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15. IMPACTS FROM ELECTRIC AND MAGNETIC FIELDS

15.1 Introduction

15.1.1.1 This section identifies and assesses the potential impacts from exposure to electric and magnetic fields generated from the overhead electricity cables, which has been conducted in accordance with the requirements stated in Clause 3.4.15 of the EIA Study Brief (ESB-340/2021) (hereinafter the Study Brief).

15.2 Environmental Legislation, Standards and Guidelines

15.2.1 International Commission on Non-ionizing Radiation Protection (ICNIRP)

15.2.1.1 Guidelines on limits of exposure to Electric Field (ELF) and Electro-Magnetic Field (EMF) were issued by the International Commission on Non-ionizing Radiation Protection (ICNIRP) in Year 1998 [1]. The guidelines have been updated in Year 2010 [2]. The guidelines were recognized by the World Health Organization. ELF and EMF generated from the overhead cables shall comply with the guidelines stated in **Table 15.1**.

Table 15.1 Guidelines on Limits of Exposure to 50Hz Power Frequency Electric and Magnetic Fields Issued by ICNIRP

Exposure Characteristics	Electric Field Strength, V/m [a]	Magnetic Flux Density, μT [a]
General Public Continuous	5,000 [b][c]	100 [b] 200 [c]
Occupational Continuous	10,000 [b][c]	500 [b] 1000 [c]

Remarks
[a] Unperturbed root-mean-square (rms) values.
[b] The standards stipulated in Guidelines following the ICNIRP (1998) limits for 50 Hz electric and magnetic fields.
[c] The standards stipulated in Guidelines following the ICNIRP (2010) limits for 50 Hz electric and magnetic fields.

15.2.2 Hong Kong Planning Standards and Guidelines

15.2.2.1 As stated in Clause 2.3.10 of Chapter 7 of the Hong Kong Planning Standards and Guidelines (HKPSG), the EMF exposure limits promulgated in the guidelines issued by ICNIRP in 1998 are adopted. The relevant standards are presented in **Table 15.1**.

15.2.2.2 As the ICNIRP (1998) guidelines on magnetic flux density which are more stringent than the ICNIRP (2010), the ICNIRP (1998) guidelines on magnetic flux density is adopted as the assessment criteria in this Study.

15.3 Identification of Potential Impacts

15.3.1.1 ELF and EMF are present everywhere in our environment. ELF is generated by difference in voltage. The higher the voltage, the stronger will be the resultant ELF. EMF fields are created by electric current. The greater the current, the stronger the EMF. ELF and EMF are produced by virtually all electrical consumer appliances, computer terminals, wiring in homes, offices and power lines.

[1] International Commission on Non-Ionizing Radiation Protection, Guidelines for limiting exposure in time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz). Health Phys. 74:494-522; 1998.
[2] International Commission on Non-Ionizing Radiation Protection, Guidelines for limiting exposure in time-varying electric and magnetic fields (1 Hz - 100 kHz). Health Phys. 99(6):818-836; 2010.

15.3.1.2 The location of the existing 400kV overhead cable is presented in **Figure 15.1**. The overhead cable run from Tit Hang, west of Pak Shek Au, across the Fanling Highway, the west of Hadden Hill, to the east of San Tin Barracks. The area under the overhead cable are currently zoned Open Storage, Green Belt and Conservation Area, and occupied by open storages area and villages. People living in these areas and the workers work in the open storage areas, and brownfield sites would expose to ELF and EMF associated with the overhead cable for certain extends.

15.3.1.3 According to the latest Revised RODP (**Figure 2.1**), the overhead cable and associated pylons are situated at and/or are close to the eastern portion of the development area. As such, the potential ELF and EMF impacts to the proposed developments at this portion of the development area were assessed. The proposed land uses of development area under / in the vicinity of the overhead cable are presented in **Table 15.2**.

Table 15.2 Proposed Land Use under / in the Vicinity of the 400kV Overhead Cable

Proposed Land Use		Approximate Horizontal Distance between the Land Use from the 400kV Overhead Cable, m
ID	**Land Use**	
OU(I&T)3.1.7	Other Specified Use (Information and Technology)	265
OU(I&T)3.1.8		35
OU.1.6	Other Specified Use	130
OU.1.7	Other Specified Use	35
OU.1.8	Other Specified Use	0
A1.7	Amenity	0
A1.8		0
A1.15		0
OU(LSW)1.1	Other Specified Use (Logistics, Storage and Warehouse)	0
OU.1.9	Other Specified Use	0
G.3.1	Government, Institution or Community	205
G.3.2		160
RSc.3.1	Public Housing	70
E.3.1	Educational Use	45
RSc.3.2	Public Housing	45
O.4.2	Open Space	140
OU(I&T)4.4.1	Other Specified Use (Information and Technology)	0
OU(I&T)4.4.3		0
OU(I&T)4.4.4		0
GB.4.1	Green Belt	0
OU.4.2	Other Specified Use	0
OU.4.3	Other Specified Use	0
A.4.1	Amenity	0
OU(LSW).4.1	Other Specified Use (Logistics, Storage and Warehouse)	0

15.4 Assessment Methodology

15.4.1 General

15.4.1.1 ELF and EMF measurement have been carried out in accordance with the ELF and EMF standards stipulated in Chapter 7 of the HKPSG and the guidelines issued by the ICNIRP in 1998, as well as the requirements of the Study Brief.

15.4.1.2 The strength of ELF and EMF which are generated by the existing overhead cable have been measured on-site and evaluated with reference to the assessment criteria.

15.4.2 Electric Field Strength Measurement Procedures

15.4.2.1 The electric field adjacent to a conducting surface is normal to the surface. Therefore, the horizontal component of the electric field, particularly where it is generated by overhead cables, can be ignored close to the ground surface. Single-axis measurement (vertical component) is therefore sufficient near the ground at a height of 1.0 m above the ground under overhead cables.

15.4.2.2 In order to take electric field level measurements representing the unperturbed field at a given location, the area should be free as far as possible from other overhead cables, towers, trees, fences, tall grass, or other irregularities or objects. It is preferred that the location should be relatively flat. It should be noted that the influence of vegetation on the electric field level can be significant. In general, field enhancement occurs above individual items of vegetation and field attenuation occurs near the sides. The distance between the measuring probe and the object should be at least 1.0 m. The measurements were performed to first find out the highest radiation frequency. A 30-minute measurement of electric field at that frequency would be conducted. The measured resultant magnetic field were recorded.

15.4.3 Magnetic Field Strength Measurement Procedures

15.4.3.1 Magnetic field measurements should be made with three-axis instruments and should be of the resultant field.

15.4.3.2 Non-permanent objects containing magnetic materials or nonmagnetic conductors should be at least three times the largest dimensions of the object away from the point of measurement in order to measure the unperturbed field value. The distance between the measuring probe and permanent magnetic objects should be at least 1.0m in order to accurately measure the unperturbed field. The measurements were performed to first find out the highest radiation frequency. A 30-minute measurement of magnetic field at that frequency would be conducted. The measured resultant magnetic field were recorded.

15.4.4 Locations of Measurement Points

15.4.4.1 The selection criteria of the measurement locations are based on potential risk of human exposure to ELF and EMF during operation of the Project. The measurement points were selected to be located within the proposed land uses as far as practicable. However, due to existing site limitations, such as inaccessible by public, no suitable measurement location fulfilling the above requirements mentioned in **Sections 15.4.2** to **15.4.3**. Hence, the measurement locations are selected to be located nearest to the proposed land use as far as practicable. As a result, 20 sampling points are proposed which cover the proposed development area in the vicinity of the overhead cable. The measurement points are listed in **Table 15.3** and presented in **Figure 15.1**.

Table 15.3 Measurement Locations

Proposed Land Use		Relevant Measurement Points
ID	**Land Use**	
OU(I&T)3.1.7	Other Specified Use (Information and Technology)	ST02
OU(I&T)3.1.8		ST01, ST02, ST03
OU.1.6	Other Specified Use	ST02, ST04

Proposed Land Use		Relevant Measurement Points
ID	Land Use	
OU.1.7	Other Specified Use	ST03, ST04
OU.1.8	Other Specified Use	ST03
A1.7	Amenity	ST05
A.8	Amenity	ST05
A1.15	Amenity	ST06
OU(LSW)1.1	Other Specified Use (Logistics, Storage and Warehouse)	ST06, ST07
OU.1.9	Other Specified Use	ST06, ST07
G.3.1	Government, Institution or Community	ST08
G.3.2		ST08, ST09
RSc.3.1	Public Housing	ST09
E.3.1	Educational Use	ST10
RSc.3.2	Public Housing	ST11
O.4.2	Open Space	ST11, ST12
OU(I&T)4.4.1	Other Specified Use (Information and Technology)	ST12, ST14
OU(I&T)4.4.3		ST13
OU(I&T)4.4.4		ST19
GB.4.1	Green Belt	ST14, ST15, ST16, ST17, ST19
OU.4.2	Other Specified Use	ST20
OU.4.3	Other Specified Use	ST16, ST17, ST18, ST19
A.4.1	Amenity	ST16, ST19
OU(LSW).4.1	Other Specified Use (Logistics, Storage and Warehouse)	ST18, ST20

15.5 Evaluation of Potential Impacts

15.5.1.1 The measurement results as presented in **Table 15.4** indicate that the ELF and EMF at all measurement points were only a few percent of the general public and occupational exposure standards stated in **Table 15.1**. No adverse electric and magnetic field impact from the existing 400 kV overhead cable to the proposed developments would be anticipated.

Table 15.4 Measurement Results

Measurement Point	Electric Field Strength, V/m [1]	Magnetic Flux Density, μT [1]
ST1	172.5	0.750
ST2	0.2	0.050
ST3	175.0	0.520
ST4	161.5	1.480
ST5	155.0	1.400
ST6	90.0	0.584
ST7	198.0	0.788
ST8	155.0	0.224
ST9	186.0	0.226
ST10	10.0	0.560
ST11	5.5	0.040
ST12	15.0	0.640
ST13	40.0	0.280

Measurement Point	Electric Field Strength, V/m [1]	Magnetic Flux Density, μT [1]
ST14	192.5	0.626
ST15	124.5	0.820
ST16	90.0	0.740
ST17	3.4	0.560
ST18	35.5	0.576
ST19	1.5	0.744
ST20	6.0	0.620
Standard for General Public Exposure	5,000	100
Standard for Occupational Exposure	10,000	500

15.6 Mitigation Measures

15.6.1.1 No adverse impact due to exposure to ELF and EMF from existing 400 kV overhead cable is anticipated for the proposed developments of the Project. Thus, mitigation measure is deemed not necessary.

15.7 Evaluation of Residual Impacts

15.7.1.1 No residual impact due to exposure to ELF and EMF from existing 400 kV overhead cable is anticipated for the Project.

15.8 Environmental Monitoring and Audit

15.8.1.1 No adverse impact due to exposure to ELF and EMF from existing 400 kV overhead cable is anticipated for the Project. Thus environmental monitoring and audit is deemed not necessary.

15.9 Conclusion

15.9.1.1 According to the Revised RODP, the 400kV overhead cable and pylons are situated at and/or are close to the eastern portion of the development area. As such, the potential ELF and EMF impacts to the proposed developments at this portion of the development area have been assessed in accordance with the requirements in the Study Brief. On-site measurement of ELF and EMF at the selected locations which represent the proposed land uses of the development areas were conducted.

15.9.1.2 The measured ELF and EMF generated from the existing 400 kV overhead cable were well below the stipulated guideline limits issued by the ICNIRP in 1998. Hence, the existing 400 kV overhead cable located within the Project area would not pose adverse impact to proposed developments of the Project.