

EME Survey

2 Storey Commercial Building at 241 – 245 Pennant Hills Road Carlingford, NSW, 2118

Performed for
Triple Eight Corporation Pty. Ltd.

Report Number: T140542

Issue Date: 25 June 2014



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Report Number: T140542

Site Name: 2 Storey Commercial Building

Site Address: 241 – 245 Pennant Hills Road
Carlingford, NSW, 2118

Test Date: 10th June 2014

Standard:

Australian Communications and Media Authority
Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard 2007 (No. 1)

Australian Radiation Protection and Nuclear Safety Agency
Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz (2002).

National Health and Medical Research Council
Interim guidelines on the limits of exposure to 50/60 Hz electric and magnetic fields (1989) published by the National Health and Medical Research Council

AS/NZS 2772.2:2011
*Radio Frequency Radiation
Part 2: Principles and Methods of Measurement and computation – 3 kHz – 300 GHz.*

Customer Information:

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Responsible Party: Mr Nigel White

Testing Officers:



Jason Cameron



Les Dickenson

Authorised Signatory:



Jason Cameron

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1.0 INTRODUCTION

This report details the measurements of Radio Frequency (RF) and Extreme Low Frequency (ELF) electromagnetic energy (EME) at the 2 storey commercial building located at 241-245 Pennant Hills Road, Carlingford, NSW, 2118.

Broadband RF measurements in the frequency range of 27 MHz to 3 GHz were carried out at several locations. Broadband ELF field measurements (50 to 2000 Hz) were also performed.

The RF fields were compared against the limits of *the Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz (2002)-RPS3*, published by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). The provisions of the ARPANSA standard are mandated by the Australian Communications and Media Authority (ACMA) to protect the general public from over-exposure to RF fields from radio transmitters.

The RF field measurements were performed in accordance with EMC Technologies NATA accreditation, using appropriate measurement equipment and procedures.

The ELF fields were compared against the recommended limits given in the NHMRC Interim Guidelines on the Limits of Exposure to 50/60 Hz Electric and Magnetic Fields (1989). Site surveys of 50Hz ELF fields were done in accordance with EMC Technologies quality assurance procedures, however are not covered in the scope of NATA accreditation.

The terms electromagnetic radiation (EMR) and electromagnetic energy (EME) have the same meaning when used in this report.

2.0 EXECUTIVE SUMMARY

The purpose of this survey was to provide an independent assessment of the levels of EME at the site.

Testing was performed between 10:30 am and 12:00 pm on 10th June 2014.

No Radio Frequency (RF) Electric Field measurement above 3.3 V/m was found, which is 1.45% of the continuous exposure level allowed by RPS 3. The limit applied was the General Public, Non Occupational limit.

No predicted Radio Frequency (RF) Electric Field values exceeded the General Public Limit. The maximum predicted field strength was 2.9% of the General Public, Non Occupational limit.

No Extreme Low Frequency (ELF) Magnetic Field measurement was found to be higher than 28.39mG, which is 2.84% of the continuous exposure limit. The limit applied was 1000mG.

No Extreme Low Frequency (ELF) Electric Field measurement was found to be higher than 74.65 V/m, which is 1.49% of the continuous exposure limit. The limit applied was 5000 V/m.

3.0 SCOPE OF THE MEASUREMENTS

The purpose of the measurement was to determine the level of Electromagnetic Energy inside the property boundary at 241-245 Pennant Hills Road, Carlingford NSW 2118. Both ELF and RF energy within the areas were examined during testing.

All results in this report are indicative only of the time they were recorded.

4.0 SITE DATA

The testing was performed at the two storey commercial building located at 241-245 Pennant Hills Road, Carlingford NSW 2118. The emissions measured at the site were mainly generated by the sub power station located across Felton Road (ELF), or the Radio Communications tower located nearby (RF). The locations of the measurements are shown in the figure below.



Figure 1: Measurement Locations Onsite

5.0 THE AUSTRALIAN STANDARDS, REGULATIONS & DEFINITIONS

5.1 Reference Standards and Regulations

Apparatus and Transmitters

The ACMA Radiocommunications Licence Conditions (Apparatus Licence) Determination 2003 sets out the conditions for the licence to operate transmitting equipment. It mandates the General Public/non-occupational provisions of the ARPANSA RPS3 standard. Further information can be gained from the ACMA web site: <http://www.acma.gov.au/standards/index.htm>.

Human Exposure Standard

The Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz (2002), referred to as the ARPANSA RPS3 standard, sets limits for human exposure to RF fields to prevent adverse health effects. The ARPANSA RPS3 Standard specifies basic restrictions for occupational and general public exposure. It also stipulates equipment and usage parameters in order to assist in the determination of compliance with the specified limits.

RF Field Measurements and Evaluations- Methodology

The Australian Standard AS/NZS 2772.2:2011 Radio Frequency Radiation, Part 2: Principles and Methods of Measurement and computation – 3kHz to 300GHz, specifies techniques and instrumentation for the measurement of potentially hazardous electromagnetic sources. The measurements were performed in accordance with this standard.

Human Exposure to ELF Fields

The National Health and Medical Research Council have published Interim Guidelines on Limits of Exposure to 50/60Hz Electric and Magnetic Fields, known as Radiation Health Series 30. Rationale for exposure limits are also given in this document.

5.2 Definitions

Basic Restrictions

Mandatory limits on exposure to RF fields are based on established health effects and are termed 'Basic Restrictions'. Protection against adverse health effects requires that these Basic Restrictions are not exceeded. However, these mandatory Basic Restrictions are impractical to measure, therefore, a set of reference levels utilising quantities much easier to measure was established as an alternate means of compliance with the Basic Restrictions. ¹

Reference Levels

The reference levels were conservatively formulated such that conformity with these reference levels will ensure compliance with the Basic Restrictions. The reference levels are measured as a quantity of Power Flux Density (S) in units Watts per metres squared (W/m^2). ²

General Public Exposure

Exposure of persons, other than in the course of or intrinsic to their work. This category includes persons of all ages and health status who will be generally unaware that exposure is taking place. The exposure of the general public and workers in the precincts of the area surveyed is regarded as General Public/Non-occupational exposure

Occupational Exposure

Exposure under controlled conditions, in the course of and intrinsic to the nature of their work, of a population consisting of adults who are trained or informed to be aware of potential risks and to take appropriate precautions. The duration of occupational exposure is limited to the duration of the working day or duty shift per 24 hours and the duration of the working lifetime. This category excludes pregnant workers, who must not be exposed at levels in excess of the non-occupational limit.

1 Derived from excerpts from Section 2.2 of the Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz (2002)

2 Derived from excerpts from Section 2.2 of the Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz (2002)

6.0 Reference Levels

6.1 General Public Exposure Category

Reference levels are defined in Table 7 Section 2 of the Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz (2002). The table below was obtained from the Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz (2002).

Frequency Range	E-field strength (V/m rms)	H-field strength (A/m rms)	Equivalent plane wave power flux density S_{eq} (W/m ²)
100 kHz – 150 kHz	86.8	4.86	—
150 kHz – 1 MHz	86.8	$0.729 / f$	—
1 MHz – 10 MHz	$86.8 / f^{0.5}$	$0.729 / f$	—
10 MHz – 400 MHz	27.4	0.0729	2
400 MHz – 2 GHz	$1.37 \times f^{0.5}$	$0.00364 \times f^{0.5}$	$f / 200$
2 GHz – 300 GHz	61.4	0.163	10

f is the frequency in MHz

Radiation Protection Standard No 3 Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz. The limit for the most stringent frequency range was used: 27.4V/m.

6.2 NHMRC EXPOSURE GUIDELINES

The NHMRC (National Health and Medical Research Council) recommends that the maximum exposure levels to the general public be limited to 5000 V/m (Electric fields) and 1000mG (Magnetic Fields). Details of the exposure guidelines can be found in the following NHMRC publication: “Interim guidelines on limits of exposure to 50/60 Hz electric and magnetic fields (1989)”.

7.0 MEASUREMENT EQUIPMENT

The following equipment was used to perform the magnetic field and electric field measurements.

Equipment	Serial No:	Model	Traceability	Cal Date	Cal Due Date
ELF Field Meter	91026	HI-3604	ARPANSA	16/09/2013	16/09/2015
RF Field Meter	AS/0066	EMR 300	EMCT	08/02/2013	08/02/2015
RF Electric Field Probe	BB-0039	Type 8.3	EMCT	08/02/2013	08/02/2015

7.1 Measurement Uncertainty

The following measurement uncertainty has been conservatively determined in accordance with ISO17025 and NATA requirements.

Broadband E-field Measurement Uncertainty:

Broadband Probe	± 1.2 dB
Environmental	± 1.8 dB (Worst case)
Total:	± 3.0 dB

8.0 MEASUREMENT PROCEDURE

Measurements with the EMR-300 Field Probe:

Measurements were carried out with the EMR-300 Radiation Meter, Model EMR-300, probe type 8.3. The field meter was set to Max Hold mode with each location scanned in height between head and knee height to locate the peak field reading. At the point where the maximum field strength was recorded, the reading was averaged over a 6 minute period and was recorded. The EME levels were recorded in V/m as measured by the field meter. The levels recorded were then squared and compared to the square of the applied limit in (V/m). The result in percentage is then comparable to measurements done in Power Density in Watts per metre squared (W/m^2).

The field meter was verified before and after the survey using a Portable EMR Meter Verification System Model: 110, Serial No: 8.

Measurements with the Holaday ELF Field Probe:

Magnetic field measurements (50-60Hz) were performed using the Holaday ELF Field Probe. The magnetic field strength was measured in milli-Gauss. Measurements were taken at the maximum point found by scanning the human body from 0.5 m to 2.0 m. The measurements were taken in three orthogonal directions.

Definition of the three orthogonal orientations:



Discussion of the Data Logging:

At each location the measurements were taken in three orthogonal orientations (X, Y and Z). After the testing, the orthogonal readings at each height and each location were used to calculate the resulting vector field levels according the following formula:

$$\text{Result (XYZ)} = \sqrt{X^2 + Y^2 + Z^2}$$

9.0 MEASUREMENT RESULTS

The measured values are recorded in the following tables. The worst case reading at each test location was recorded and compared to the applied limit.

RF E-Field Measurement

Measurements were performed to the ARPANSA standard for E-Field. For the applied limits refer to section 6.1 of this report.

Measurement Location	Measured Level [V/m]	Limit Applied [V/m]	Percentage of Limit [%]
1	<1	27.4	< 0.13
2	<1	27.4	< 0.13
3	<1	27.4	< 0.13
4	<1	27.4	< 0.13
5	<1	27.4	< 0.13
6	<1	27.4	< 0.13
7	<1	27.4	< 0.13
8	<1	27.4	< 0.13
9	<1	27.4	< 0.13
10	<1	27.4	< 0.13
11	<1	27.4	< 0.13
12	<1	27.4	< 0.13
13	<1	27.4	< 0.13
14	<1	27.4	< 0.13
15	<1	27.4	< 0.13
16	<1	27.4	< 0.13
17	<1	27.4	< 0.13
18	<1	27.4	< 0.13
19	<1	27.4	< 0.13
20	<1	27.4	< 0.13
21	<1	27.4	< 0.13
22	<1	27.4	< 0.13
23	<1	27.4	< 0.13
24	1.0	27.4	0.13
25	3.0	27.4	1.20
26	3.3	27.4	1.45
27	<1	27.4	< 0.13
28	<1	27.4	< 0.13

Conclusion: The above tables show that no location measured exceeded the General Public exposure limit. The highest reading was found at location 26 with 3.3 V/m or 1.45% of the General public limit.

ELF E-Field Measurement

Measurements were performed to the additional requirements for E-field for 50-60Hz. The measurement results are summarised in the table below.

Measurement Position	Measured Level			Vector Sum [V/m]	Percentage of Limit 5kV/m [%]
	X [V/m]	Y [V/m]	Z [V/m]		
1	3.2	1.6	2.3	4.25	0.09
2	4.0	3.3	3.4	6.20	0.12
3	2.3	2.3	1.7	3.67	0.07
4	20.8	12.2	11.9	26.89	0.54
5	33.7	14.4	18.8	41.19	0.82
6	18.8	13.3	12.0	25.97	0.52
7	17.9	10.6	11.5	23.77	0.48
8	27.0	15.6	15.8	34.96	0.70
9	23.5	16.4	15.7	32.68	0.65
10	13.9	10.4	10.6	20.34	0.41
11	12.6	11.1	9.7	19.39	0.39
12	15.0	7.2	7.3	18.17	0.36
13	30.2	18.0	17.7	39.36	0.79
14	60.5	33.5	28.1	74.65	1.49
15	51.2	33.1	28.8	67.43	1.35
16	25.3	19.7	20.2	37.90	0.76
17	31.7	16.4	15.3	38.83	0.78
18	29.8	17.6	15.2	37.80	0.76
19	25.4	14.2	14.4	32.47	0.65
20	41.3	26.0	21.2	53.21	1.06
21	5.7	7.6	8.0	12.42	0.25
22	2.0	1.6	1.6	3.02	0.06
23	24.5	17.3	13.6	32.93	0.66
24	22.0	9.3	7.8	25.13	0.50
25	26.2	19.8	6.7	33.52	0.67
26	7.2	3.1	3.8	8.71	0.17
27	1.3	1.2	1.2	2.14	0.04
28	1.2	1.2	1.2	2.08	0.04

Conclusion: The above tables show that no location measured exceeded the General Public exposure limit. The highest reading was found at location 14 with a vector sum of 74.65 V/m or 1.49% of the General public limit.

ELF B-Field Measurement

Measurements were performed to the additional requirements for B-field for 50-60Hz. The measurement results are summarised in the table below.

Measurement Position	Measured Level			Vector Sum [mG]	Percentage of Limit 1000mG [%]
	X [mG]	Y [mG]	Z [mG]		
1	1.8	1.9	1.0	2.80	0.28
2	1.1	1.2	1.3	2.08	0.21
3	3.1	3.2	1.9	4.84	0.48
4	5.4	5.2	2.7	7.97	0.80
5	8.5	8.4	4.7	12.84	1.28
6	7.8	7.7	7.1	13.06	1.31
7	7.8	7.5	5.2	12.01	1.20
8	7.7	7.5	4.4	11.61	1.16
9	3.4	3.6	4.0	6.37	0.64
10	3.3	3.6	4.1	6.38	0.64
11	3.3	3.7	3.9	6.31	0.63
12	3.2	3.4	3.9	6.08	0.61
13	3.2	3.6	3.8	6.14	0.61
14	3.2	3.5	3.7	6.01	0.60
15	2.8	3.0	3.2	5.20	0.52
16	2.5	2.6	2.6	4.45	0.44
17	2.2	2.4	2.4	4.04	0.40
18	2.2	2.3	2.2	3.87	0.39
19	2.0	2.2	1.9	3.53	0.35
20	2.9	2.3	2.1	4.26	0.43
21	1.8	2.1	1.9	3.36	0.34
22	5.1	20.0	19.5	28.39	2.84
23	2.4	20.0	20.0	28.39	2.84
24	1.4	1.4	2.3	3.03	0.30
25	1.1	1.2	2.1	2.66	0.27
26	0.7	0.7	0.6	1.16	0.12
27	9.1	9.4	5.8	14.31	1.43
28	8.9	11.2	13.7	19.81	1.98

Conclusion: The above tables show that no location measured exceeded the General Public exposure limit. The highest reading was found at locations 22 and 23 with a vector sum of 28.39mG or 2.84% of the General public limit.

10.0 PREDICTION RESULTS

A number of residential buildings up to a maximum of 9 storeys high are proposed for construction onsite. Measurements at these heights were not possible on the day of the survey, so a desktop assessment of the theoretical maximum RF fields was conducted. The existing and proposed antennas installed on the nearby communications tower were assessed using RF-Map2 software. The information about these antennas was obtained from the Radio Frequency National Site Archive (RFNSA), site ID: 2118003. Predictions are only possible above 30 MHz, so a desktop assessment of the ELF fields was not done.

RF E-Field Predictions

The maximum EME level predicted was found at 19.8m above ground level. The point of interest was 108m from the communications tower, with a bearing of 116 degrees true north from the tower location. A plot of the RF field distribution at 1.5m above ground level is shown below.

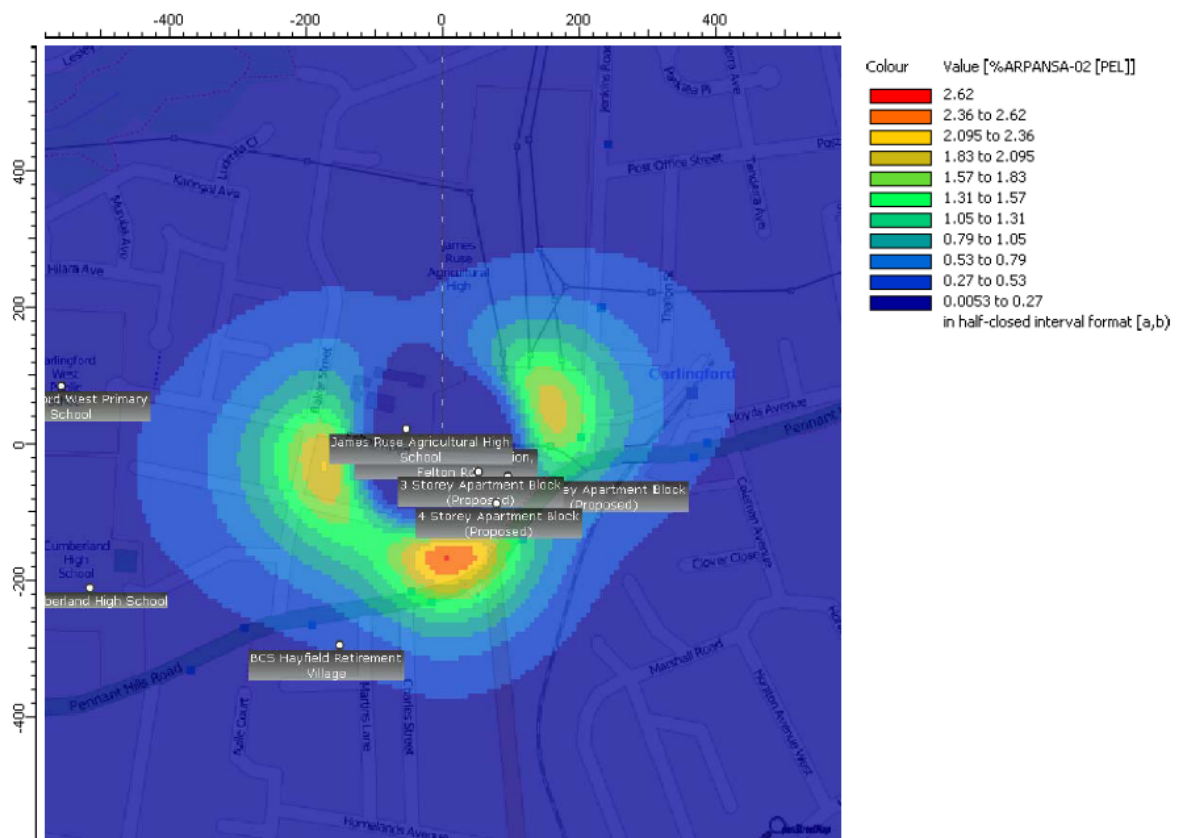


Figure 2: Predicted Maximum RF Field Strength @ 1.5m Above Ground Level

Conclusion: The desktop assessment did not find any locations where the RF field strength would exceed the General Public exposure limit. The highest reading was 2.9% of the General public limit, located at 19.8m above ground level in the vicinity of the proposed 9 storey apartment block.

11.0 CONCLUSION

The measurements to the ARPANSA limits for RF fields showed that no levels are above the General Public limit.

No electric field RF measurement above 3.3 V/m was found, which is 1.45% of the continuous exposure level allowed by RPS 3. The limit applied was the most stringent non occupational limit of 27.4 V/m.

No RF field strength values were predicted onsite that exceeded the General Public limit. The maximum predicted field strength was 2.9% of the General Public limit.

The measurements of ELF fields showed that no levels were above the applied limit.

No Electric Field ELF measurements were found higher than 28.39 mG, which is 1.49% of the continuous exposure limit allowed by the NHMRC recommendations. The limit applied was 5000 V/m.

No Magnetic Field ELF measurements were found higher than 74.65 V/m, which is 2.84% of the continuous exposure limit allowed by the NHMRC recommendations. The limit applied was 1000mG.