Ambient Electromagnetic Field Measurement / Assessment

FOR:

Super Star Holding Group
5301 / 438 Victoria Av.
Chatswood, NSW 2067

PROJECT:

Mixed-use development of land at
164 - 170 Croatia Av.
Edmondson Pk, NSW 2174

REPORT: F1952
ISSUE: May 2021

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Test site: Mixed-use development of land at
164 - 170 Croatia Av.
Edmondson Pk, NSW 2174

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Testing date(s): 13/14 May 2021

Specification: International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz):2010

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AMBIENT ELECTROMAGNETIC FIELD MEASUREMENT / ASSESSMENT
for

Super Star Holding Group

REVISION HISTORY

Rev.	Issue date	Changes
d	18/05/2021	n/a
0	20/05/2021	Addition: Sec. 2.2 – kV to V conversion factor
		Correction: Fig. 2, Appendix A – 90m mark along northern property border is now in the right position
		Addition: Appendix C - electromagnetic field limits stated on each graph
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Contents

AMBIENT ELECTROMAGNETIC FIELD MEASUREMENT /ASSESSMENT
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1. SCOPE

Faraday was engaged to assess an impact of HV power systems on the area designated for the mixed-use development at 164 - 170 Croatia Av. Edmondson Pk, NSW 2174 **.**

1.1 Power frequency electromagnetic field measurements were taken at lots 25 and 26 perimeter fence where directly exposed to Endeavour Energy overhead power lines (North) and Sydney Trans rail line (South) including substation.

1.2 The data collected through the measurements, after application of suitable correction factors (safety margin and predicted increase in the power consumption), was checked for compliance with guidelines regulating human exposure to electromagnetic emissions in Australia.

2. UNITS

For the purpose of this report, electromagnetic field levels were expressed as follows:

2.1 The magnetic flux densities have been expressed in Tesla, abbreviated as T.
Note that the older unit, used prior to year 1988 (when full transition from the Imperial to the International System of Units, SI, occurred in Australia), was Gauss - abbreviated as Gs or G:

11nT	= 0.001μT	= 0.000001mT	= 0.01mGs	= 0.00001Gs
10nT	= 0.01μT	= 0.00001mT	= 0.1mGs	= 0.0001Gs
100nT	= 0.1μT	= 0.0001mT	= 1mGs	= 0.001Gs
1000nT	= 1μT	= 0.001mT	= 10mGs	= 0.01Gs
10000nT	= 10μT	= 0.01mT	= 100mGs	= 0.1Gs
100000nT	= 100μT	= 0.1mT	= 1000mGs	= 1Gs
1000000nT	= 1000μT	= 1mT	= 10000mGs	= 10Gs
10000000nT	= 10000μT	= 10mT	= 100000mGs	= 100Gs
100000000nT	= 100000μT	= 100mT	= 1000000mGs	= 1000Gs

n - nano (one milliardth) μ - micro (one millionth) m - milli (one thousandth)

2.2 Electric field have been expressed in volts per metre [V/m].

1mV = 0.001V
1V = 1000mV
1kV = 10000V

m - milli (one thousandth) k – kilo (one thousand)

3. REGULATIONS

3.1 Human exposure to power frequency magnetic field

Currently there is no standard in Australia regulating human exposure to power frequencies electromagnetic field.

3.1.1 In December 2006 Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) released the draft *Radiation Protection Standard: Exposure Limits for Electric and Magnetic Fields 0Hz – 3kHz*. The standard, however, has not been ratified to date.

3.1.2 In June 2015 The Radiation Health Committee withdraw the National Health and Medical Research Council (NHMRC) *Interim guidelines on limits of exposure to 50/60 Hz electric and magnetic fields (1989), Radiation Health Series No.30*, and proposed to adopt International Commission on Non-Ionizing Radiation Protection (ICNIRP) *Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz)*.

3.1.2.1 A link to the ICNIRP guidelines is now active on ARPANSA website with the following statement:

"…The ICNIRP ELF guidelines are consistent with ARPANSA's understanding of the scientific basis for the protection of the general public (including the foetus) and workers from exposure to ELF EMF…".

https://www.arpansa.gov.au/understanding-radiation/what-is-radiation/non-ionising-radiation/low-frequency-electric-magnetic-fields#controlling-exposure-to-elf-electric-and-magnetic-fields

4 EXPOSURE LIMITS

The ICNRIP recommends the following reference levels for unperturbed power frequency magnetic emissions (the below listed values are not to be exceeded):

- 0.2mT for general public
- 1mT occupational exposures.

5 TEST EQUIPMENT

The EMI measurement instrumentation and ancillary equipment selected for the measurement is listed in table 1, the following page:

Table 1. Equipment used to conduct the measurement

DEVICE	*MAKE / MODEL*	*SERIAL NUMBER*	*CALIBRATION DUE*
LF Spectrum meter	Aaronia Spectran / NF-5035	42538	April 2023

5.1 The measuring instrument calibration certificate (signature page only) is included in Appendix C.

6 TEST METHODOLOGY

The measurements were conducted at a single frequency of 50 Hz.

Individual harmonics (up to 650Hz) were also measured at selected locations to confirm the overall harmonics level.

6.1 Multiple locations were tested along the property perimeter fence - north and south sides.

6.1.1 The measurement data was collected approx. 1.2m above ground level for the minimum period of 6 minutes per location. No adjustments were made for ground level variations along the test route.

6.2 For detailed information about the test locations refer to Fig 2 in Appendix A.

7 MEASUREMENT UNCERTAINTY

Errors associated with the used test instrumentation and the measurement methodology are typically within ±5%.

7.1 The measured field fluctuations observed on site were:

- ±15% - magnetic component
- ±10% - electric component.

7.2 Frequency variation: ±1Hz

7.3 Safety factor of 3dB (1.41) should be typically applied to all measured values.

8 LIMITATIONS

All measurements are taken with the utmost care in order to determine maximum electromagnetic field levels, however, it is possible that a critical emission may not have occurred during the measurement session.

8.3 Measurements were taken at the present test site conditions, as on 13th – 14th May 2021. As changes to the site conditions typically impact measurement results, it may be necessary to investigate a possibility of increased electromagnetic field levels.

9 MEASUREMENT RESULTS

The following table shows ambient electric and magnetic field levels measured along the perimeter fences, within areas directly exposed to power services. See Fig 2 in Appendix A for the markup of the test lines. Graphical representation of the measurement data is shown in Appendix B.

9.1 The following tables show electromagnetic field values measured on site.

Table 2. 50Hz electromagnetic field levels registered along property's northern fence affected by Sydney Trains power services – measuring line X_1.

Test No.	Distance to reference loc. [m]	Electric field [mV/m]		Magnetic field [µT]	
		measured	added 3dB	6min. max	added 3dB
1	0	820	1156	171	241
2	5	1000	1410	139	196
3	10	580	818	79	111
4	15	490	691	54	76
5	20	560	790	35	49
6	25	470	663	26	37
7	30	540	761	25	35
8	35	480	677	18	25
9	40	560	790	16	23
10	45	490	691	16	23
11	50	570	804	15	21
12	55	450	635	15	21
13	60	580	818	14	20
14	65	690	973	14	20
15	70	605	853	14	20
16	75	570	804	14	20
17	80	609	859	14	20
18	85	3000	4230	7	10
19	90	670	945	14	20
20	95	600	846	9	13
21	100	570	804	14	20
22	105	900	1269	14	20
23	110	3200	4512	9	13
24	115	618	871	10	14
25	120	530	747	9	13
26	125	550	776	7	10
27	130	570	804	6	8
28	135	550	776	7	10
29	140	560	790	5	7
30	145	630	888	7	10
31	150	570	804	6	8
32	155	550	776	6	8
33	160	570	804	5	7
34	165	570	804	8	11
35	170	590	832	5	7
36	175	570	804	14	20
37	180	550	776	6	8
38	185	550	776	10	14
39	190	619	873	11	16
40	195	725	1022	5	7
41	200	895	1262	8	11
42	205	720	1015	5	7
43	210	620	874	< 5*)	< 7

Human exposure limits:
- electric field – 5000V/m
- magnetic field – 200µT

Human exposure limits: - electric field – 5000V/m - magnetic field – 200µT						
	44	215	520	733	< 5*)	< 7
	45	220	550	776	< 5*)	< 7
	46	225	520	733	< 5*)	< 7
	47	230	500	705	< 5*)	< 7
	48	235	490	691	< 5*)	< 7
	49	240	485	684	< 5*)	< 7
	50	245	510	719	< 5*)	< 7
	51	250	510	719	< 5*)	< 7
	Test No.	Distance to reference loc. [m]	measured	added 3dB	6min. max	added 3dB
			Electric field [mV/m]		**Magnetic field [µT]**	

*) value below sensitivity level of measuring system

Table 3. 50Hz electromagnetic field levels registered along property's southern fence affected by Endeavour Energy HV power line and private power services – measuring line X_2.

Human exposure limits: - electric field – 5000V/m - magnetic field – 200µT	Test No.	Distance to reference loc. [m]	**Electric field [V/m]**		**Magnetic field [µT]**	
			measured	added 3dB	6min. max	added 3dB
	1	0	10	14	65	92
	2	5	12	17	59	83
	3	10	9	13	54	76
	4	15	11	16	50	71
	5	20	10	14	50	71
	6	25	11	16	52	73
	7	30	9	13	43	61
	8	35	10	14	37	52
	9	40	9	13	29	41
	10	45	15	21	31	44
	11	50	39	55	32	45
	12	55	31	44	26	37
	13	60	28	39	29	41
	14	65	19	27	35	49
	15	70	20	28	35	49
	16	75	22	31	38	54
	17	80	35	49	41	58
	18	85	44	62	45	63
	19	90	70	99	50	71

9.2 Power harmonics content was also measured for the magnetic emissions.

Table 4. Magnetic field levels registered at frequencies 0.1 – 1.1kHz (power harmonics).

FREQUENCY [Hz]	**Harmonics content [%]**	
	Test line X_1	**Test line X_2**
150	3.3	24
250	-	14
350	0.9	5

9.2.1 Harmonics emissions must be considered when assessing the maximum expected magnetic field level by adding them to all measured values after 3dB correction is applied.

9.3 The measurement results are graphically represented in Appendix C.

10 CONCLUSIONS

From the measurements, the registered electromagnetic emissions were all well below limits of exposure prescribed for general public in ICNIRP guidelines.

10.1 Maximum 271nT & 4.5V/m can be expected along the southern border of the property, and 133nT & 99V/m along the northern border of the property. This is respectively 738 & 1111 times, and 1504 & 51 times below the limits applicable to general public.

10.1.1 The measured magnetic field values are very low, which allows for significant increases in the electrical systems load.

Please note that the electric field levels do not change with load variations.

11 COMMENTS

The reported electric and magnetic fields typically reduce away from their sources, but minor increases of the field level may occur at elevations within areas exposed to Endeavour Energy HV cabling (northern property line). The increased emissions are not expected to significantly affect the planned development, providing all required setback distances are maintained.

11.1 It is expected that the electrical services distributed throughout the development will generate higher electromagnetic emissions than the emissions generated by the external to the site HV and LV systems – current and in the future.

APPENDIX A

DRAWINGS

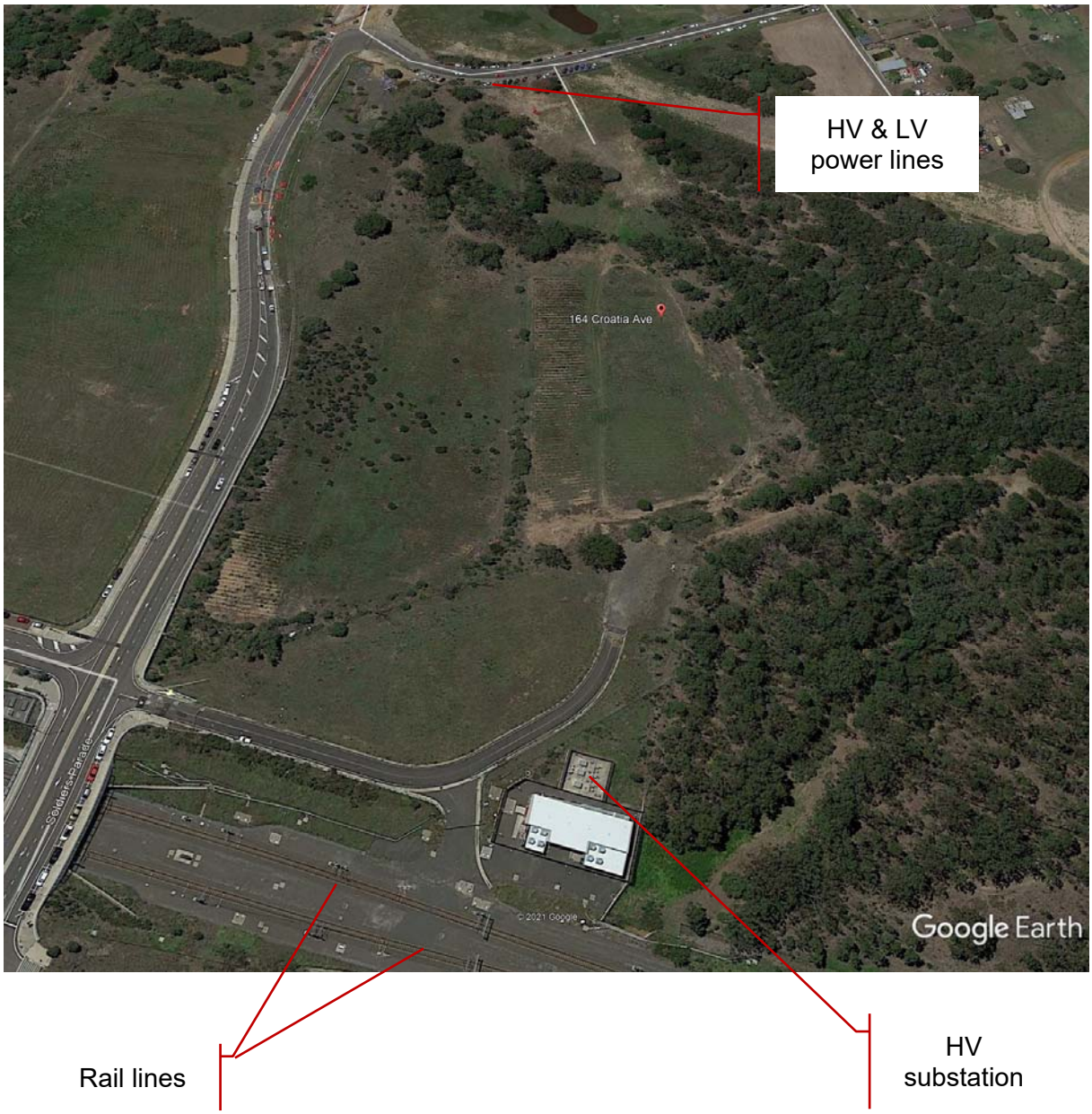


Fig 1. Aerial image of the area designated for development – location of power services which may impact the development.

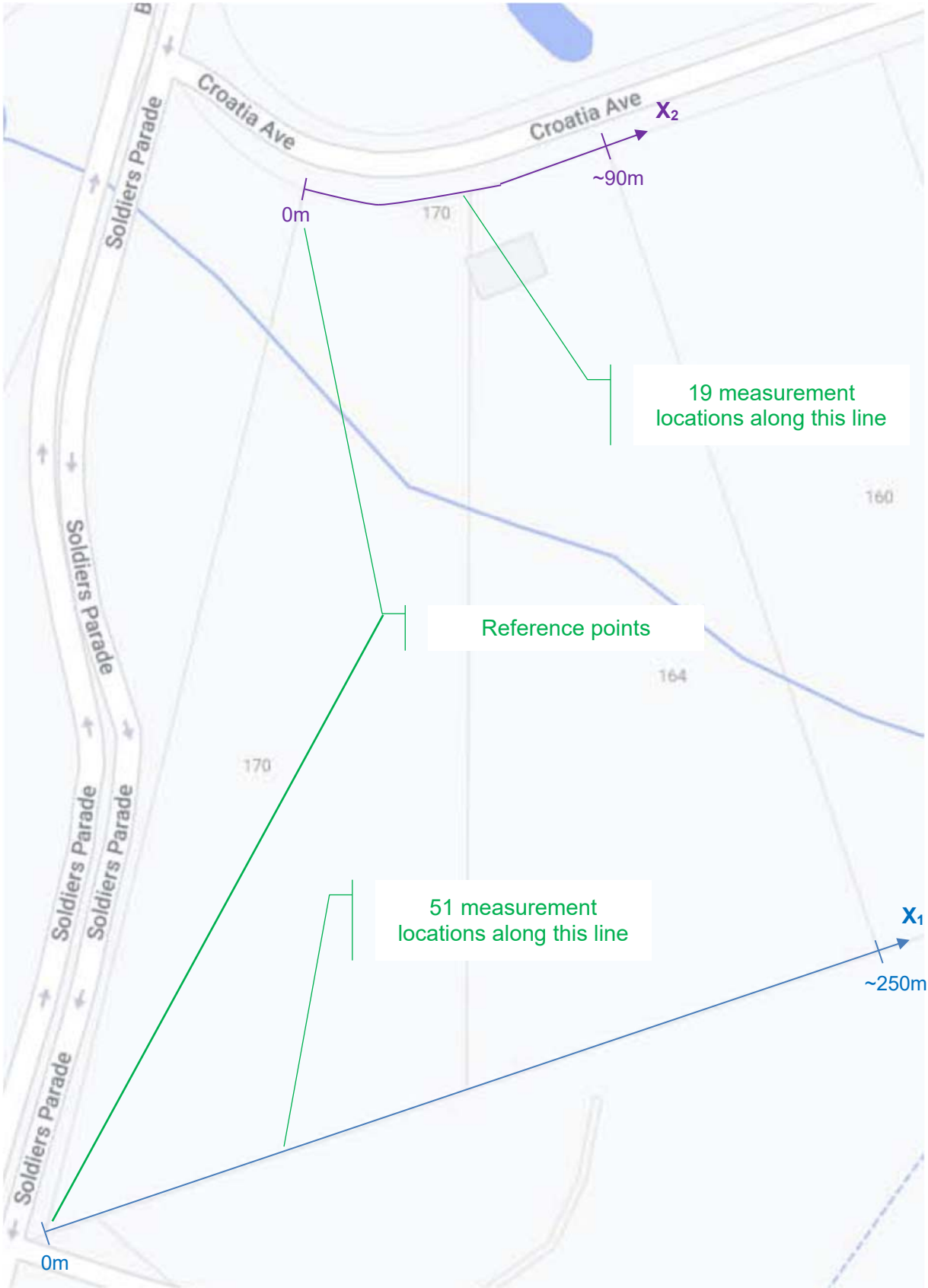


Fig 2. Map of the area designated for development – electromagnetic field test lines.

APPENDIX B

PHOTOGRAPHS

Phot. 1. Rail lines

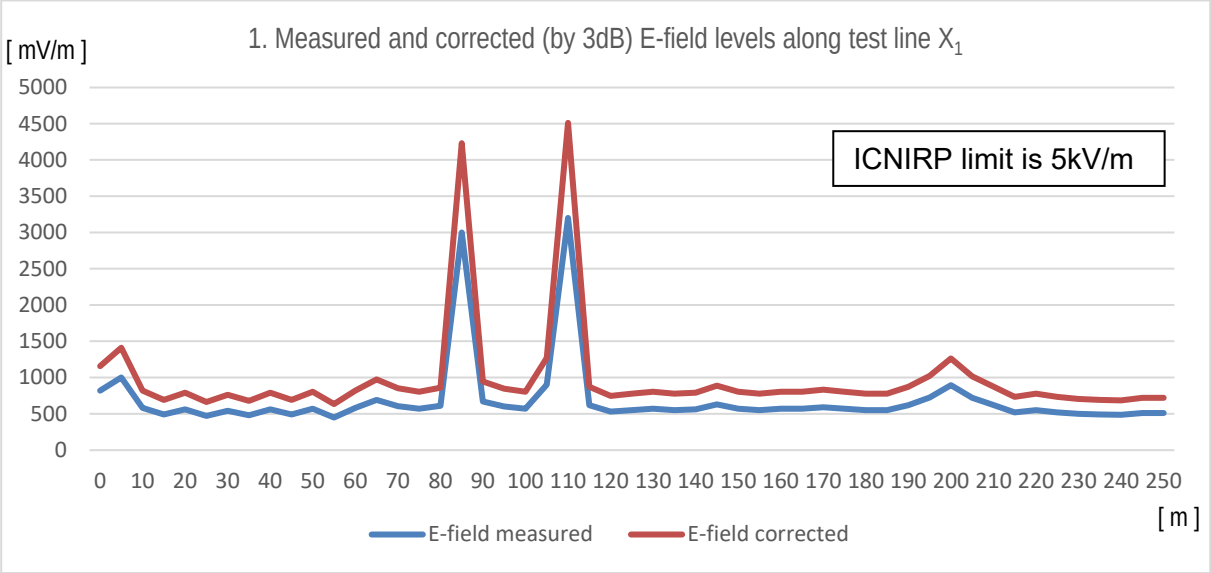
Phot 2. Sydney Trains HV substation located approx. 66m from the property fence.

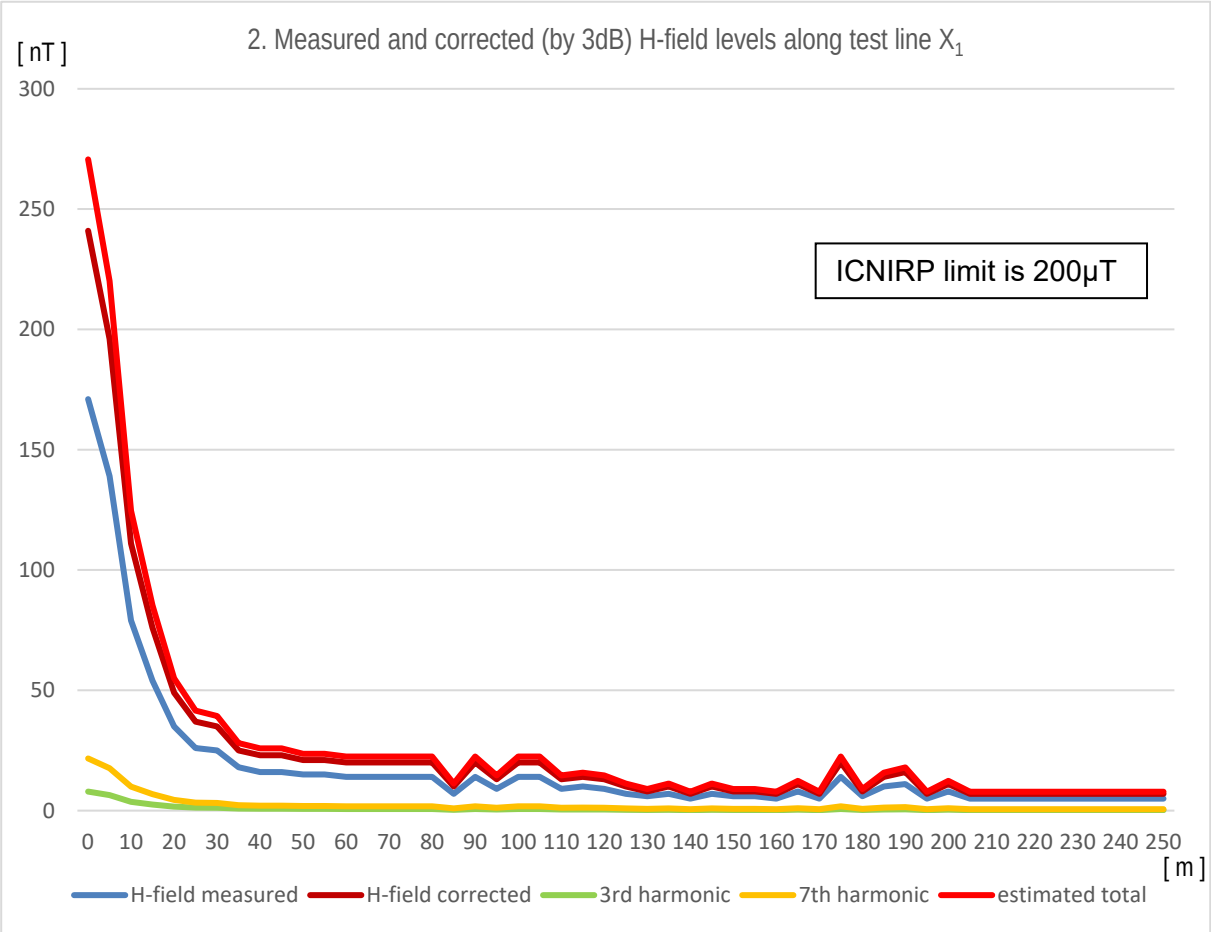
Phot. 3. Endeavour Energy HV power lines on Croatia Av. at the intersection with Soldiers Pde.

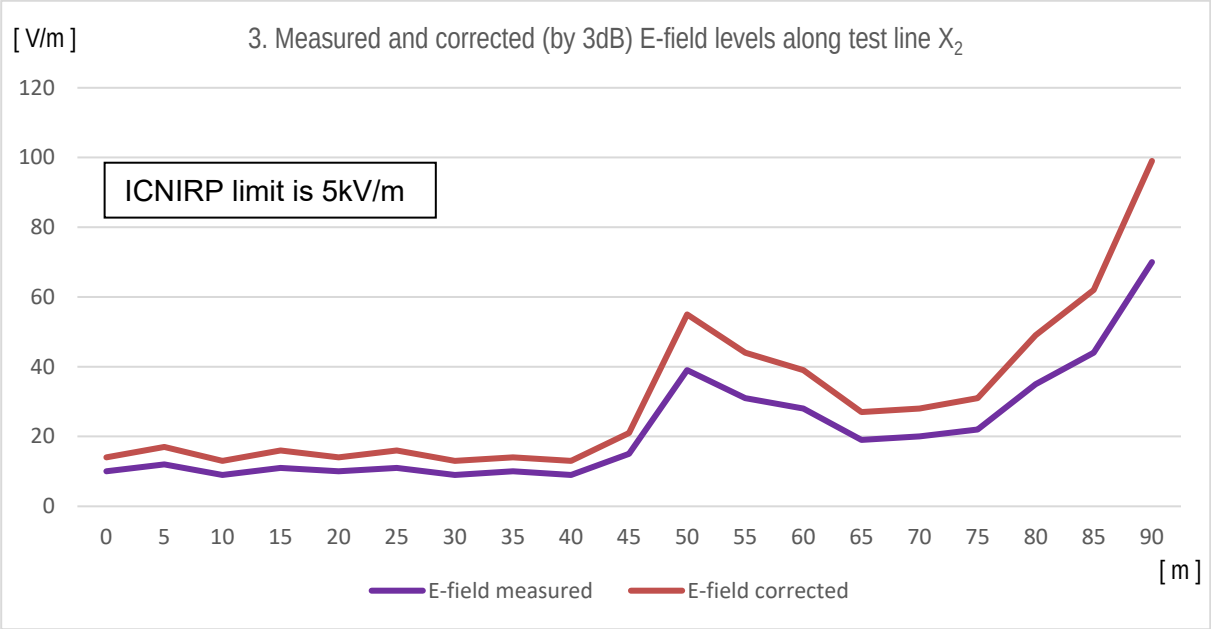
Phot. 4. Endeavour Energy HV power lines on Croatia Av. north-east of the property.

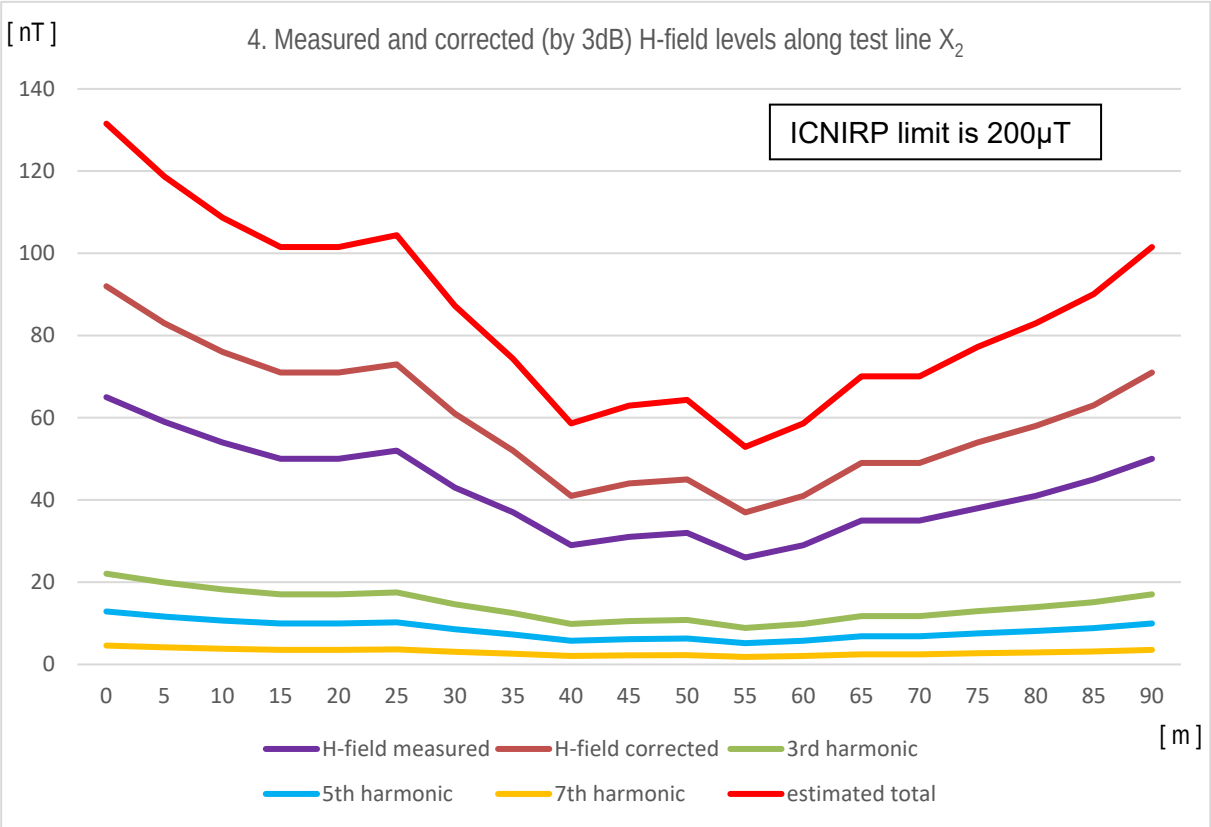
APPENDIX C

GRAPHICAL REPRESENTATION OF MEASUREMENT RESULTS









APPENDIX D

MEASUREMENT INSTRUMENTATION CALIBRATION CERTIFICATE
(signature page only)

Kalibrierschein
Calibration Certificate

Nummer 20-3324
Number

Gegenstand *Item*	SPECTRAN EMV-Messgerät
Hersteller *Manufacturer*	Aaronia AG
Typ *Type*	NF-5035
Serien Nr. *Serial No.*	42538
Bestellung Nr. *Order No.*	
Ort u. Datum der Kalibrierung *Place and date of calibration*	Strickscheid, 2021-04-21
Umfang der Kalibrierung *Scope of calibration*	Standard Calibration
Eingangsprüfung *Perfomance of receipt*	
Kalibrierergebnis *Result of calibration*	Measurement results within specifications
Umfang des Kalibrierscheins *Extent of the certificate*	9 pages incl. this

Dieser Kalibrierschein dokumentiert, dass der genannte Gegenstand nach festgelegten Vorgaben geprüft und gemessen wurde. Die Messwerte lagen im Regelfall mit einer Wahrscheinlichkeit von annähernd 95% im zugeordneten Werteintervall (Erweiterte Messunsicherheit mit k=2).
Die Kalibrierung erfolgte mit Messmitteln und Normalen, die direkt oder indirekt durch Ableitung mittels anerkannter Kalibriertechniken rückgeführt sind auf Normale der PTB/DKD oder anderer nationaler/internationaler Standarts zur Darstellung der physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI). Wenn keine Normale existieren, erfolgt die Rückführung auf Bezugsnormale der Aaronia-Laboratorien.
Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Kalibrierscheine ohne Signifizierung sind ungültig.
Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.
This calibration cerificate documents, that the named item is tested and measured against defined specifications..
Measurement results are located usually in the corresponding interval with a probability of approx. 95% (coverage factor k=2).
Calibration is performed with test equipment and standarts directly or indirectly traceable by means of approved calibration techniques to the PTB/DKD or other national / international standarts, which realize the physical units of measurement according to the International System of Units (SI).
In all cases where no standarts are available, measurements are referenced to standarts of the Aaaronia laboratories.
This certificate may not be reproduced other than in full. Calibration certificates without signature are not valid.
The user is obliged to have the object recalibrated at appropriate intervals.

Ausstellungsdatum *Date of Issue*	**Laborleitung** *Head of laboratory*	**Bearbeiter** *Person responsible*
2021-04-21	Jörg Steilen	Tobias Adams

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