C	1105 A	2	2210 A

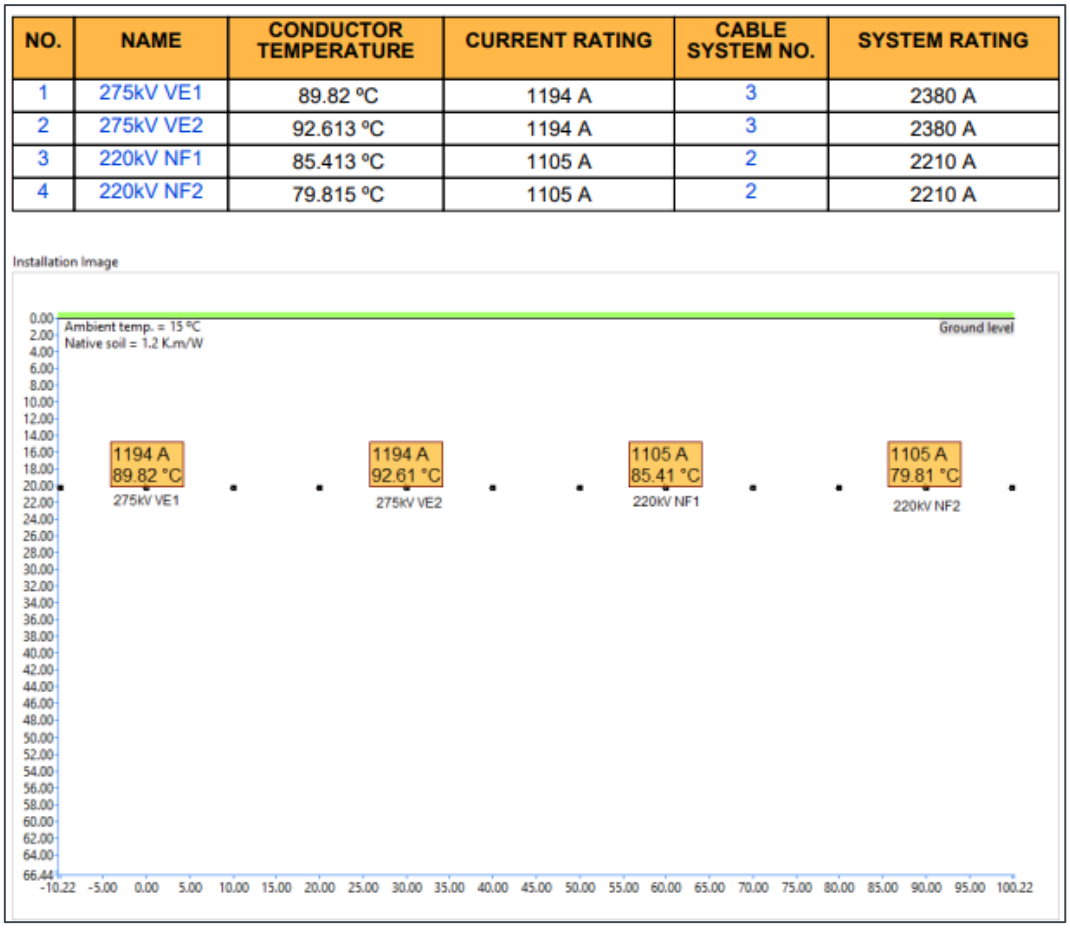

Figure 3-1-12: Cable installation arrangement (Scenario 6a).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-12.

Table 3-12: Summary of the EMF study results (Scenario 6a).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	8.2
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	7.69

Based on the results presented in Table 3-12, the maximum electromagnetic field intensity of the cables is 8.2 µT at 0 m above the ground.

Figure 3-2-12 shows the graphical representation of the magnetic field with respect to lateral distance.

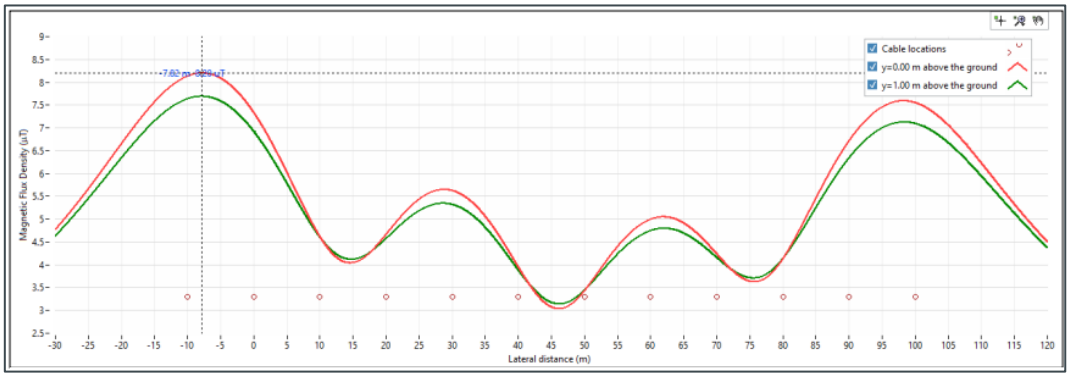

Figure 3-2-12: Magnetic field (µT) with respect to lateral distance (m) (Scenario 6a).

3.13. Scenario 7

In Scenario 7, the EMF assessment will be conducted for 850MW 400 kV NF cable in Open cut trench.

3.13.1. Simulation Parameters and Cables Details

- Cable laying in open cut trench.
- Depth of the cable is 1100 mm.
- Cable size is 2000 mm^2 400 kV Al.
- Flat arrangement with 500 mm spacing among phases.

3.13.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	400kV NF1	35.362 °C	646 A	3	1290 A
2	400kV NF2	35.362 °C	646 A	3	1290 A

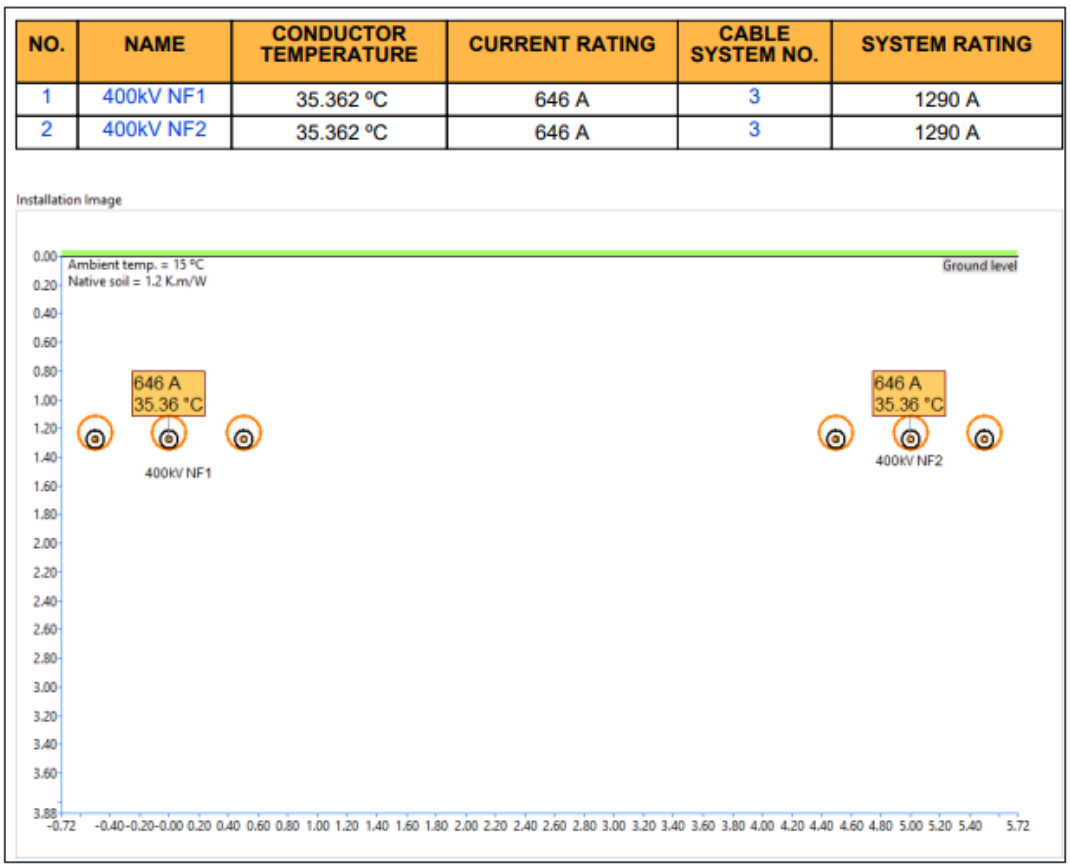

Figure 3-1-13: Cable installation arrangement (Scenario 7).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-13.

Table 3-13: Summary of the EMF study results (Scenario 7).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	57.63
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	19.06

Based on the results presented in Table 3-13, the maximum electromagnetic field intensity of the cables is 57.63 µT at 0 m above the ground.

Figure 3-2-13 shows the graphical representation of the magnetic field with respect to lateral distance.

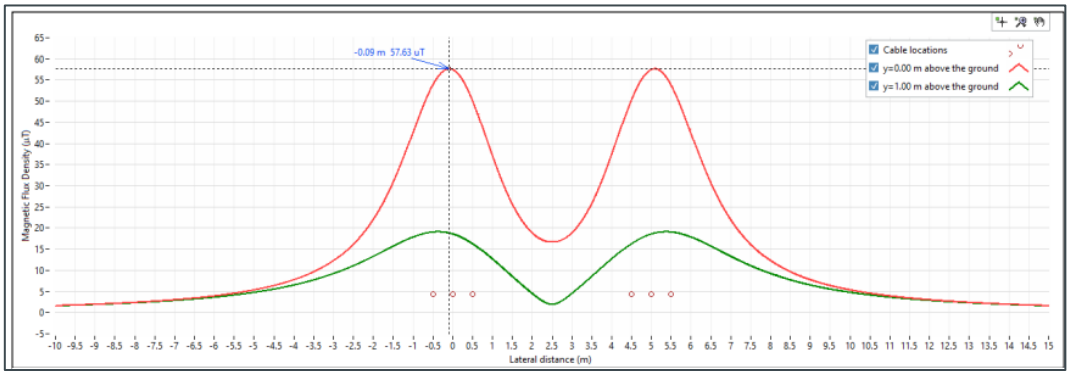

Figure 3-2-13: Magnetic field (µT) with respect to lateral distance (m) (Scenario 7).

3.14. Scenario 8

In Scenario 8, the EMF assessment will be conducted for 1000MW 400 kV NF cable in Open cut trench.

3.14.1. Simulation Parameters and Cables Details

- Cable laying in open cut trench.
- Depth of the cable is 1100 mm.
- Cable size is 2000 mm^2 400 kV Al.
- Flat arrangement with 500 mm spacing among phases.

3.14.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	400kV NF1	41.042 °C	760 A	3	1520 A
2	400kV NF2	41.042 °C	760 A	3	1520 A

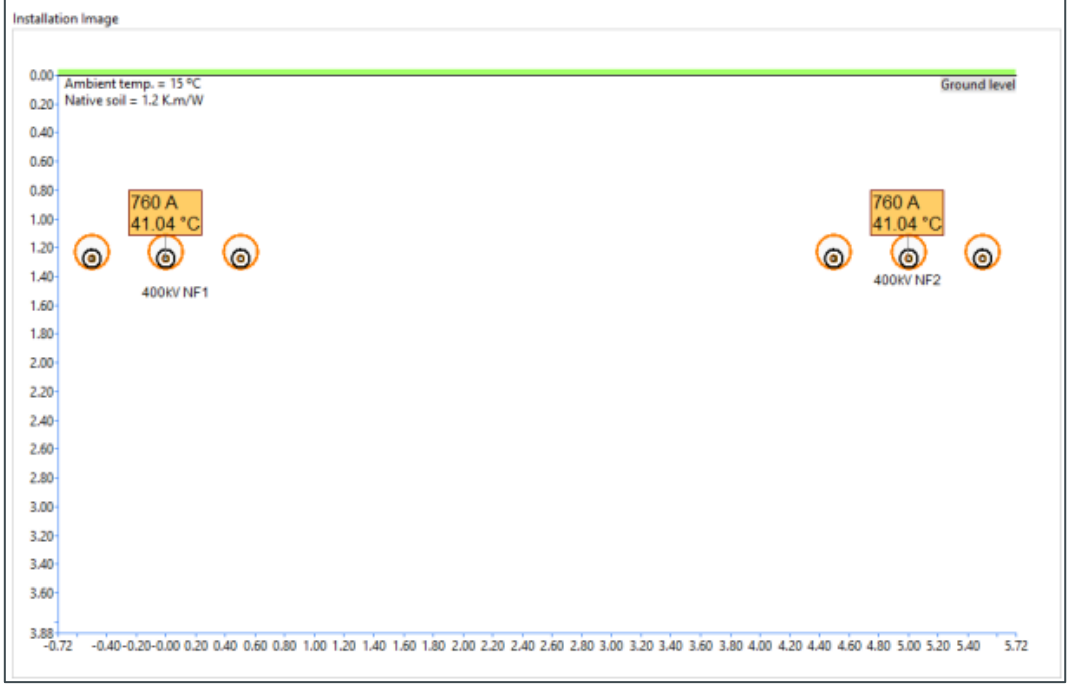

Figure 3-1-14: Cable installation arrangement (Scenario 8).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-14.

Table 3-14: Summary of the EMF study results (Scenario 8).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	67.8
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	22.43

Based on the results presented in Table 3-14, the maximum electromagnetic field intensity of the cables is 67.8 µT at 0 m above the ground.

Figure 3-2-14 shows the graphical representation of the magnetic field with respect to lateral distance.

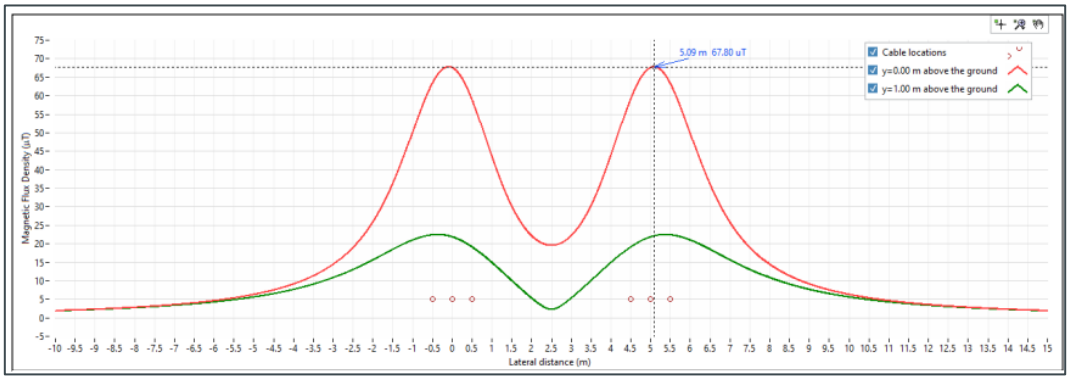

Figure 3-2-14: Magnetic field (µT) with respect to lateral distance (m) (Scenario 8).

3.15. Scenario 9

In Scenario 9, the EMF assessment will be conducted for 850MW 400 kV NF cable in Shallow HDD at 5m depth.

3.15.1. Simulation Parameters and Cables Details

- Cable laying in Shallow HDD.
- The depth of the cable is 5m.
- Cable size is 2000 mm^2 400 kV Al.
- Flat arrangement with 5m spacing among phases.

3.15.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	400kV NF1	35.213 °C	646 A	3	1290 A
2	400kV NF2	35.213 °C	646 A	3	1290 A

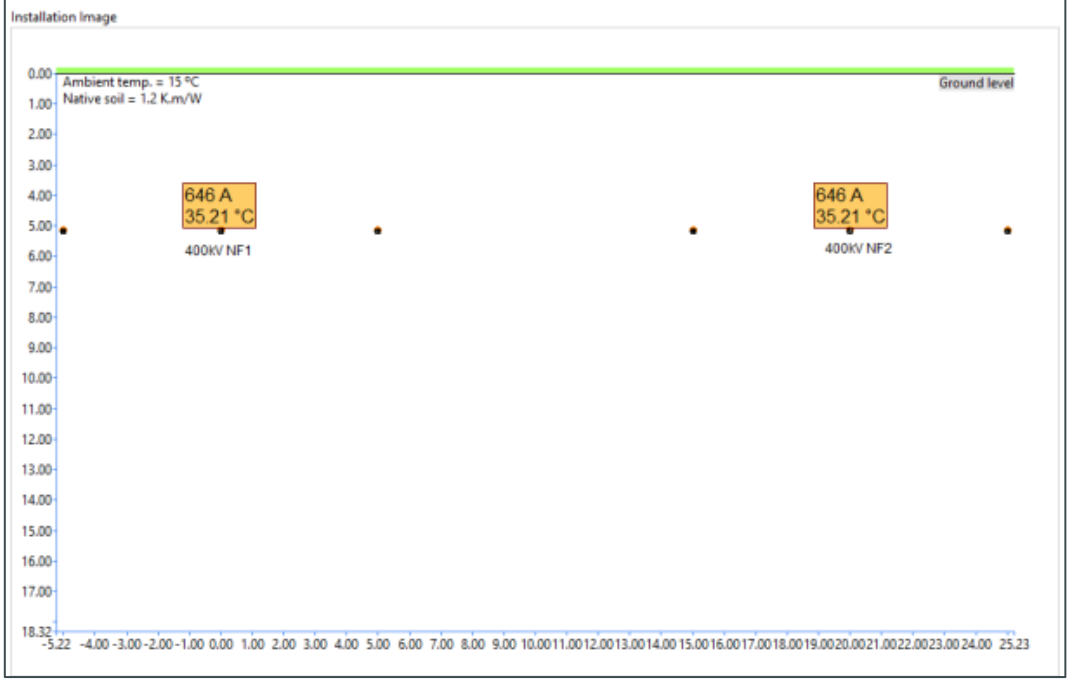

Figure 3-1-15: Cable installation arrangement (Scenario 9).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-15.

Table 3-15: Summary of the EMF study results (Scenario 9).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	22.91
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	17.94

Based on the results presented in Table 3-15, the maximum electromagnetic field intensity of the cables is 22.91 µT at 0 m above the ground.

Figure 3-2-15 shows the graphical representation of the magnetic field with respect to lateral distance.

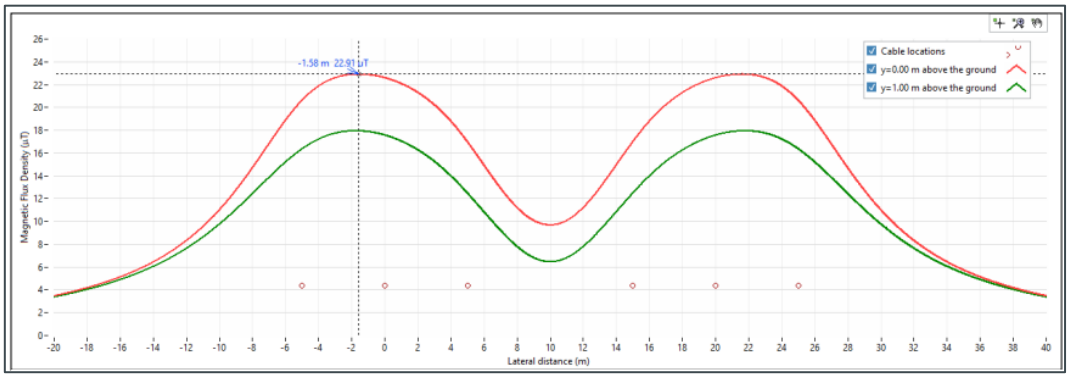

Figure 3-2-15: Magnetic field (µT) with respect to lateral distance (m) (Scenario 9).

3.16. Scenario 10

In Scenario 10, the EMF assessment will be conducted for 1000MW 400 kV NF cable in Shallow HDD at 5m depth.

3.16.1. Simulation Parameters and Cables Details

- Cable laying in Shallow HDD.
- The depth of the cable is 5m.
- Cable size is 2000 mm^2 400 kV Al.
- Flat arrangement with 5m spacing among phases.

3.16.2. Simulation Results

Cable Arrangement and Current Carrying Capacity

NO.	NAME	CONDUCTOR TEMPERATURE	CURRENT RATING	CABLE SYSTEM NO.	SYSTEM RATING
1	400kV NF1	40.857 °C	760 A	3	1520 A
2	400kV NF2	40.857 °C	760 A	3	1520 A

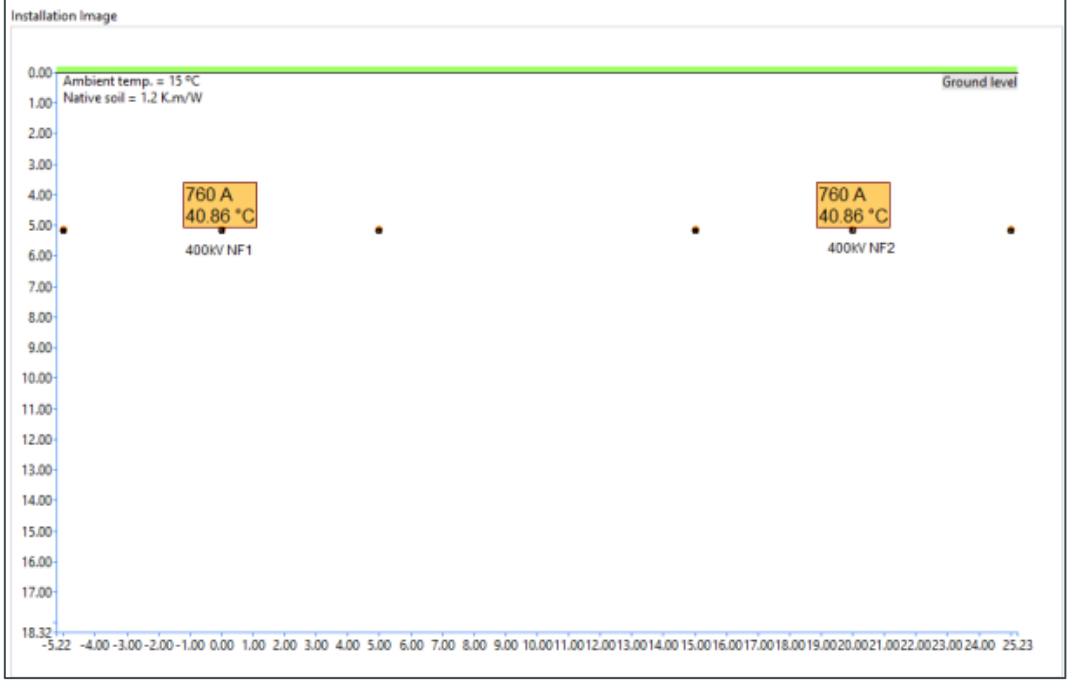

Figure 3-1-16: Cable installation arrangement (Scenario 10).

EMF Modelling Result

Based on the modelled installation, cable, and environmental conditions. The electromagnetic field intensity of the cables can be determined by referencing the results presented in Table 3-16.

Table 3-16: Summary of the EMF study results (Scenario 10).

S#	Description	Unit	Values
1	Maximum Electromagnetic field intensity @ 0m above the ground	µT	26.95
2	Maximum Electromagnetic field intensity @ 1m above the ground	µT	21.1

Based on the results presented in Table 3-16, the maximum electromagnetic field intensity of the cables is 26.95 µT at 0 m above the ground.

Figure 3-2-16 shows the graphical representation of the magnetic field with respect to lateral distance.

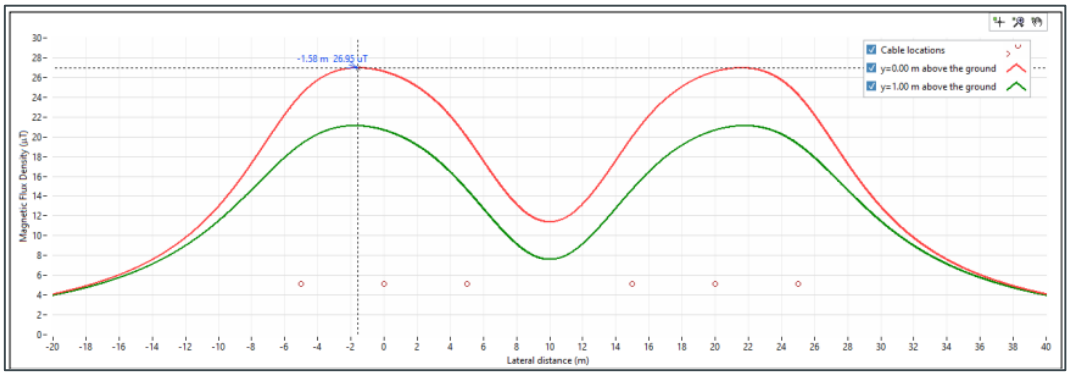

Figure 3-2-16: Magnetic field (µT) with respect to lateral distance (m) (Scenario 10).

4. Comparison of All Scenarios Result

Table 4-1 presents the comparison results of the EMF study for all 16 scenarios at 0m above ground level. The maximum electromagnetic field intensity for all cases can be determined by referring to the results presented in Table 4-1.

Table 4-1: Summary of EMF simulation results.

Scenarios	Description	Values (μT)
Scenario 1	Electromagnetic field intensity @ 0m above the ground	104.22
Scenario 1a	Electromagnetic field intensity @ 0m above the ground	106.14
Scenario 2	Electromagnetic field intensity @ 0m above the ground	99.02
Scenario 2a	Electromagnetic field intensity @ 0m above the ground	106.20
Scenario 3	Electromagnetic field intensity @ 0m above the ground	41.63
Scenario 3a	Electromagnetic field intensity @ 0m above the ground	41.19
Scenario 4	Electromagnetic field intensity @ 0m above the ground	39.21
Scenario 4a	Electromagnetic field intensity @ 0m above the ground	41.26
Scenario 5	Electromagnetic field intensity @ 0m above the ground	8.24
Scenario 5a	Electromagnetic field intensity @ 0m above the ground	8.20
Scenario 6	Electromagnetic field intensity @ 0m above the ground	7.75
Scenario 6a	Electromagnetic field intensity @ 0m above the ground	8.20
Scenario 7	Electromagnetic field intensity @ 0m above the ground	57.63
Scenario 8	Electromagnetic field intensity @ 0m above the ground	67.80
Scenario 9	Electromagnetic field intensity @ 0m above the ground	22.91
Scenario 10	Electromagnetic field intensity @ 0m above the ground	26.95

Based on the above summary table, the analysis reveals that the maximum electromagnetic field intensity in all cases is 106.2 μT at 0 meters above the ground in Scenario 2a.

5. EMF Compliance

The UK's approach to managing public exposure to electromagnetic fields (EMFs) is based on the 1998 ICNIRP Guidelines, which have been formally endorsed by the UK Government [12]. This is reflected in national policies and enforced through voluntary Codes of Practice agreed upon with the Energy Networks Association (ENA) [11].

5.1. Public Exposure Limits:

For areas where members of the public may spend significant time (e.g., homes, schools), the following limits apply:

- **Electric Field Strength**: 9 kV/m
- **Magnetic Flux Density**: 360 µT [11].

These limits are designed to protect against known acute health effects from power-frequency fields (50 Hz) and are consistent with the ICNIRP's reference levels [12].

The ICNIRP 1998 Guidelines set the public exposure limit for magnetic fields at 100 µT (rms) to prevent known health effects [12]. However, the UK uses the 360 µT reference level, for practical compliance assessment. This higher value accounts for short-term peaks and ensures that infrastructure design remains within safe limits [11].

As per the simulation results of all 16 scenarios, the worst-case value is around 106.20 µT, which is within the limit of 360 µT required for compliance.

6. Conclusion

The electromagnetic field (EMF) analysis for all 16 scenarios shows that the maximum magnetic field intensity is 106.2 µT, observed in Scenario 2a. This value is well within the UK's public exposure reference limit of 360 µT, as outlined in the ICNIRP-endorsed national guidelines. The reference level accounts for realistic operating conditions and short-term variations in field strength. Based on these results, all scenarios evaluated are in full compliance with the applicable EMF exposure standards, confirming that the proposed configurations pose no exceedance of public safety limits.

Recommendation:

Although all simulated values remain compliant, the results can be further improved by increasing the cable burial depth in open-cut trench installations. This adjustment will reduce the maximum magnetic field intensity to below 100 µT, offering an enhanced safety margin and aligning with best engineering practices for minimising public exposure.

7. References

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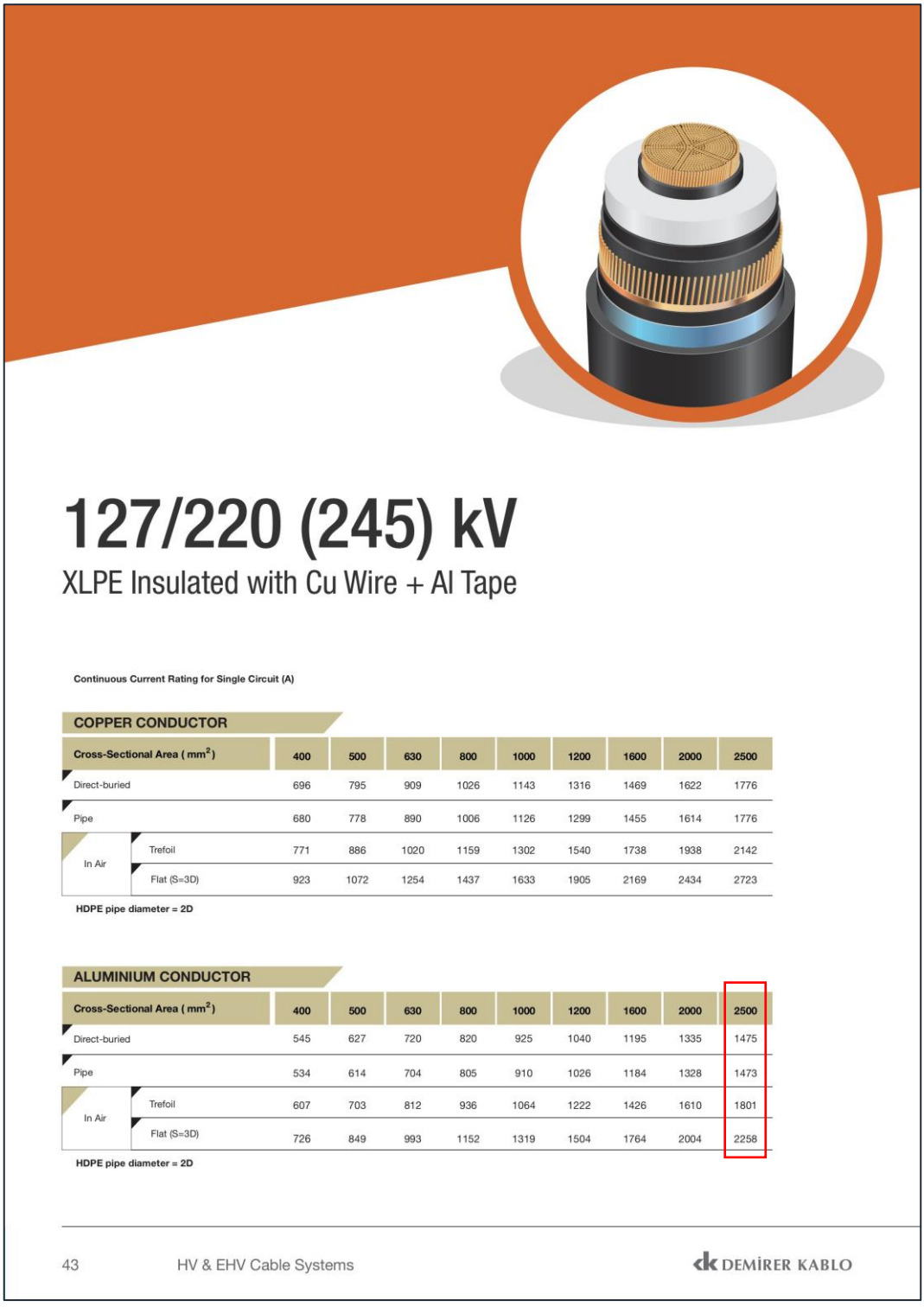
Appendices

Appendix-A Datasheets



127/220 (245) kV

XLPE Insulated with Cu Wire + Al Tape

Continuous Current Rating for Single Circuit (A)

COPPER CONDUCTOR

Cross-Sectional Area (mm^2)		400	500	630	800	1000	1200	1600	2000	2500
Direct-buried		696	795	909	1026	1143	1316	1469	1622	1776
Pipe		680	778	890	1006	1126	1299	1455	1614	1776
In Air	Trefoil	771	886	1020	1159	1302	1540	1738	1938	2142
	Flat (S=3D)	923	1072	1254	1437	1633	1905	2169	2434	2723

HDPE pipe diameter = 2D

ALUMINIUM CONDUCTOR

Cross-Sectional Area (mm^2)		400	500	630	800	1000	1200	1600	2000	2500
Direct-buried		545	627	720	820	925	1040	1195	1335	1475
Pipe		534	614	704	805	910	1026	1184	1328	1473
In Air	Trefoil	607	703	812	936	1064	1222	1426	1610	1801
	Flat (S=3D)	726	849	993	1152	1319	1504	1764	2004	2258

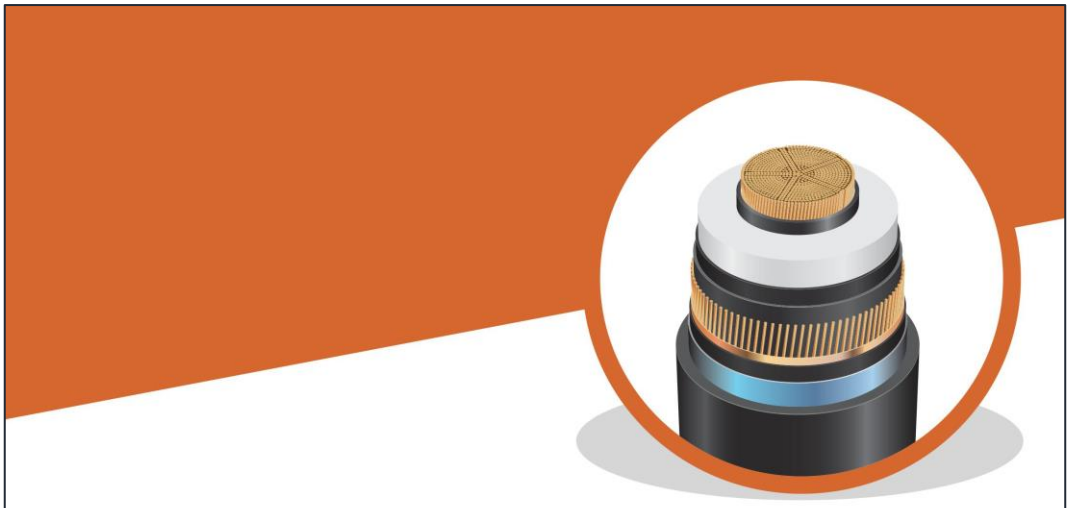
HDPE pipe diameter = 2D

Figure A-1: Electrical data for 220 kV XLPE AC Cable (Part 1) [6].

CONDUCTOR (Cu)	Cross-Sectional Area (mm^2)	400	500	630	800	1000	1200	1600	2000	2500
	Shape	Circular	Circular	Circular	Circular	Circular	Milliken	Milliken	Milliken	Milliken
	Diameter (mm)	23,45	26,4	30,25	34	39	43,5	49,5	56	63,5
Thickness of Conductor Screen (mm)		3,3	1,8	1,2	1,2	1,4	1,4	1,5	1,6	1,6
Thickness of Insulation (mm)		23	22	21	21	20	20	20	20	20
Thickness of Insulation Screen (mm)		1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
Cu-Screen Cross-Sectional Area (mm^2)		150	150	150	150	150	150	150	150	150
Thickness of Outer Sheath (mm)		3,6	3,6	3,7	3,8	3,8	4	4,2	4,6	4,9
Outer Diameter of Cable (mm)		93	91	92	96	99	105	112	119	128
Weight of Cable (kg/m)		10,3	10,9	12,1	14	16,1	18,3	22,4	26,8	32,8
Max. DC Cu Conductor Resistance at 20°C (ohm/km)		0,047	0,0366	0,0283	0,0221	0,0176	0,0151	0,0113	0,009	0,0072
Capacitance (µF/km)		0,139	0,143	0,156	0,168	0,191	0,209	0,229	0,252	0,277
Inductance (mH/km)		0,462	0,434	0,408	0,394	0,375	0,365	0,352	0,339	0,33

CONDUCTOR (Al)	Cross-Sectional Area (mm^2)	400	500	630	800	1000	1200	1600	2000	2500
	Shape	Circular	Circular	Circular	Circular	Circular	Milliken	Milliken	Milliken	Milliken
	Diameter (mm)	24,25	27,4	30,6	34,8	39	43,5	50,2	56,5	63,5
Max. DC Al Conductor Resistance at 20°C (ohm/km)		0,0778	0,0605	0,0469	0,0367	0,0291	0,0247	0,0186	0,0149	0,0127
Weight of Cable (kg/m)		8,1	8	8,2	9,1	9,9	11,1	12,8	14,7	17

Figure A-2: Electrical data for 220 kV XLPE AC Cable (Part 2) [6].



190/330 (362) kV

XLPE Insulated with Cu Wire + Al Tape

Continuous Current Rating for Single Circuit (A)

COPPER CONDUCTOR

Cross-Sectional Area (mm^2)		800	1000	1200	1600	2000	2500
Direct-buried		1013	1128	1298	1447	1596	1746
Pipe		1000	1117	1287	1441	1593	1751
In Air	Trefoil	1157	1298	1529	1724	1921	2122
	Flat (S=3D)	1402	1596	1859	2113	2384	2659

HDPE pipe diameter = 2D

ALUMINIUM CONDUCTOR

Cross-Sectional Area (mm^2)		800	1000	1200	1600	2000	2500
Direct-buried		809	913	1025	1177	1313	1450
Pipe		800	903	1017	1172	1310	1453
In Air	Trefoil	932	1058	1212	1412	1593	1782
	Flat (S=3D)	1123	1289	1468	1719	1959	2205

HDPE pipe diameter = 2D

Figure A-3: Electrical data for 275 kV XLPE AC Cable (Part 1) [6].

CONDUCTOR (Cu)	Cross-Sectional Area (mm²)	800	1000	1200	1600	2000	2500
	Shape	Circular	Circular	Milliken	Milliken	Milliken	Milliken
	Diameter (mm)	34	39	43,5	49,5	56	63,5
Thickness of Conductor Screen (mm)		1,2	1,4	1,4	1,5	1,6	1,6
Thickness of Insulation (mm)		28	27	27	27	26	26
Thickness of Insulation Screen (mm)		1,2	1,2	1,2	1,2	1,2	1,2
Cu-Screen Cross-Sectional Area (mm²)		185	185	185	185	185	185
Thickness of Outer Sheath (mm)		4,3	4,3	4,5	4,7	5	5,3
Outer Diameter of Cable (mm)		111	114	120	127	132	141
Weight of Cable (kg/m)		16,6	18,8	21,3	25,2	29,4	35,6
Max. DC Cu Conductor Resistance at 20°C (ohm/km)		0,0221	0,0176	0,0151	0,0113	0,009	0,0072
Capacitance (µF/km)		0,138	0,155	0,168	0,183	0,206	0,227
Inductance (mH/km)		0,425	0,402	0,039	0,375	0,358	0,346

CONDUCTOR (Al)	Cross-Sectional Area (mm²)	800	1000	1200	1600	2000	2500
	Shape	Circular	Circular	Milliken	Milliken	Milliken	Milliken
	Diameter (mm)	34,8	39	43,5	50,2	56,5	63,5
Max. DC Al Conductor Resistance at 20°C (ohm/km)		0,0367	0,0291	0,0247	0,0186	0,0149	0,0127
Weight of Cable (kg/m)		11,7	12,3	13,8	15,7	17,2	19,9

Figure A-4: Electrical data for 275 kV XLPE AC Cable (Part 2) [6].

220/380 (420) kV

XLPE Insulated with Cu Wire +Al Tape

Continuous Current Rating for Single Circuit (A)

COPPER CONDUCTOR

Cross-Sectional Area (mm^2)		800	1000	1200	1600	2000	2500	3000
Direct-buried		1006	1120	1287	1434	1583	1730	2004
Pipe		996	1110	1277	1428	1582	1737	2021
In Air	Trefoil	1153	1293	1521	1715	1911	2111	2457
	Flat (S=3D)	1387	1586	1853	2105	2367	2640	3116

HDPE pipe diameter = 2D

ALUMINIUM CONDUCTOR

Cross-Sectional Area (mm^2)		800	1000	1200	1600	2000	2500	3000
Direct-buried		806	906	1017	1166	1302	1436	1640
Pipe		795	897	1008	1161	1301	1440	1652
In Air	Trefoil	928	1054	1214	1405	1585	1772	2038
	Flat (S=3D)	1111	1281	1463	1712	1945	2189	2542

HDPE pipe diameter = 2D

Figure A-5: Electrical data for 400 kV XLPE AC Cable (Part 1) [6].

CONDUCTOR (Cu)	Cross-Sectional Area (mm^2)	800	1000	1200	1600	2000	2500	3000
	Shape	Circular	Circular	Milliken	Milliken	Milliken	Milliken	Milliken
	Diameter (mm)	34	39	43,5	49,5	56	63,5	71
Thickness of Conductor Screen (mm)		1,8	1,4	1,4	1,5	1,6	1,6	1,6
Thickness of Insulation (mm)		30	28	27	27	27	27	27
Thickness of Insulation Screen (mm)		1,2	1,2	1,2	1,2	1,2	1,2	1,2
Cu-Screen Cross-Sectional Area (mm^2)		185	185	185	185	185	185	185
Thickness of Outer Sheath (mm)		4,4	4,4	4,5	4,7	5,1	5,3	5,6
Outer Diameter of Cable (mm)		116	117	120	127	134	143	152
Weight of Cable (kg/m)		17,6	19,2	21,3	25,4	29,9	36	42,7
Max. DC Cu Conductor Resistance at 20°C (ohm/km)		0,0221	0,0176	0,0151	0,0113	0,009	0,0072	0,006
Capacitance (µF/km)		0,135	0,151	0,168	0,182	0,2	0,22	0,241
Inductance (mH/km)		0,433	0,405	0,39	0,375	0,362	0,349	0,336

CONDUCTOR (Al)	Cross-Sectional Area (mm^2)	800	1000	1200	1600	2000	2500	3000
	Shape	Circular	Circular	Milliken	Milliken	Milliken	Milliken	Milliken
	Diameter (mm)	34,8	39	43,5	50,2	56,5	63,5	71
Max. DC Al Conductor Resistance at 20°C (ohm/km)		0,0367	0,0291	0,0247	0,0186	0,0149	0,0127	0,0099
Weight of Cable (kg/m)		12,7	12,7	13,8	15,9	17,7	20,3	23,4

Figure A-6: Electrical data for 400 kV XLPE AC Cable (Part 2) [6].

Appendix-B Simulation Report

Scenario 1

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-0.500	1.280	1175.000	-120	FORWARD	ON
1	B	0.000	1.280	1175.000	0	FORWARD	ON
1	C	0.500	1.280	1175.000	120	FORWARD	ON
2	A	4.500	1.280	1175.000	-120	FORWARD	ON
2	B	5.000	1.280	1175.000	0	FORWARD	ON
2	C	5.500	1.280	1175.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -10.00
Maximum horizontal distance (m) = 15.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-0.09	104.22
0	5.09	104.22
1	-0.37	34.57
1	5.37	34.57

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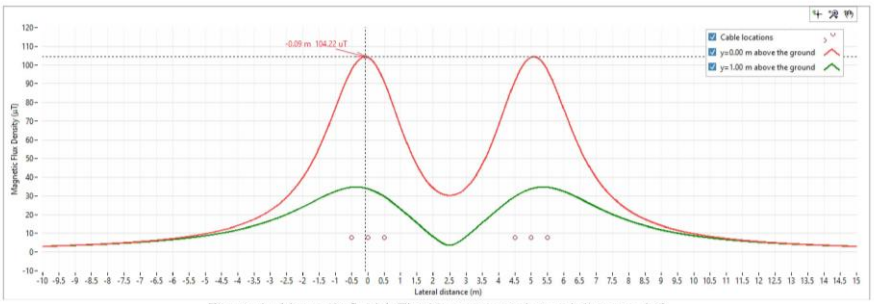

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

Scenario 1a

ELEK Cable High Voltage V7.0 29-03-2025, 02:04 am

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-0.500	1.273	1194.000	-120	FORWARD	ON
1	B	0.000	1.273	1194.000	0	FORWARD	ON
1	C	0.500	1.273	1194.000	120	FORWARD	ON
2	A	4.500	1.273	1194.000	-120	FORWARD	ON
2	B	5.000	1.273	1194.000	0	FORWARD	ON
2	C	5.500	1.273	1194.000	120	FORWARD	ON
3	A	18.500	1.280	1175.000	-120	FORWARD	ON
3	B	19.000	1.280	1175.000	0	FORWARD	ON
3	C	19.500	1.280	1175.000	120	FORWARD	ON
4	A	23.500	1.280	1175.000	-120	FORWARD	ON
4	B	24.000	1.280	1175.000	0	FORWARD	ON
4	C	24.500	1.280	1175.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -10.00
Maximum horizontal distance (m) = 34.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-0.09	106.14
1	-0.41	34.67

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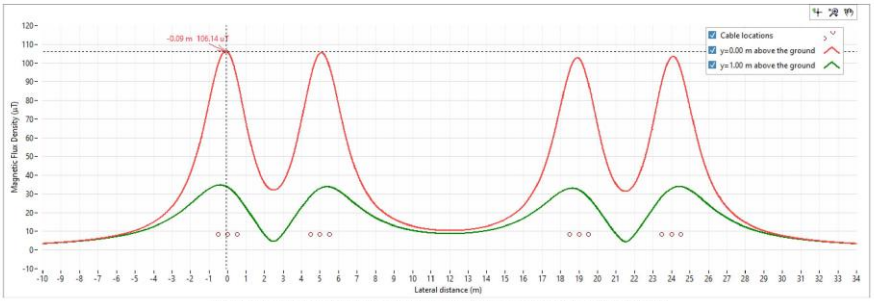

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

Scenario 2

ELEK Cable High Voltage V7.0 29-03-2025, 01:48 am

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-0.500	1.273	1105.000	-120	FORWARD	ON
1	B	0.000	1.273	1105.000	0	FORWARD	ON
1	C	0.500	1.273	1105.000	120	FORWARD	ON
2	A	4.500	1.273	1105.000	-120	FORWARD	ON
2	B	5.000	1.273	1105.000	0	FORWARD	ON
2	C	5.500	1.273	1105.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -10.00
Maximum horizontal distance (m) = 15.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-0.08	99.02
0	5.08	99.02
1	-0.37	32.7
1	5.37	32.7

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ELEK Cable High Voltage V7.0 29-03-2025, 01:48 am

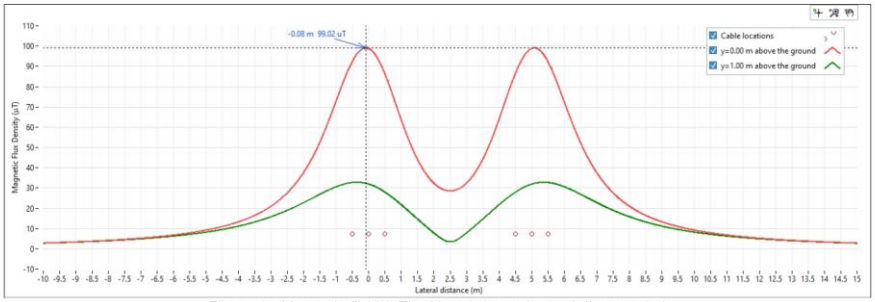

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

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Scenario 2a

ELEK Cable High Voltage V7.0 29-03-2025, 01:53 am

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-0.500	1.273	1194.000	-120	FORWARD	ON
1	B	0.000	1.273	1194.000	0	FORWARD	ON
1	C	0.500	1.273	1194.000	120	FORWARD	ON
2	A	4.500	1.273	1194.000	-120	FORWARD	ON
2	B	5.000	1.273	1194.000	0	FORWARD	ON
2	C	5.500	1.273	1194.000	120	FORWARD	ON
3	A	18.500	1.273	1105.000	-120	FORWARD	ON
3	B	19.000	1.273	1105.000	0	FORWARD	ON
3	C	19.500	1.273	1105.000	120	FORWARD	ON
4	A	23.500	1.273	1105.000	-120	FORWARD	ON
4	B	24.000	1.273	1105.000	0	FORWARD	ON
4	C	24.500	1.273	1105.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -10.00
Maximum horizontal distance (m) = 34.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-0.09	106.2
1	-0.41	34.71

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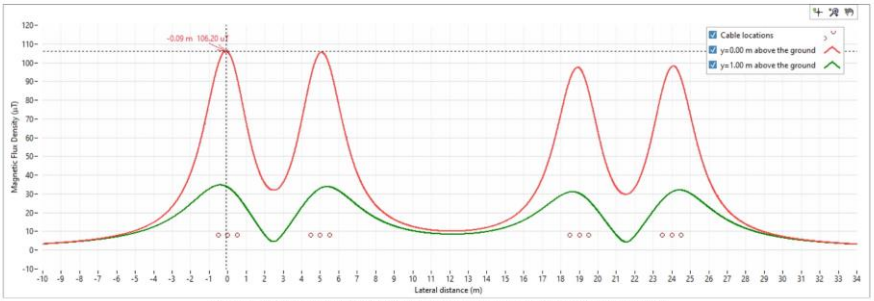

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

Scenario 3

ELEK Cable High Voltage V7.0 29-03-2025, 01:44 am

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-5.000	5.179	1175.000	-120	FORWARD	ON
1	B	0.000	5.179	1175.000	0	FORWARD	ON
1	C	5.000	5.179	1175.000	120	FORWARD	ON
2	A	15.000	5.179	1175.000	-120	FORWARD	ON
2	B	20.000	5.179	1175.000	0	FORWARD	ON
2	C	25.000	5.179	1175.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -20.00
Maximum horizontal distance (m) = 40.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-1.59	41.63
0	-1.58	41.63
0	-1.57	41.63
0	21.57	41.63
0	21.58	41.63
0	21.59	41.63
1	-1.78	32.61
1	-1.77	32.61
1	-1.76	32.61
1	21.76	32.61
1	21.77	32.61
1	21.78	32.61

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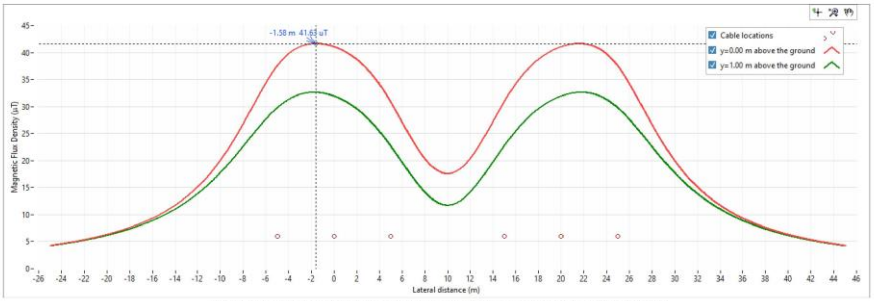

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

Scenario 3a

ELEK Cable High Voltage V7.0 29-03-2025, 02:01 am

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-5.000	5.173	1194.000	-120	FORWARD	ON
1	B	0.000	5.173	1194.000	0	FORWARD	ON
1	C	5.000	5.173	1194.000	120	FORWARD	ON
2	A	15.000	5.173	1194.000	-120	FORWARD	ON
2	B	20.000	5.173	1194.000	0	FORWARD	ON
2	C	25.000	5.173	1194.000	120	FORWARD	ON
3	A	35.000	5.179	1175.000	-120	FORWARD	ON
3	B	40.000	5.179	1175.000	0	FORWARD	ON
3	C	45.000	5.179	1175.000	120	FORWARD	ON
4	A	55.000	5.179	1175.000	-120	FORWARD	ON
4	B	60.000	5.179	1175.000	0	FORWARD	ON
4	C	65.000	5.179	1175.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -20.00
Maximum horizontal distance (m) = 80.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-2.03	41.19
0	-2.02	41.19
1	-2.3	32.09
1	-2.29	32.09
1	-2.28	32.09

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ELEK Cable High Voltage V7.0 29-03-2025, 02:01 am

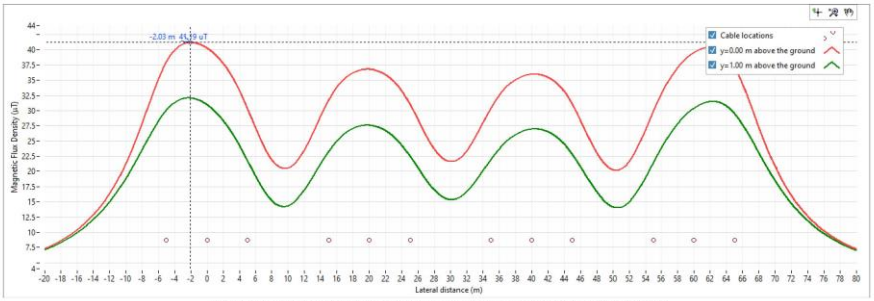

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

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Scenario 4

ELEK Cable High Voltage V7.0 29-03-2025, 12:59 pm

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-5.000	5.173	1105.000	-120	FORWARD	ON
1	B	0.000	5.173	1105.000	0	FORWARD	ON
1	C	5.000	5.173	1105.000	120	FORWARD	ON
2	A	15.000	5.173	1105.000	-120	FORWARD	ON
2	B	20.000	5.173	1105.000	0	FORWARD	ON
2	C	25.000	5.173	1105.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -20.00
Maximum horizontal distance (m) = 40.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-1.59	39.21
0	-1.58	39.21
0	-1.57	39.21
0	21.57	39.21
0	21.58	39.21
0	21.59	39.21
1	-1.78	30.71
1	-1.77	30.71
1	-1.76	30.71
1	21.76	30.71
1	21.77	30.71
1	21.78	30.71

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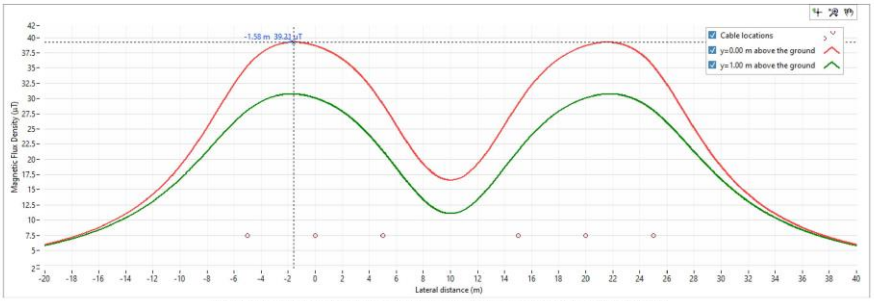

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

Scenario 4a

ELEK Cable High Voltage V7.0 29-03-2025, 01:06 pm

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-5.000	5.173	1194.000	-120	FORWARD	ON
1	B	0.000	5.173	1194.000	0	FORWARD	ON
1	C	5.000	5.173	1194.000	120	FORWARD	ON
2	A	15.000	5.173	1194.000	-120	FORWARD	ON
2	B	20.000	5.173	1194.000	0	FORWARD	ON
2	C	25.000	5.173	1194.000	120	FORWARD	ON
3	A	35.000	5.173	1105.000	-120	FORWARD	ON
3	B	40.000	5.173	1105.000	0	FORWARD	ON
3	C	45.000	5.173	1105.000	120	FORWARD	ON
4	A	55.000	5.173	1105.000	-120	FORWARD	ON
4	B	60.000	5.173	1105.000	0	FORWARD	ON
4	C	65.000	5.173	1105.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -20.00
Maximum horizontal distance (m) = 80.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-2	41.26
1	-2.26	32.15
1	-2.25	32.15

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ELEK Cable High Voltage V7.0 29-03-2025, 01:06 pm

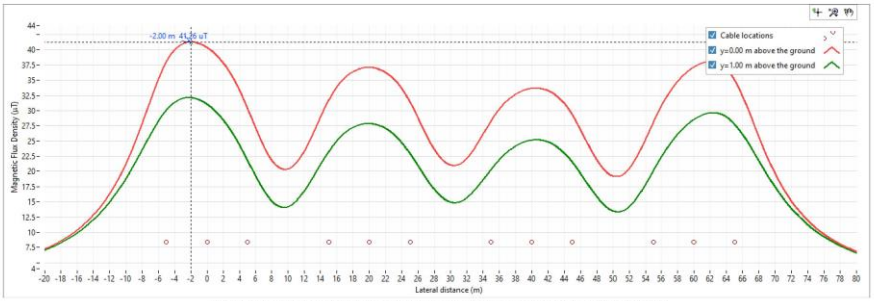

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

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Scenario 5

ELEK Cable High Voltage V7.0 29-03-2025, 01:10 pm

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-10.000	20.180	1175.000	-120	FORWARD	ON
1	B	0.000	20.180	1175.000	0	FORWARD	ON
1	C	10.000	20.180	1175.000	120	FORWARD	ON
2	A	20.000	20.180	1175.000	-120	FORWARD	ON
2	B	30.000	20.180	1175.000	0	FORWARD	ON
2	C	40.000	20.180	1175.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -30.00
Maximum horizontal distance (m) = 60.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-5.26	8.24
0	-5.25	8.24
0	-5.24	8.24
0	-5.23	8.24
0	-5.22	8.24
0	35.22	8.24
0	35.23	8.24
0	35.24	8.24
0	35.25	8.24
0	35.26	8.24
1	-5.22	7.71
1	-5.21	7.71
1	-5.2	7.71

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Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
1	-5.19	7.71
1	-5.18	7.71
1	-5.17	7.71
1	-5.16	7.71
1	-5.15	7.71
1	-5.14	7.71
1	-5.13	7.71
1	-5.12	7.71
1	-5.11	7.71
1	-5.1	7.71
1	-5.09	7.71
1	-5.08	7.71
1	-5.07	7.71
1	-5.06	7.71
1	35.06	7.71
1	35.07	7.71
1	35.08	7.71
1	35.09	7.71
1	35.1	7.71
1	35.11	7.71
1	35.12	7.71
1	35.13	7.71
1	35.14	7.71
1	35.15	7.71
1	35.16	7.71
1	35.17	7.71
1	35.18	7.71
1	35.19	7.71
1	35.2	7.71
1	35.21	7.71
1	35.22	7.71

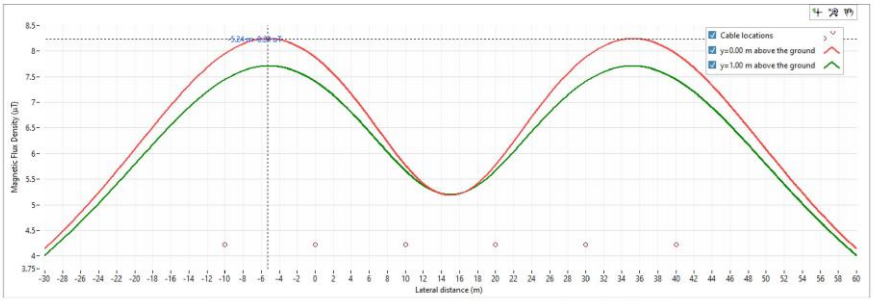

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

Scenario 5a

ELEK Cable High Voltage V7.0 29-03-2025, 01:17 pm

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-10.000	20.173	1194.000	-120	FORWARD	ON
1	B	0.000	20.173	1194.000	0	FORWARD	ON
1	C	10.000	20.173	1194.000	120	FORWARD	ON
2	A	20.000	20.173	1194.000	-120	FORWARD	ON
2	B	30.000	20.173	1194.000	0	FORWARD	ON
2	C	40.000	20.173	1194.000	120	FORWARD	ON
3	A	50.000	20.180	1175.000	-120	FORWARD	ON
3	B	60.000	20.180	1175.000	0	FORWARD	ON
3	C	70.000	20.180	1175.000	120	FORWARD	ON
4	A	80.000	20.180	1175.000	-120	FORWARD	ON
4	B	90.000	20.180	1175.000	0	FORWARD	ON
4	C	100.000	20.180	1175.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -30.00
Maximum horizontal distance (m) = 120.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-8.04	8.2
0	-8.03	8.2
0	-8.02	8.2
0	-8.01	8.2
0	-8	8.2
0	-7.99	8.2
0	-7.98	8.2

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Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-7.97	8.2
0	-7.96	8.2
0	-7.95	8.2
0	-7.94	8.2
0	-7.93	8.2
0	-7.92	8.2
0	-7.91	8.2
0	-7.9	8.2
0	-7.89	8.2
1	-8.14	7.69
1	-8.13	7.69
1	-8.12	7.69
1	-8.11	7.69
1	-8.1	7.69
1	-8.09	7.69
1	-8.08	7.69
1	-8.07	7.69
1	-8.06	7.69
1	-8.05	7.69
1	-8.04	7.69
1	-8.03	7.69
1	-8.02	7.69
1	-8.01	7.69
1	-8	7.69
1	-7.99	7.69
1	-7.98	7.69

ELEK Cable High Voltage V7.0 29-03-2025, 01:17 pm

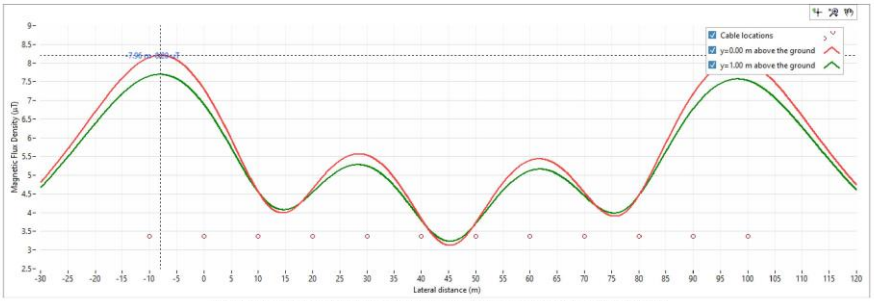

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

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Scenario 6

ELEK Cable High Voltage V7.0 29-03-2025, 01:19 pm

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-10.000	20.173	1105.000	-120	FORWARD	ON
1	B	0.000	20.173	1105.000	0	FORWARD	ON
1	C	10.000	20.173	1105.000	120	FORWARD	ON
2	A	20.000	20.173	1105.000	-120	FORWARD	ON
2	B	30.000	20.173	1105.000	0	FORWARD	ON
2	C	40.000	20.173	1105.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -30.00
Maximum horizontal distance (m) = 60.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-5.27	7.75
0	-5.26	7.75
0	-5.25	7.75
0	-5.24	7.75
0	-5.23	7.75
0	-5.22	7.75
0	-5.21	7.75
0	35.21	7.75
0	35.22	7.75
0	35.23	7.75
0	35.24	7.75
0	35.25	7.75
0	35.26	7.75

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Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	35.27	7.75
1	-5.23	7.25
1	-5.22	7.25
1	-5.21	7.25
1	-5.2	7.25
1	-5.19	7.25
1	-5.18	7.25
1	-5.17	7.25
1	-5.16	7.25
1	-5.15	7.25
1	-5.14	7.25
1	-5.13	7.25
1	-5.12	7.25
1	-5.11	7.25
1	-5.1	7.25
1	-5.09	7.25
1	-5.08	7.25
1	-5.07	7.25
1	-5.06	7.25
1	-5.05	7.25
1	35.05	7.25
1	35.06	7.25
1	35.07	7.25
1	35.08	7.25
1	35.09	7.25
1	35.1	7.25
1	35.11	7.25
1	35.12	7.25
1	35.13	7.25
1	35.14	7.25
1	35.15	7.25
1	35.16	7.25
1	35.17	7.25
1	35.18	7.25
1	35.19	7.25
1	35.2	7.25
1	35.21	7.25
1	35.22	7.25
1	35.23	7.25

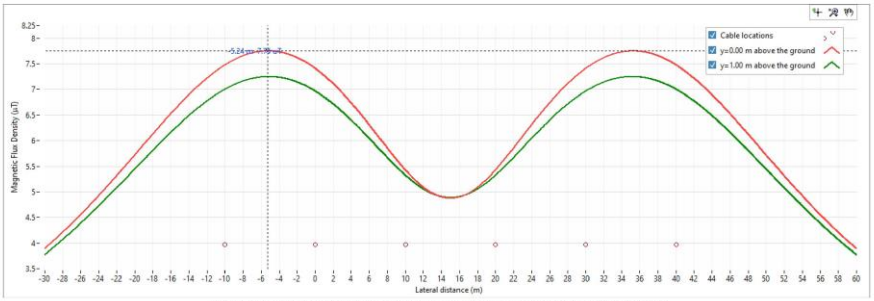

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

Scenario 6a

ELEK Cable High Voltage V7.0 29-03-2025, 01:26 pm

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-10.000	20.173	1194.000	-120	FORWARD	ON
1	B	0.000	20.173	1194.000	0	FORWARD	ON
1	C	10.000	20.173	1194.000	120	FORWARD	ON
2	A	20.000	20.173	1194.000	-120	FORWARD	ON
2	B	30.000	20.173	1194.000	0	FORWARD	ON
2	C	40.000	20.173	1194.000	120	FORWARD	ON
3	A	50.000	20.173	1105.000	-120	FORWARD	ON
3	B	60.000	20.173	1105.000	0	FORWARD	ON
3	C	70.000	20.173	1105.000	120	FORWARD	ON
4	A	80.000	20.173	1105.000	-120	FORWARD	ON
4	B	90.000	20.173	1105.000	0	FORWARD	ON
4	C	100.000	20.173	1105.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -30.00
Maximum horizontal distance (m) = 120.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-7.87	8.2
0	-7.86	8.2
0	-7.85	8.2
0	-7.84	8.2
0	-7.83	8.2
0	-7.82	8.2
0	-7.81	8.2

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Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-7.8	8.2
0	-7.79	8.2
0	-7.78	8.2
0	-7.77	8.2
1	-7.92	7.69
1	-7.91	7.69
1	-7.9	7.69

ELEK Cable High Voltage V7.0 29-03-2025, 01:26 pm

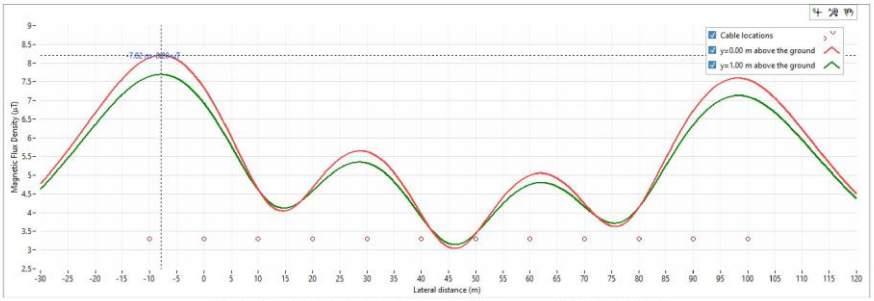

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

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Scenario 7

ELEK Cable High Voltage V7.0 28-03-2025, 08:19 pm

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-0.500	1.276	646.000	-120	FORWARD	ON
1	B	0.000	1.276	646.000	0	FORWARD	ON
1	C	0.500	1.276	646.000	120	FORWARD	ON
2	A	4.500	1.276	646.000	-120	FORWARD	ON
2	B	5.000	1.276	646.000	0	FORWARD	ON
2	C	5.500	1.276	646.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -10.00
Maximum horizontal distance (m) = 15.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-0.09	57.63
0	-0.08	57.63
0	5.08	57.63
0	5.09	57.63
1	-0.37	19.07
1	5.37	19.07

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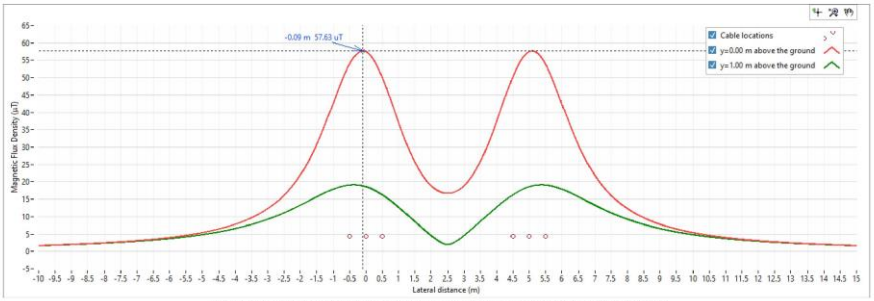

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

Scenario 8

ELEK Cable High Voltage V7.0 28-03-2025, 09:55 pm

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-0.500	1.276	760.000	-120	FORWARD	ON
1	B	0.000	1.276	760.000	0	FORWARD	ON
1	C	0.500	1.276	760.000	120	FORWARD	ON
2	A	4.500	1.276	760.000	-120	FORWARD	ON
2	B	5.000	1.276	760.000	0	FORWARD	ON
2	C	5.500	1.276	760.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -10.00
Maximum horizontal distance (m) = 15.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-0.09	67.8
0	-0.08	67.8
0	5.08	67.8
0	5.09	67.8
1	-0.37	22.43
1	5.37	22.43

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ELEK Cable High Voltage V7.0 28-03-2025, 09:55 pm

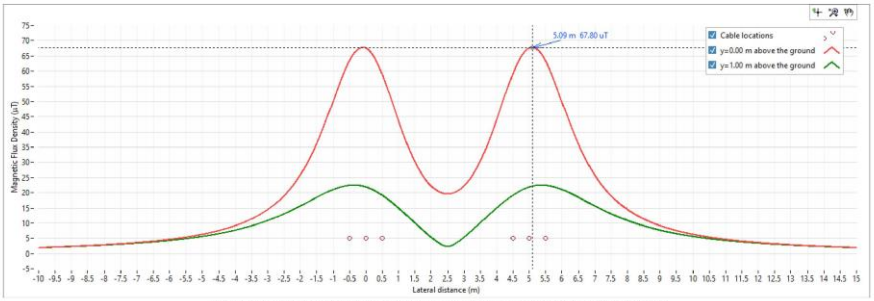

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

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Scenario 9

ELEK Cable High Voltage V7.0 29-03-2025, 01:29 pm

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-5.000	5.176	646.000	-120	FORWARD	ON
1	B	0.000	5.176	646.000	0	FORWARD	ON
1	C	5.000	5.176	646.000	120	FORWARD	ON
2	A	15.000	5.176	646.000	-120	FORWARD	ON
2	B	20.000	5.176	646.000	0	FORWARD	ON
2	C	25.000	5.176	646.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -20.00
Maximum horizontal distance (m) = 40.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-1.58	22.91
0	21.58	22.91
1	-1.79	17.94
1	-1.78	17.94
1	-1.77	17.94
1	-1.76	17.94
1	-1.75	17.94
1	21.75	17.94
1	21.76	17.94
1	21.77	17.94
1	21.78	17.94
1	21.79	17.94

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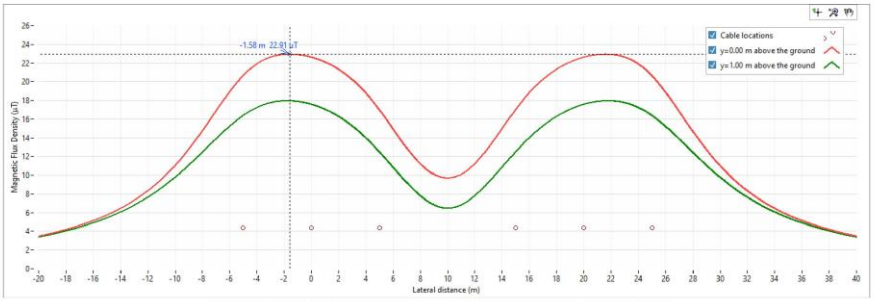

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

Scenario 10

ELEK Cable High Voltage V7.0 29-03-2025, 01:32 pm

Magnetic Field Intensity Calculations

Installation Data

Installation method = Buried
Relative soil permeability = 1.00

Cable Data

Circuit Number	Phase	X Position (m)	Y Position (m)	Current (A)	Angle (deg.)	Direction	On / Off
1	A	-5.000	5.176	760.000	-120	FORWARD	ON
1	B	0.000	5.176	760.000	0	FORWARD	ON
1	C	5.000	5.176	760.000	120	FORWARD	ON
2	A	15.000	5.176	760.000	-120	FORWARD	ON
2	B	20.000	5.176	760.000	0	FORWARD	ON
2	C	25.000	5.176	760.000	120	FORWARD	ON

Measurement Data

Minimum horizontal distance (m) = -20.00
Maximum horizontal distance (m) = 40.00
Horizontal step size (m) = 0.01
Minimum vertical distance (m) = 0.00
Maximum vertical distance (m) = 1.00
Vertical step size (m) = 1.00

Results

Height above the ground, Y (m)	Lateral distance, X (m)	Maximum field intensity, B (uT)
0	-1.6	26.95
0	-1.59	26.95
0	-1.58	26.95
0	-1.57	26.95
0	-1.56	26.95
0	21.56	26.95
0	21.57	26.95
0	21.58	26.95
0	21.59	26.95
0	21.6	26.95
1	-1.78	21.1
1	-1.77	21.1
1	21.77	21.1

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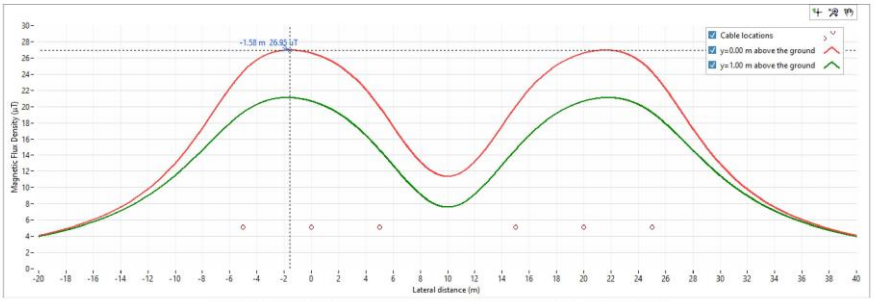

Figure 1: Magnetic field (uT) with respect to Lateral distance (m)

End of Report

NORTH FALLS

Offshore Wind Farm

HARNESSING THE POWER OF NORTH SEA WIND

North Falls Offshore Wind Farm Limited

A joint venture company owned equally by SSE Renewables and RWE.

To contact please email contact@northfallsoffshore.com

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