RF Field Measurements
Near an AM Transmission site
Oakville, ON

Prepared for

Delmanor West Oak Inc.
1280 Dundas Street West
Oakville, ON
L6M 4H9

DELMANOR

YRH
Yves R. Hamel
et Associés Inc.

424 Guy Street
suite 102
Montreal (Qc)
Canada, H3J 1S6

telephone: 514 934 3024

fax: 514 934 2245

web: www.YRH.com
e-mail: Telecom@YRH.com

O/Ref : P-2020232

Table of content

Authors :

Tudor Rosu, ing, – On site Measurements
(OIQ # 147095)

Agnieszka Zubek, ing, Senior Advisor – RF Safety
(OIQ # 120194)

Joseph Sadoun, ing. – Project manager
(OIQ # 120286)

Approved by :

Maurice Beauséjour, P.Eng.
(PEO # 100061291 – March 2022)

Introduction

Yves R. Hamel et Associés Inc. was retained by Delmanor West Oak Inc. to evaluate the possible radiofrequency impact related to a proposed development at 1280 Dundas St. W, Oakville, ON. This evaluation was requested given the proximity of the project with the transmission site of a commercial AM broadcasting site.

Previously, we had submitted to the Town of Oakville an initial report titled 'RF Impact Study for Construction near an AM Transmission Site, Oakville, ON' dated December 2020. This current report has been conducted as a follow up to the December 2020 submission and addresses the possibility of interference to systems within the structures in the proposed development. This report utilizes actual measurement data collected on location to verify if the levels comply with BPR-2 recommendations. In addition to that, and since BPR-2 evaluations require field strength measurements, levels measured were also verified against Safety Code 6 uncontrolled environment limit. This additional study has been undertaken to address comments arising in the course of the development application review and consultation.

Measurements were thus carried out by measuring both the electric and the magnetic field components on the lot where the development is planned and comparing these to the maximum permitted exposure levels set by Safety Code 6 for uncontrolled environment and then comparing the electric field records to BPR-2 recommendations. The goal of these measurements is to compare the measured levels with the standards and recommendations and evaluate the impacts to the proposed development, both indoors and outdoors. Measurements were taken during daytime operation as the AM radio stations at that location operate with same daytime and nighttime parameters as indicated in our previous report, dated December 2020.

Project Description

The proposed development is located just east of the St. Volodymyr's Cultural Centre located at 1280 Dundas St. W, Oakville, ON and across the street from the AM broadcasting site. The development portrayed below will consist of an 8-storey building (30.5 m in height) and 24 smaller units (1.5 storey / 6 m high).

Figure 1 - Proposed development overview

Broadcast Stations Description

A review of the ISED (Innovation Science and Economic Development Canada) broadcast database indicates that 2 AM (Amplitude Modulation) stations, CJYE-AM and CJMR-AM, are operating from the coordinates 43˚27'29" N - 79˚45'16" W. The reference coordinates of these stations are less than 200 m from the proposed construction project, just across Dundas Street.

CJYE-AM is a Canadian Class B AM station operating on 1250 kHz with a power of 10,000 Watts for both Day and Night operation. The antenna system consists of 4 towers, 60 m high, producing a directional pattern, identical for both Day and Night operation, with its major lobe in an azimuth of 24.3°.

CJMR-AM is a Canadian Class B AM station operating on 1320 kHz with a power of 10,000 Watts for both Day and Night operation. The antenna system consists of 6 towers, 60 m high, producing a directional pattern, identical for both Day and Night operation, with its major lobe in an azimuth of 26.1°.

It should be noted that neither stations' main lobe is directed towards the proposed development.

Safety Code 6

Health Canada publishes a document called "Safety Code 6" where the limits of human exposure to RF energy are detailed, for frequencies between 3 kHz and 300 GHz. The exposure limits specified in Safety Code 6 have been established based on a thorough evaluation of scientific literature related to thermal and non-thermal effects of RF fields, using a weight-of-evidence approach. The limits in Safety Code 6 are based on the lowest exposure levels at which any scientifically established adverse health effect occur. Furthermore, safety margins are incorporated into these exposure limits to ensure that even the worst-case exposure remains far below the established thresholds. Finally, the scientific approach used to establish the exposure limits in Safety Code 6 is comparable to that employed by other science-based international bodies such as the World Health Organisation (WHO) and the International Commission for Non Ionizing Radiation Protection (ICNIRP).

Safety Code 6 limits are set for two types of environments: Controlled Environments and Uncontrolled Environments. These two types of environments are defined as follows:

> **Controlled Environment**: An area where the RF field intensities have been adequately characterized by means of measurements or calculations and exposure is incurred by persons who are: aware of the potential for RF field exposure, cognizant of the intensity of the RF fields in their environment, aware of the potential health risks associated with RF field exposure and able to control their risk using mitigation strategies.
>
> **Uncontrolled Environment**: An area where any of the criteria defining the controlled environment are not met.

For this analysis we will use the Uncontrolled Environment standard.

The standard used in this report is based on the most recent Safety Code 6 2015 recommendations.

Frequency (MHz)	Reference Level Basis	Reference Level (E_{RL}), (V/m, RMS)		Reference Period
		Uncontrolled Environment	Controlled Environment	
0.003–10	NS	83	170	Instantaneous*
1.0–10	SAR	$87 / f^{0.5}$	$193 / f^{0.5}$	6 minutes**

Frequency, f, is in MHz. The precise frequencies at which SAR-based electric field strength reference levels for Uncontrolled and Controlled Environments begin are 1.10 MHz and 1.29 MHz, respectively.

Frequency (MHz)	Reference Level Basis	Reference Level (H_{RL}), (A/m, RMS)		Reference Period
		Uncontrolled Environment	Controlled Environment	
0.003–10	NS	90	180	Instantaneous*
0.1–10	SAR	$0.73 / f$	$1.6 / f$	6 minutes**

Frequency, f, is in MHz.

Figure 2 – Safety Code 6 electric and magnetic field limits for the frequencies in use

General Public Safety

The frequencies of operation fall under the purview of Safety Code 6 as Safety Code 6 sets limits on the intensity of electromagnetic fields in areas accessible to the general public (Uncontrolled Environment). Field intensity is measured in V/m for the electric field and A/m for the magnetic field. However, since the operating frequencies are situated below 10 MHz, Safety Code 6 limits are designed to limit two different effects: dielectric heating as well as nerve stimulation. The field limits for these two effects are specified using different basic restrictions and result in different limit values. Since both effects need to be controlled, the stricter of the two restrictions should apply.

The Safety Code 6 limits for the operating frequencies are:

	CJYE-AM	CJMR-AM
Electric Field	83 V/m (nerve stimulation) 78 V/m (heating)	83 V/m (nerve stimulation) 76 V/m (heating)
Magnetic Field	90 A/m (nerve stimulation) 0.584 A/m (heating)	90 A/m (nerve stimulation) 0.553 A/m (heating)

Table 1 - Safety Code 6 limit values for the frequencies of the AM stations Evaluation of Field Intensity

Since the SAR-based (heating) limit is stricter than nerve stimulation limit for both frequencies in use at this site, we will use that value to determine compliance with Safety Code 6. Compliance will be assessed by comparing the square of the field strength value to the square of the limit value.

Equipment and Methodology

For our survey we used a Narda SRM-3006 Selective radiation meter using a Narda 3531/04 E-Field probe and the Narda 3581/02 H-Field probe. Both these probes cover frequencies between 9 kHz and 300 MHz. We measured E-field values in V/m and H-field values in A/m.

We chose this type of equipment to measure field components of both stations simultaneously, as required by Safety Code 6 and ISED GL-01

Measurements were taken on May 20 and 21, 2021 during daytime hours.

The lot slated for development is quite extensive, measuring approximately 185 m by 300 m, with varying vegetation cover and accessibility. We selected 14 locations, distributed evenly over the lot where both electric and magnetic fields intensity measurements were conducted at ground level. The figure on the next page shows our measurement points overlaid on a satellite view of the lot.

Also, using a boom truck capable of reaching up to 27 m in height, we conducted measurements at four distinct locations on the lot. At each of those four locations, measurements were taken at heights of 1.5 m, 12 m, 18 m and 27 m above ground.

Additionally, we conducted measurements at Lion's Valley Park for comparison. We chose this location because it is roughly a similar distance from the transmitter antenna array but positioned closer to the main lobe of the AM stations.

Finally, to assess the attenuation of the radio signal that could occur inside a building, we conducted sample measurements inside two types of buildings.

Figure 3 - Location of measurement points over the proposed development area

Results

Our measurements were taken at individual locations on the lot slated for the proposed development. We took measurements at ground level, using both an electric and a magnetic field probe. Additional measurements were taken with a boom truck, to evaluate the field intensity variation with height. These last measurements, evaluating field intensity variations with height, were taken only in four selected locations that were safely accessible for the truck. We can however take these results and extrapolate them to other locations on the lot.

Table 2 of next page presents results both in terms of V/m for the E-field and A/m for the H-field and in terms of percentage of permitted exposure for uncontrolled environment, as specified in Safety Code 6. Furthermore, for each location we present peak and average values. Safety Code 6 uses averaged measurements to determine compliance. However, for BPR-2 evaluation, we will use maximum values.

Looking at Table 2, it can be observed that out of the 14 points located on the property, no value exceeded 1% of the Safety Code 6 limit for uncontrolled environment. Furthermore, the two locations at Lions Valley Park (LVP 1 and LVP 2) were both higher than any location on the proposed development, while remaining entirely compliant with Safety Code 6 limits. Indeed, on average, fields measured at the Lion Valley Park are 4 times stronger than those measured on the site of the proposed development.

Table 2 - Measurement Results

Point	E-field				H-Field			
	V/m		% of limit		A/m		% of limit	
	Max	Avg	Max	Avg	Max	Avg	Max	Avg
1	3.2	2.5	0.18%	0.11%	0.025	0.014	0.21%	0.07%
2	5.1	3.2	0.45%	0.18%	0.018	0.011	0.10%	0.04%
3	3.4	2.2	0.20%	0.08%	0.021	0.013	0.14%	0.06%
4	2.8	1.9	0.13%	0.06%	0.019	0.013	0.12%	0.05%
5	2.4	1.4	0.10%	0.04%	0.015	0.010	0.08%	0.03%
6	2.7	1.7	0.13%	0.05%	0.016	0.009	0.08%	0.03%
7	2.5	1.5	0.11%	0.04%	0.013	0.008	0.05%	0.02%
8	1.8	1.1	0.06%	0.02%	0.011	0.007	0.04%	0.02%
9	1.8	1.1	0.05%	0.02%	0.009	0.005	0.02%	0.01%
10	3.1	2.4	0.17%	0.10%	0.017	0.010	0.10%	0.03%
11	3.4	2.5	0.20%	0.11%	0.016	0.010	0.08%	0.04%
12	2.9	2.2	0.15%	0.08%	0.016	0.009	0.09%	0.03%
13	2.6	2.0	0.12%	0.07%	0.015	0.008	0.08%	0.02%
14	2.8	2.0	0.13%	0.07%	0.011	0.007	0.04%	0.02%
LVP 1	12.6	8.3	2.77%	1.18%	0.067	0.046	1.45%	0.70%
LVP 2	8.9	5.8	1.38%	0.57%	0.063	0.045	1.30%	0.66%

The following figure shows the location points where measurements were recorded at the Lion Valley Park. The first location LVP 1 was next to the playground equipment and the second location LVP 2 was along an accessible path under the trees.

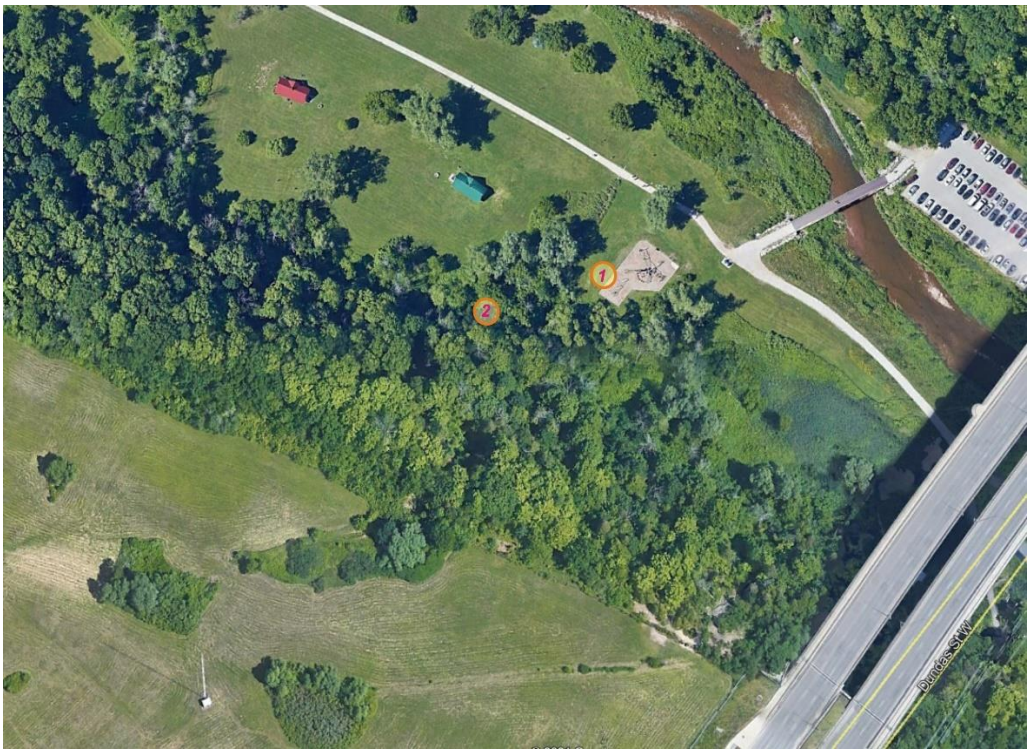

Figure 4 - Location of measurement points done at the Lion Valley Park.

Height measurements

Since the proposed development will include a building with a height of 30.5 metres, it appeared relevant to verify the variation of electric and magnetic fields with height. We chose four points on the proposed development to take measurements at various heights using a boom truck. Our readings show that in the range examined (up to 27 m above ground), E-field generally tends to decrease with height, even though some increase back to ground-level values could occur as well. We also observed that H-field remains constant in that height range. Figure 4 shows where the records were taken, and the following figures present the results in a graphic way. In conclusion, the variation in intensity relative to height is not significant enough to be considered material and, on average, remains similar as height is increased. We therefore consider that the ground-level measurements are a good prediction of the behavior of field strength even at heights greater than ground level.

Figure 5 - Location of measurement points done with a boom truck up to 27m.

The following graphs show the results measured at the 4 locations in terms of Electric Fields and Magnetic Fields for maximal and average values.

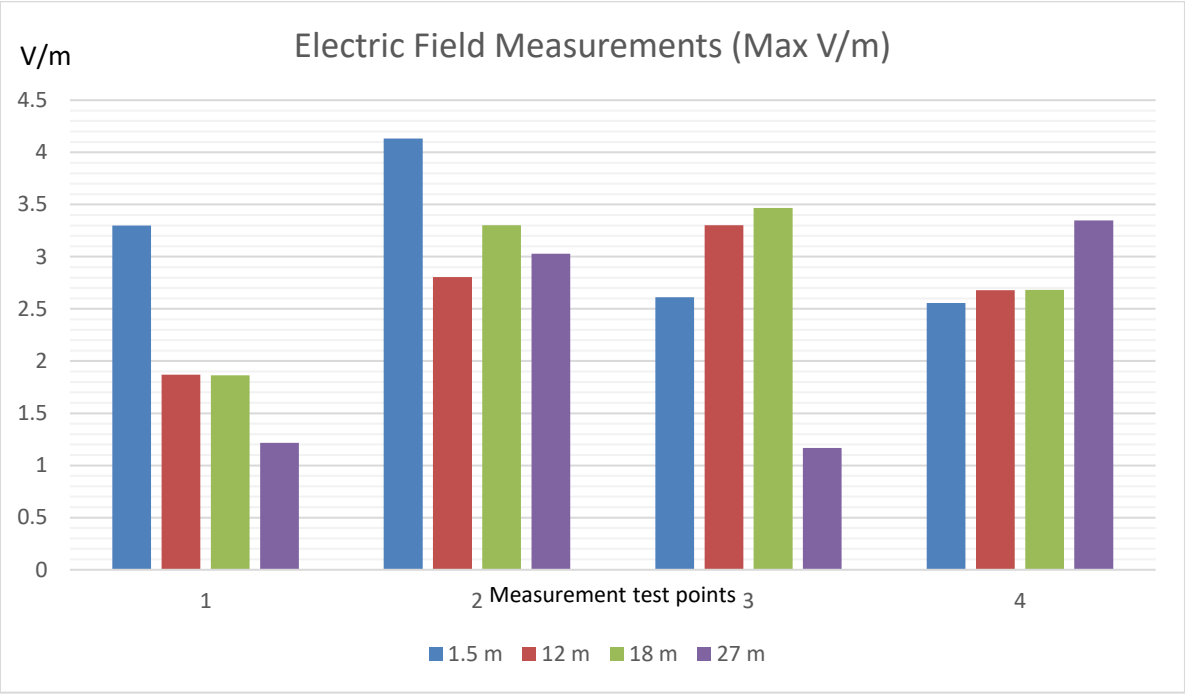

Figure 6 – Maximum electric fields recorded at various heights at four location points on the proposed lot.

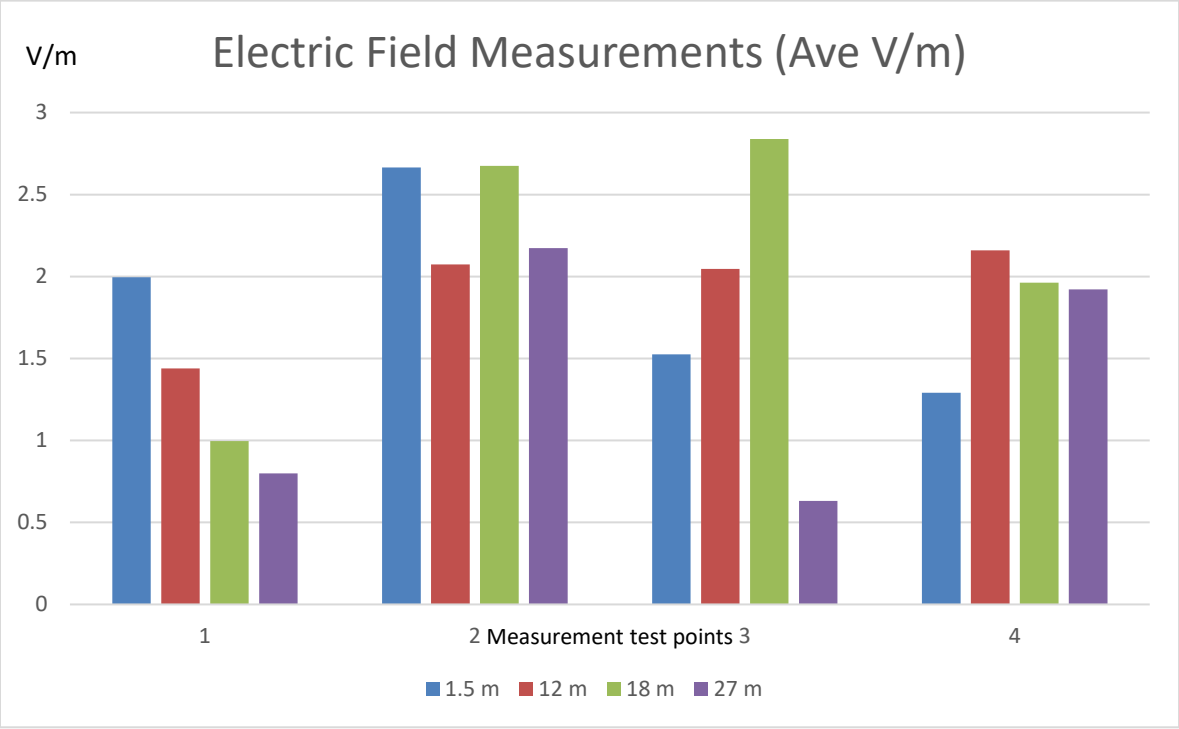

Figure 7 – Average electric fields recorded at various heights at four location points on the proposed lot.

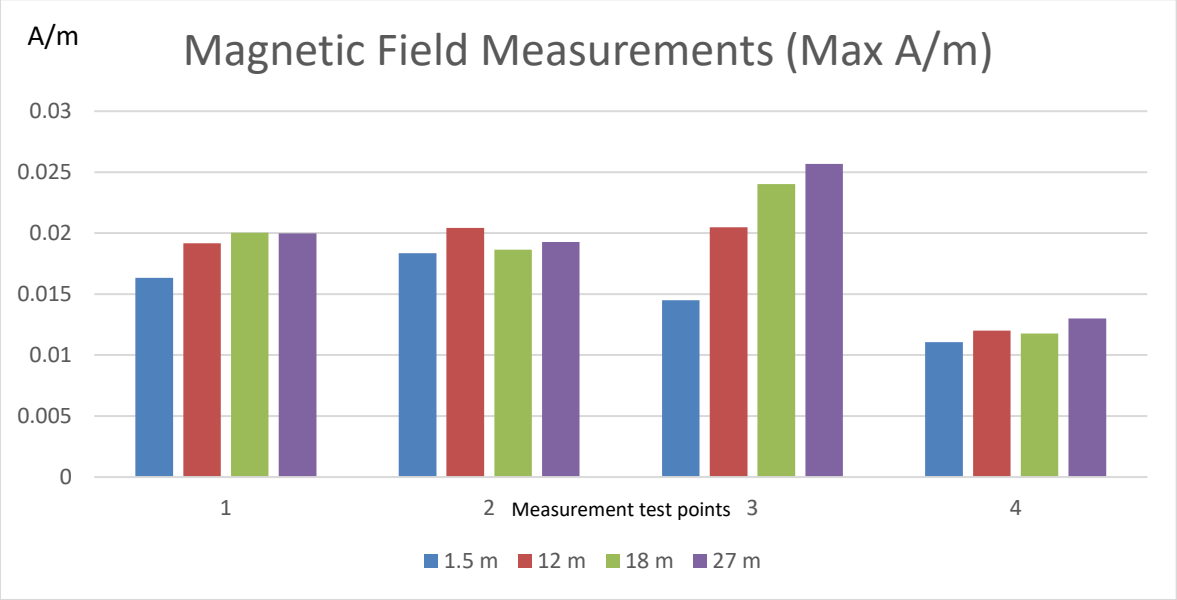

Figure 8 – Maximum magnetic fields recorded at various heights at four location points on the proposed lot.

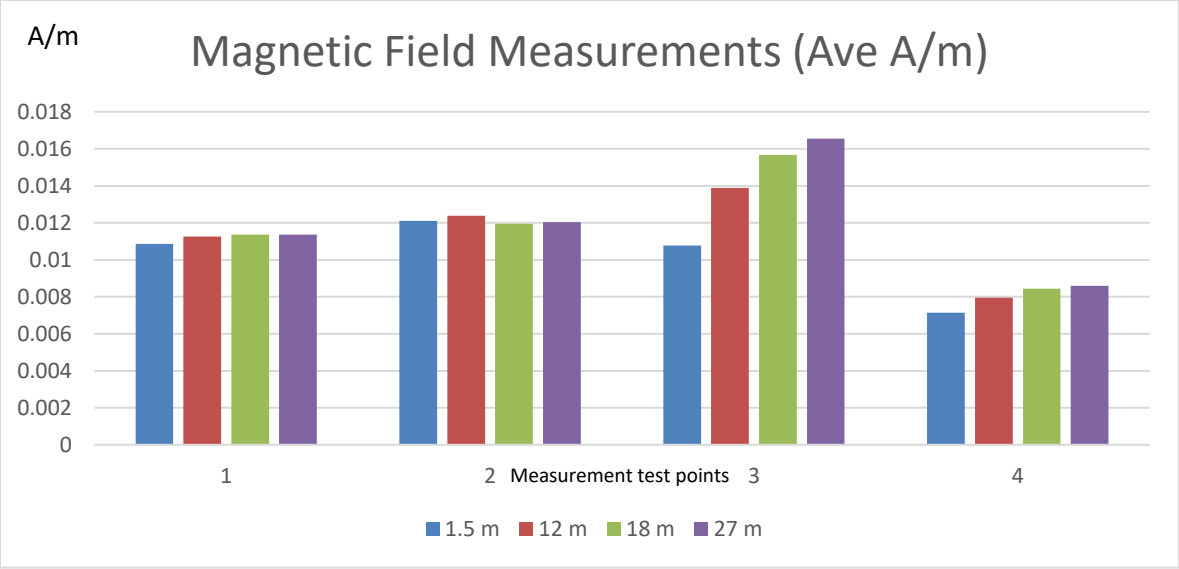

Figure 9 – Average magnetic fields recorded at various heights at four location points on the proposed lot.

Contact and Induced Currents

Another aspect of Safety Code 6 compliance pertains to contacts through the body. The currents can be either induced directly into the body or sustained through contact with other structures, such as buildings.

It is generally accepted that induced currents will not approach Safety Code 6 limits when field intensities are below 25%. Since, in our case, we established that all values measured in all locations on the proposed development are well within that limit for uncontrolled environment, it was not relevant to measure induced currents on the property.

Furthermore, it was not possible to measure contact currents since there are presently no structures on the development site where currents could be induced.

Building Attenuation Measurements

Measurements were also carried out outside and inside existing buildings (Sixteen Mile Sports Complex and a McDonald's) to evaluate the potential of building material attenuation on an AM signal.

The measured locations are shown in Figure 10, and Table 3 summarizes the results recorded at these locations. The results show that we can expect an attenuation of at least 5 dB behind the first wall of the proposed buildings. This means that levels will remain below 3 V/m inside the building when applying the attenuation factor on the maximum recorded value at Location Point 2 shown in Table 2.

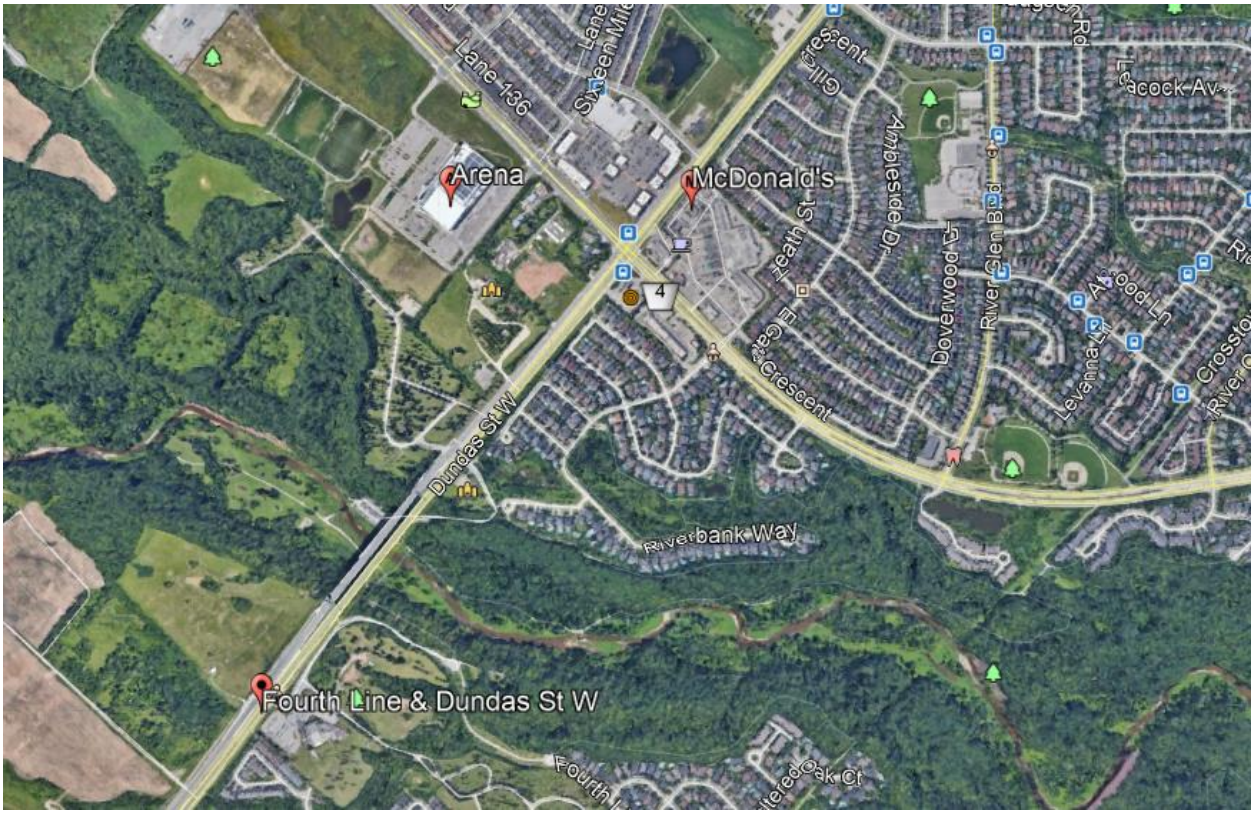

Figure 10 – Electric Field Measurements at existing buildings located in the vicinity of the AM site.

Table 3 – Building attenuation measurements

Building	Material	Outside (V/m)	Inside (V/m)	Attenuation (dB)
Arena	Glass, concrete and corrugated metal	2	0.24	-18.4
McDonald's	Glass and bricks	0.8	0.45	-5.0

Interference with Electronic Equipment

Another concern that arises due to the proximity of the AM broadcasting site is the potential for interference with electronic equipment caused by the broadcast station. Typically, these types of interferences that can affect the operation of devices can be grouped into three categories:

a) Consumer devices and building control systems, from audio systems such as intercoms and PA systems to elevator controllers, hoisting equipment, conveyors, etc.
b) Medical Electrical equipment and systems, divided in three sub-categories, based on the type of environment where they are used: professional healthcare environments such as hospitals, physician's offices, surgical centres, and limited care facilities where the equipment and systems are administered by healthcare professionals; the home healthcare environment such as homes, schools, restaurants, hotels and airplanes, where equipment and systems are less likely to be administered by healthcare professionals; and special environments such as military areas, oil and gas refineries, manufacturing facilities or heavy industrial areas.
c) Implantable devices, such as pacemakers, cochlear implants, etc.

First, it must be clarified that, as mentioned previously, all measurements taken on the property were more than one order of magnitude lower than the Safety Code 6 limits of 76 and 78 V/m, hence, there is no possible Safety Code 6 issue. Implantable devices, such as pacemakers, are built to withstand conditions equivalent to what any healthy human being could withstand and are therefore able to withstand exposure levels in excess of Safety Code 6 limits.

Medical devices typically found in medical service centres are governed by the IEC 60601-1-2, which stipulates that home use devices must withstand minimum electric fields of 3 V/m and professional use devices must withstand 10 V/m. However, manufacturers typically design their equipment to withstand electromagnetic field levels well in excess of these minimal thresholds. For instance, electric wheelchairs are typically rated at 20 V/m or more. Based on the results of the measurements, there is no identified problematic issue with medical devices eventually installed within the building, especially when considering typical building penetration loss.

With regards to the building control systems and consumer equipment, the BPR-2 provide thresholds applicable to determine the limits of responsibility of the station owner when the station is being built or commissioned to new operating parameters. Under such circumstances, the BPR-2 stipulates that if an issue is identified and the electric field value at the problematic location exceed 3.16 V/m, it falls under the responsibility of the station owner; otherwise it is considered as an insufficient impacted system immunity and the issue is the responsibility of the system owner. However, this does not apply when a radio station is already in service when the new building is being built, and in such a case, the responsibility to address such issue is on the building or impacted system owner.

As a matter of fact, only Location Points 1, 2, 3 and 11 exceeded the 3.16 V/m threshold indicated in the BPR-2. Considering that the building control systems will typically be located within the building structure, in our view the risk of an interference issue at these location points is very remote.

Conclusion

Safety Code 6

Our measurements allowed us to confirm that the site chosen for the development is entirely compliant with Safety Code 6 limits for uncontrolled environment. In fact, all measurements recorded on the lot, including Electric and Magnetic components, were entirely below the limit. No value measured anywhere on the lot exceeded 1% (or 1/100th) of the permitted exposure.

In addition, based on sample measurements done at various heights above ground (up to 27 m above ground), we can predict that Electric and Magnetic field levels will remain similar along the height of the buildings.

Attenuating Effect of Buildings

It is possible to reduce certain effects of interference inside the buildings. To try to quantify this effect, we conducted a few test measurements inside publicly accessible buildings nearby, namely the Sixteen Mile Sports Complex Arena (3070 Neyagawa Blvd) and McDonalds (486 Dundas St W). These two buildings are located further away from the transmitter antennas than the proposed development, but they are closer to the main lobe of the AM stations. The measurements were mainly designed to assess the attenuation of the building by measuring inside and directly outside the building.

In the case of the sports centre, a building constructed of metal sheeting, cinder blocks and very few windows, the attenuation was in the range of 18 dB. At the McDonalds, a smaller building with numerous windows, the attenuation was in the range of 5 dB. Applying the smallest attenuation to the values measured on the proposed lot shows that all values that would exist inside the building once constructed would be less than 3 V/m. Hence, we expect that the risk of interference inside the proposed buildings to be negligible and field levels will remain well below the Safety Code 6 limits both inside and outside the buildings.

Interference

The results of the measurements show that the entire development is more than one order of magnitude below the Safety Code 6 limits for these two stations, which rules out any possible issue with Safety Code 6, including with any implantable devices such as pacemakers. The results also show that the electric field strength intensity within the future building will be significantly lower than the thresholds of 3 V/m and 10 V/m specified within the applicable IEC 60601-1-2 standard and related to the medical devices typically found in any medical service centre.

Finally, the measurement results show that even if it is not possible to conclusively rule out any risk of potential interference with the building control systems in the proposed development, the electric field intensity measured indicates that the possibility of any such impact is very remote.

References

1- Health Canada. Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz. Safety Code 6, 2015

2- IEC 60601-1-2, Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral Standard: Electromagnetic disturbances - Requirements and tests

3- Innovation Science and Economic Development Canada (ISED), Broadcasting Procedures and Rules Part 2: Application Procedures and Rules for AM Broadcasting Undertakings (BPR-2), Issue 3, February 2016.

Appendix 1 – Calibration certificates

Narda Safety Test Solutions GmbH
Sandwiesenstrasse 7 - 72793 Pfullingen - Germany
Phone: +49 7121 9732 0 - Fax: +49 7121 9732 790

narda
Safety Test Solutions

Calibration Certificate

Narda Safety Test Solutions hereby certifies that the object referred to in this certificate has been calibrated by qualified personnel using Narda's approved procedures. The calibration was carried out in accordance with a certified quality management system which conforms to ISO 9001

OBJECT	Selective Radiation Meter, Basic Unit, SRM-3006
MANUFACTURER	Narda Safety Test Solutions GmbH
PART NUMBER (P/N)	3006/01
SERIAL NUMBER (S/N)	D-0041
CUSTOMER	
CALIBRATION DATE (YYYY-MM-DD)	2020-02-17
RESULT ASSESSMENT	within specifications
AMBIENT CONDITIONS	Temperature: (23 ± 3)°C Relative humidity: (20 to 60) %
CALIBRATION PROCEDURE	3006-8701-00A

ISSUE DATE: 2020-02-17
(YYYY-MM-DD)

CALIBRATED BY
Volker Kretschmann

AUTHORIZED SIGNATORY

Advanced Test Equipment Rentals
The Knowledge. The Equipment. The Solution.

CALIBRATION CERTIFICATE

ATEC Asset ID 16178

Work Order 2021001836

Certificate Number: 2021001836-Rev1

Asset ID	16178	Calibration Date	2/1/2021
Manufacturer	Narda	Due Date	2/1/2023
Model Number	NARD-3831/04	Temperature (C°)	22
Serial Number	AA-0176	Humidity	35
Description	9 KHz - 300 MHz, Single Axis E-Field	Procedure	
	Antenna		Rev. Revision

Customer Name: Advanced Test Equipment Corporation
Customer Address: 10401 Roselle St San Diego , CA 92121
Comments: Calibration performed by an Authorized Subcontractor.

This Calibration is traceable to the International System of Units (SI), through National Metrology Institutes (NIST, PTB, NRC, NPL, etc.), ratiometric techniques, or natural physical constants. This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval of Advanced Test Equipment Corporation (ATEC). The calibration has been completed in accordance with ATEC's Active Use Calibration System. ATEC conforms to the requirements of the Quality Management System registered to ISO 9001:2015 (QAS International; US3790).

Standards Used

Model	Manufacturer	Serial	Asset ID	Due Date
No standards recorded				

Calibrated by: Jacob Hoffer
Approved by: Javier Estrada

ATEC Corporation
10401 Roselle St.
San Diego, CA 92121

Telephone 888-488-2832
Facsimile 858-588-6570
Internet www.ATECorp.com

3/18/2021
Page 1 of 1

Advanced Test Equipment Rentals
The Knowledge. The Equipment. The Solution.

CALIBRATION CERTIFICATE

ATEC Asset ID
26974

Work Order

Certificate Number: 20200804007-Rev0

Asset ID	26974	Calibration Date	1/15/2020
Manufacturer	Narda	Due Date	1/15/2022
Model Number	NARD-3561/02	Temperature C°	22.37
Serial Number	AA 0202	Humidity	51.1
Description	9kHz-2GHz Three Axis Antenna H-Field for SRM-3006	Procedure	

Rev. Revision

Customer Name: Advanced Test Equipment Corporation
Customer Address: 10401 Roselle St San Diego , CA 92121
Comments: Calibration performed by an Authorized Subcontractor.

This Calibration is traceable to the International System of Units (SI), through National Metrology Institutes (NIST, PTB, NRC, NPL, etc.), ratiometric techniques, or natural physical constants. This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval of Advanced Test Equipment Corporation (ATEC). The calibration has been completed in accordance with ATEC's Active Use Calibration System. ATEC conforms to the requirements of the Quality Management System registered to ISO 9001:2015 (QAS International; US2790).

Standards Used

Model	Manufacturer	Serial	Asset ID	Due Date

No standards recorded

Calibrated by: William Swann
Approved by: Javier Estrada

ATEC Corporation
10401 Roselle St.
San Diego, CA 92121

Telephone 888-488-2832
Facsimile 858-588-6570
Internet www.ATECorp.com

3/18/2021
Page 1 of 1