



Safety Code-6 Analysis Freedom Mobile 3G & LTE Network

Radio frequency exposure for
uncontrolled and controlled environment

Freedom Mobile

207 Queen's Quay West, Suite 710
Toronto, ON M5J 1A7

3655 Wesbrook Mall, Vancouver, BC		
[BVA0252A]		
3655 Wesbrook Mall, Vancouver, BC		
Lat: <input type="text" value="49.250845"/>	Long: <input type="text" value="-123.233173"/>	
New site <input checked="" type="radio"/>	Existing site <input type="radio"/>	Colocations <input type="radio"/>

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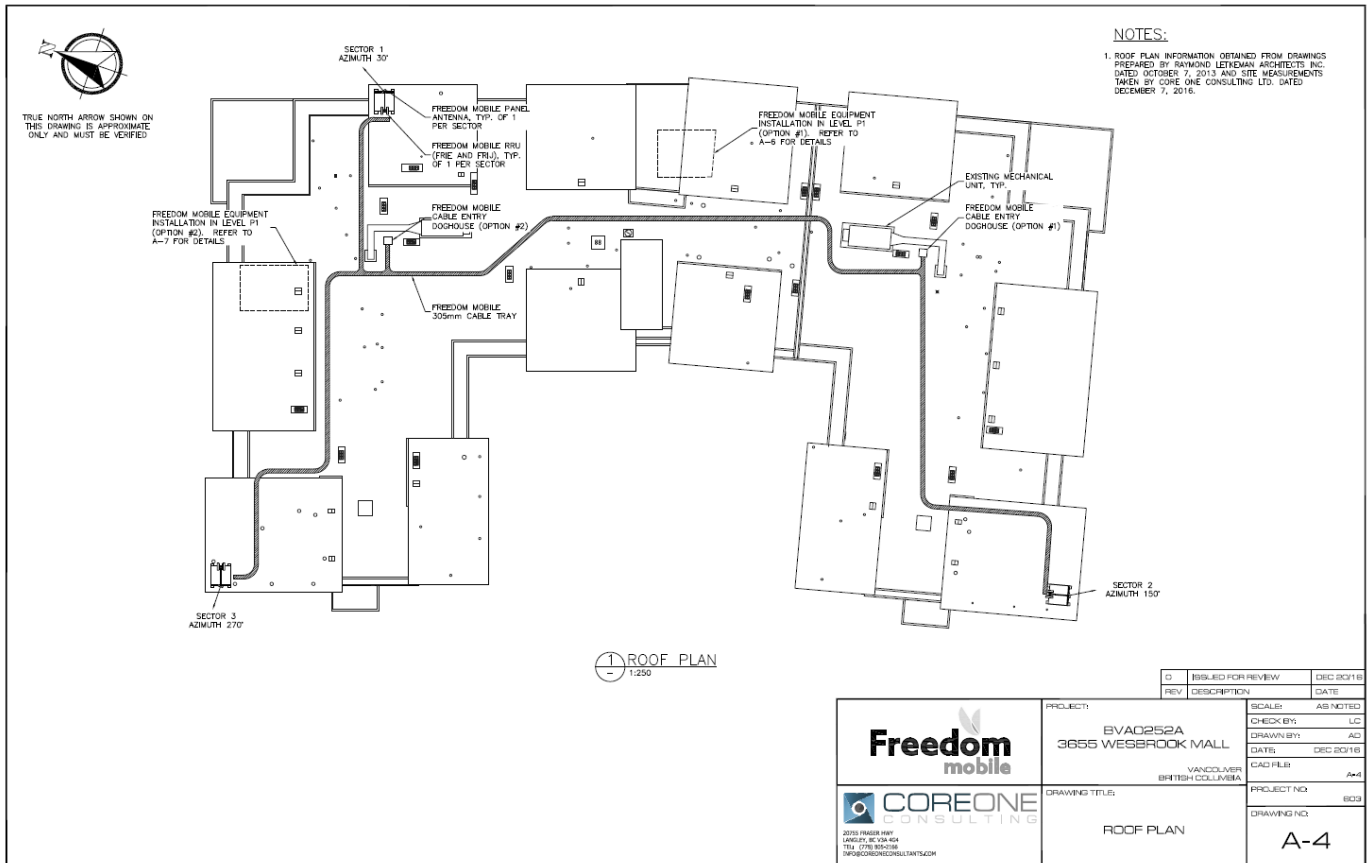
- The site is compliant (uncontrolled environment)
- The site is compliant (controlled environment)
- The site is non-compliant (both environments)

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Site Description (1 of 2)

The site BVA0252A is located at 3655 Wesbrook Mall, Vancouver, BC. It is a 19.1 m building on which a number of Freedom Mobile antennas are installed. These antennas are shown on the drawings and their operating parameters are presented in the tables shown on pages 4 and 5.

Freedom Mobile antennas are installed on the rooftop affixed on self-support pole. Access to the roof is locked. The site is therefore a controlled environment.

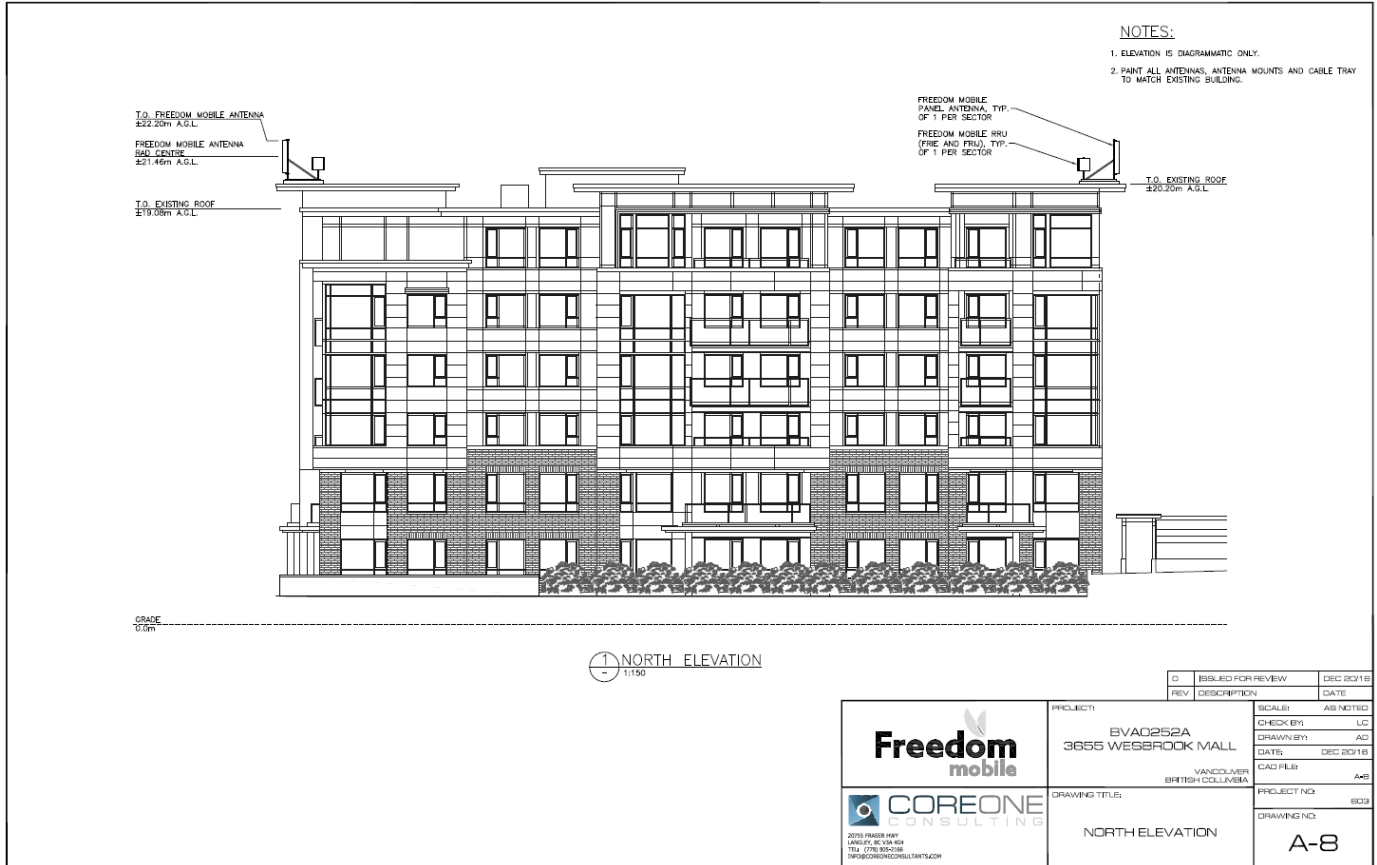


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Site Description (2 of 2)



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Antenna listing (1 of 2)

Freedom Mobile

Antenna #	Service Type	Ant. Height (m) Base	Antenna Model	Antenna Gain (dBi)	Antenna Tilt (Elect / Mech)	TX Power (W)	Antenna Azimuth	Frequency Range/Carrier Frequency (MHz)
1	WCDMA	21.78	80010727	17.3	-3/0	60	30	2122.6 / 2127.5
2	WCDMA	21.78	80010727	17.3	-3/0	60	160	2122.6 / 2127.5
3	WCDMA	21.78	80010727	17.3	-3/0	60	280	2122.6 / 2127.5
0	LTE	21.78	80010727	17.3	-3/0	160	30	2162.5
0	LTE	21.78	80010727	17.3	-3/0	160	160	2162.5
0	LTE	21.78	80010727	17.3	-3/0	160	280	2162.5

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Site Overview



[All Sector]



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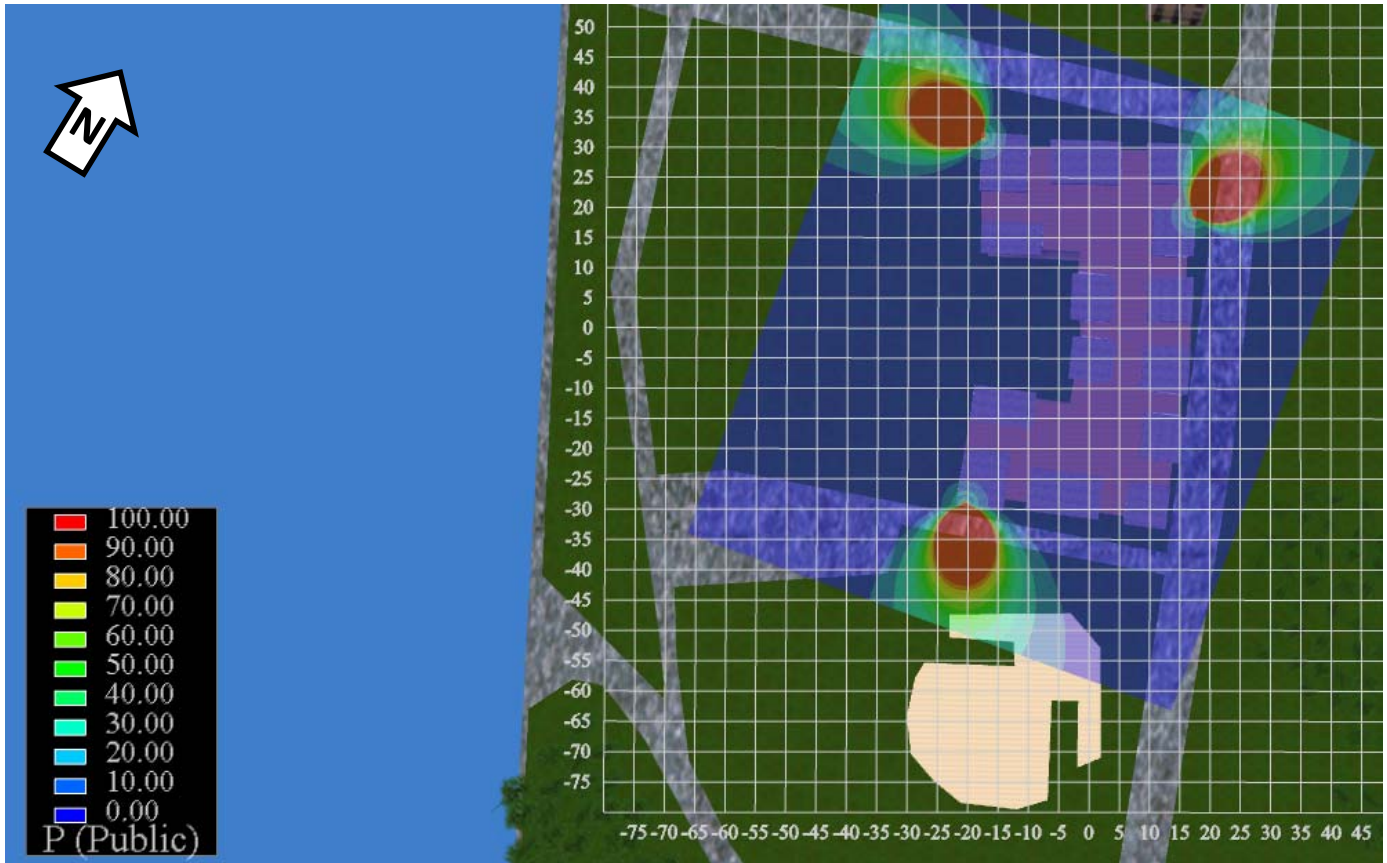
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RF simulation for controlled environment 2m above rooftop level.



[All Sector]



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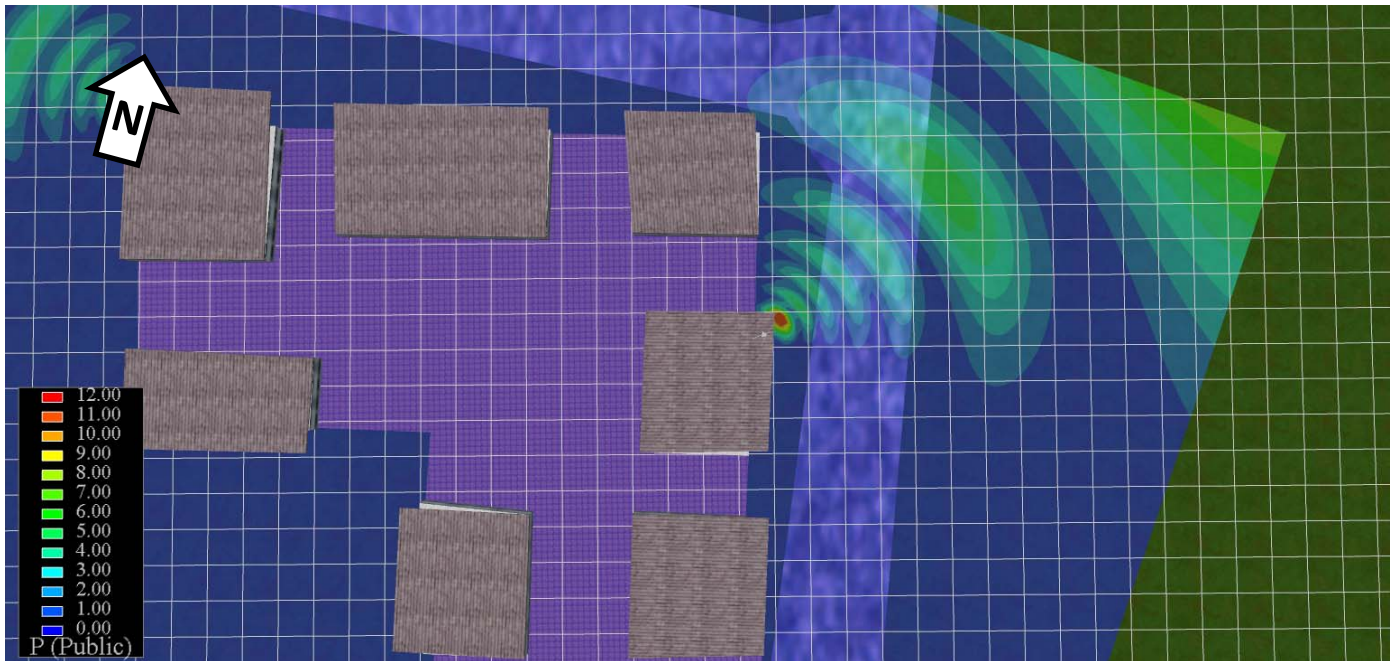
Comment: The analysis shows that at 2m above the rooftop, the RF signal doesn't exceed 30% of the controlled environment limit.

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RF simulation for controlled environment at rooftop level.



Sector 1



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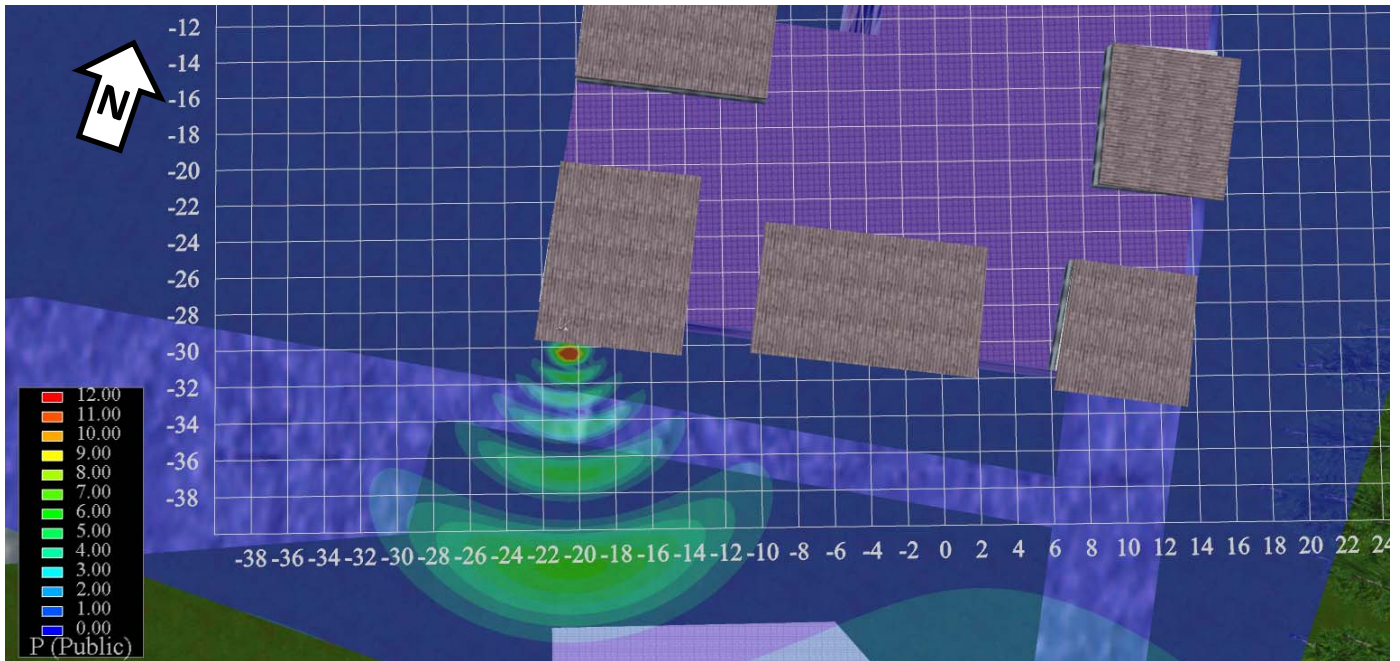
Comment: The analysis shows that at the level of the rooftop near sector 1 antenna, the RF signal doesn't exceed 1% of the controlled environment limit. It will be lower still inside the living areas below.

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RF simulation for controlled environment at rooftop level.



Sector 2



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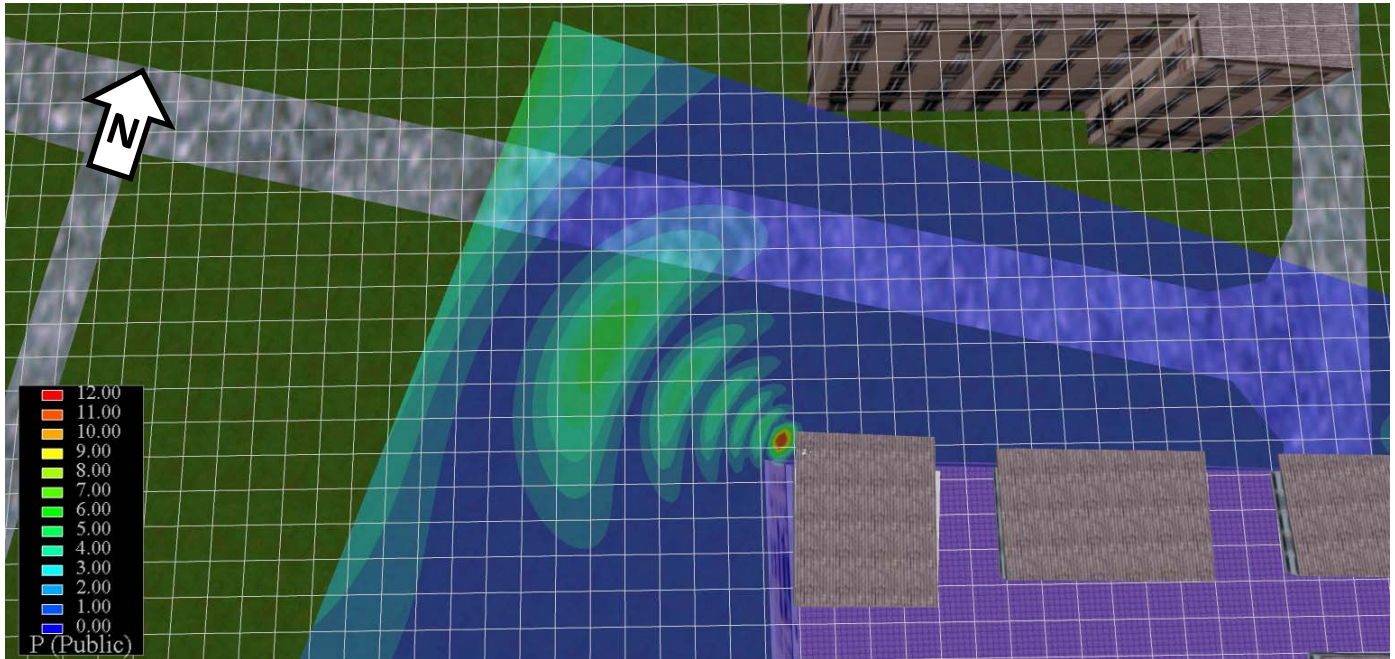
Comment: The analysis shows that at the level of the rooftop near sector 2 antenna, the RF signal doesn't exceed 1% of the controlled environment limit. It will be lower still inside the living areas below.

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RF simulation for controlled environment at rooftop level.



Sector 3



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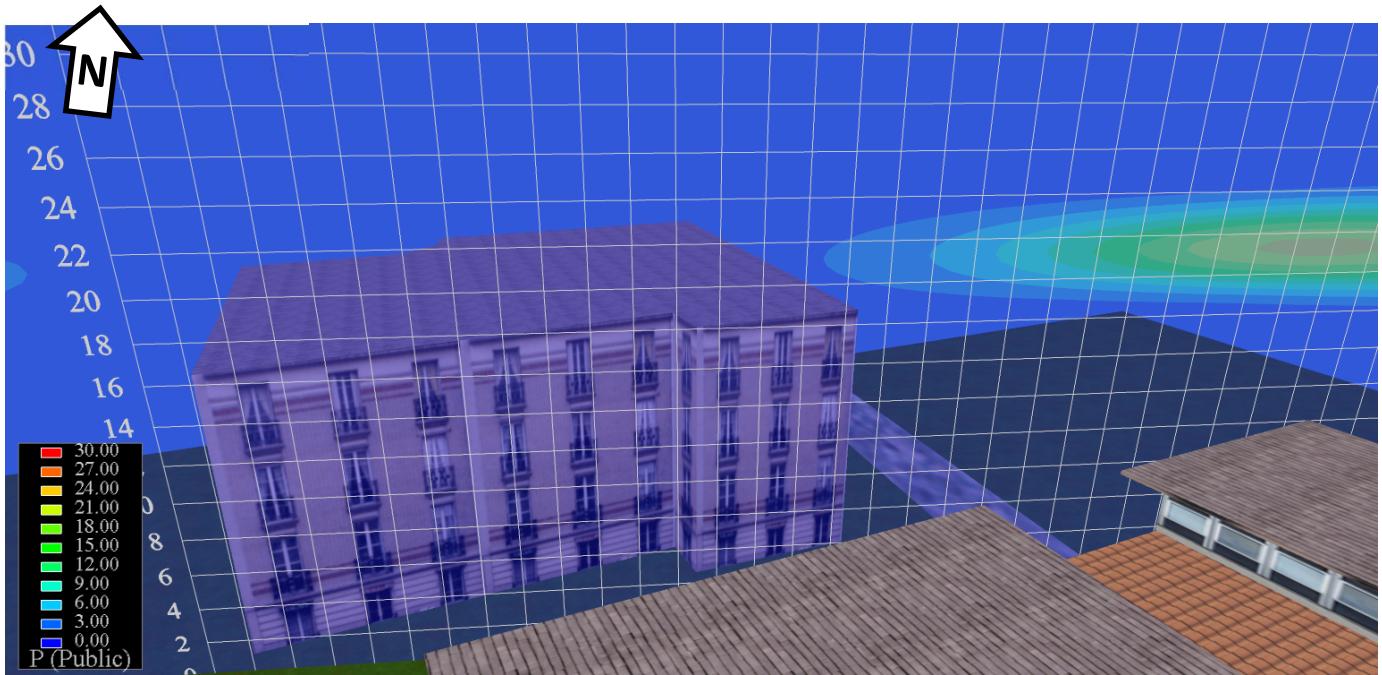
Comment: The analysis shows that at the level of the rooftop near sector 3 antenna, the RF signal doesn't exceed 1% of the controlled environment limit. It will be lower still inside the living areas below.

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RF simulation for uncontrolled environment facing North adjacent building.



[All Sector]

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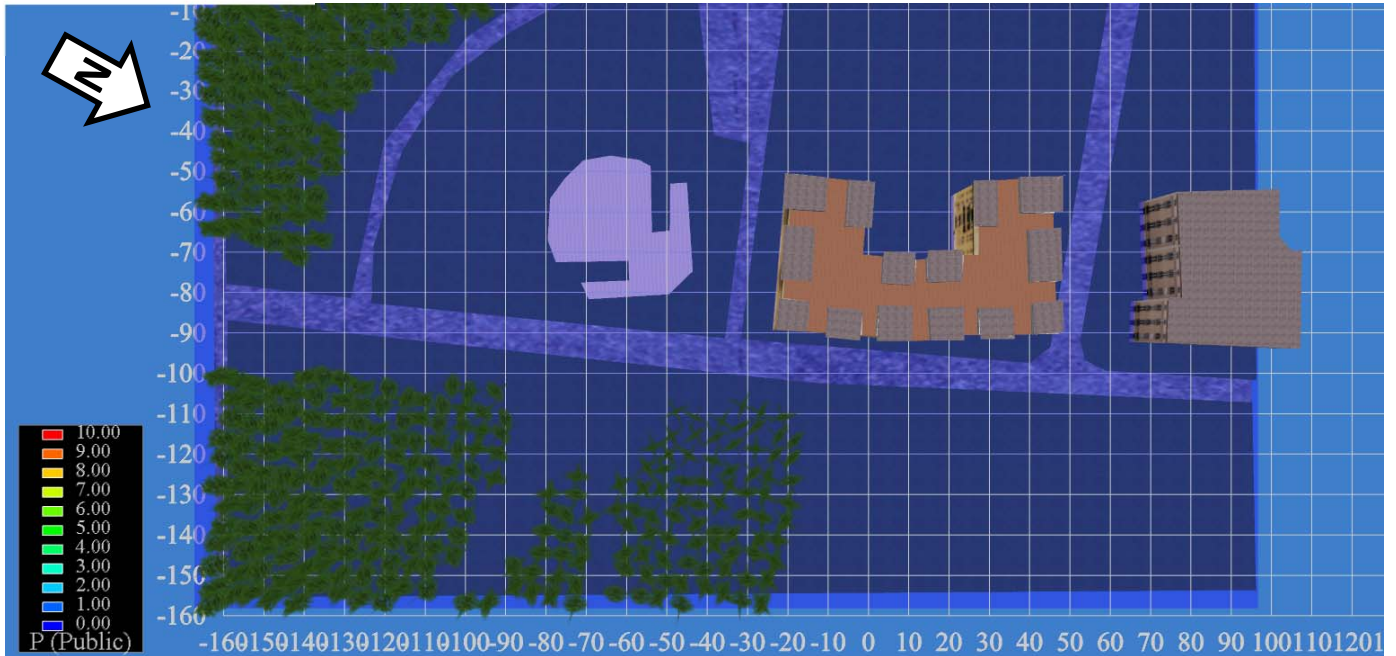
Comment: The analysis shows the RF signal facing North adjacent rooftop. RF signal would not exceed 3% of the uncontrolled environment limit.

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RF simulation for uncontrolled environment 2m above ground.



[All Sector]



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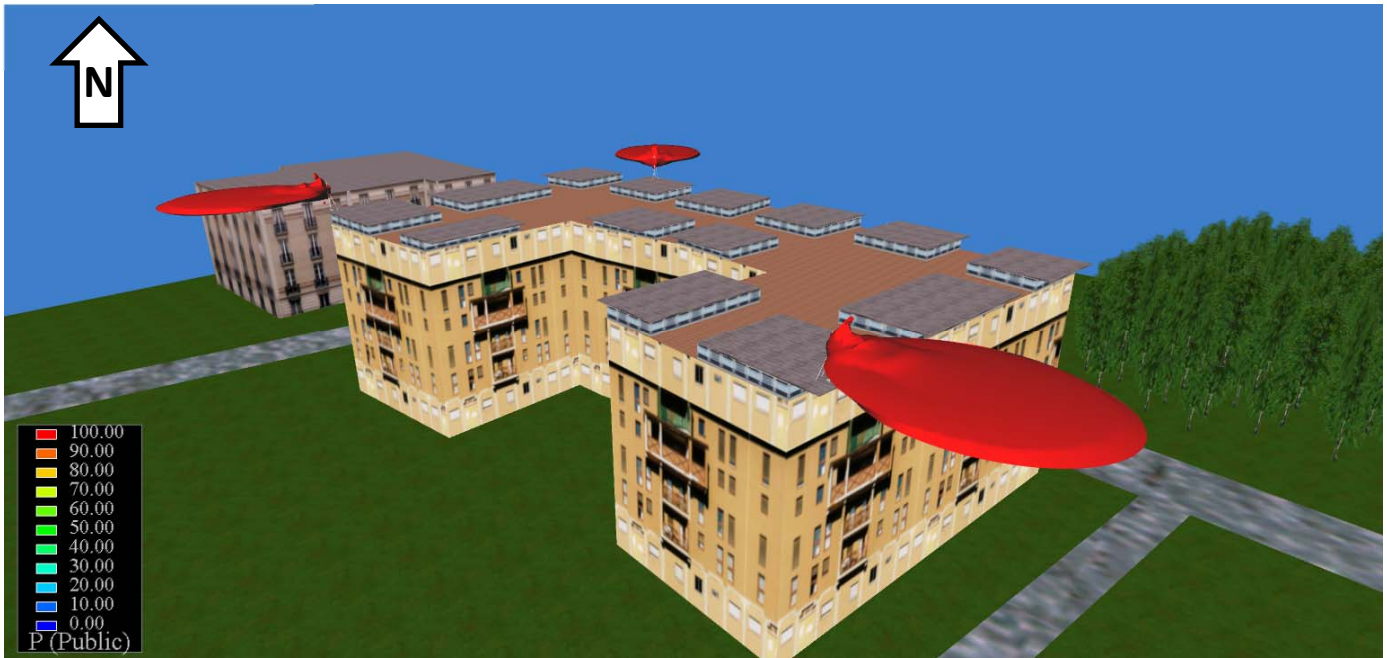
Comment: The analysis shows that at 2m above ground, the RF signal doesn't exceed 1% of the uncontrolled environment limit.

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RF simulation for uncontrolled environment 3D (1 of 2)



[North view]

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RF simulation for uncontrolled environment 3D (2 of 2)



[South view]

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RF simulation result

Uncontrolled environment

The safety code 6 analysis shows that the site is compliant to the uncontrolled environment.

2m above ground levels would be below 1%.

Facing adjacent building, levels would be below 3% of the limit.

At roof height, levels are below 1% and even lower inside the building

At 2 m above the highest roof surface levels are below 30%

Controlled environment

The safety code 6 analysis shows that the site is compliant to the controlled environment limit. Level on all sections of the rooftop would not exceed 20% of the limit.

General action required

- MOVE ANTENNA(S) (RELOCATE ANTENNA AND/OR MOUNT)
- INSTALL WARNING SIGNS AROUND NON COMPLIANT ANTENNA
- LOCK/MARK ACCESS POINT AT ENTRANCE AND INSTALL CAUTION SIGN
- ADJUST ANTENNA ORIENTATION (RE-AZIMUTH OR UP-TILT)
- ATTENUATE OR SHUTDOWN ANTENNA(S) OR SECTOR(S)



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This site is compliant uncontrolled/controlled.

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Site compliance (1 of 2)



% Worst contributor (uncontrolled / controlled environment)

[All Sector]

Antenna

- 1- Freedom Mobile antennas contribute for less than 3 % of the uncontrolled environment limit, facing the adjacent building and less than 1% at 2m above the ground level.
- 2- Freedom Mobile antennas contribute for less than 20 % of the controlled environment limit, 2m above the rooftop;



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Comment: This site is compliant uncontrolled/controlled.

Site compliance (2 of 2)

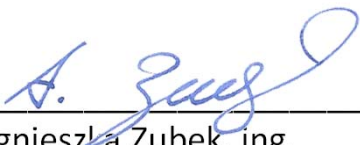
Freedom mobile maximum RF exposure

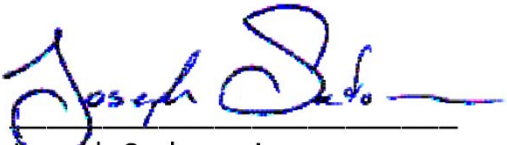
Maximum exposure on this site for uncontrolled environment : 3 %

Final result

- The site is **compliant** with the maximum exposure limits established in Health Canada's Safety Code 6 for **uncontrolled environment**.
- The site is **compliant** with the maximum exposure limits established in Health Canada's Safety Code 6 for **controlled environment**.
- The site is **non-compliant** with the maximum exposure limits established in Health Canada's Safety Code 6 for **both environments**.

I hereby certify that this report was completed using appropriated methods; that the information contained herein is exact to the best of our knowledge and that compliance with Safety Code 6 limits in each section of the site is as described above.

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Additional explanations on Safety Code 6 (1 of 3)

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 upon 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 remain 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) or the International Commission for Non Ionising Radiation Protection (ICNIRP)

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

Controlled Environment: An area where the RF field intensities have been adequately characterised 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 for all normally accessible areas such as ground or rooftop around the site while Controlled Environment standard will be used for areas accessible only to qualified workers such as the tower.

The standard used in this report is based on the most recent Safety Code 6 2015 recommendations. The figure below illustrates the power density limits for Controlled and Uncontrolled Environments for the 2015 standards.

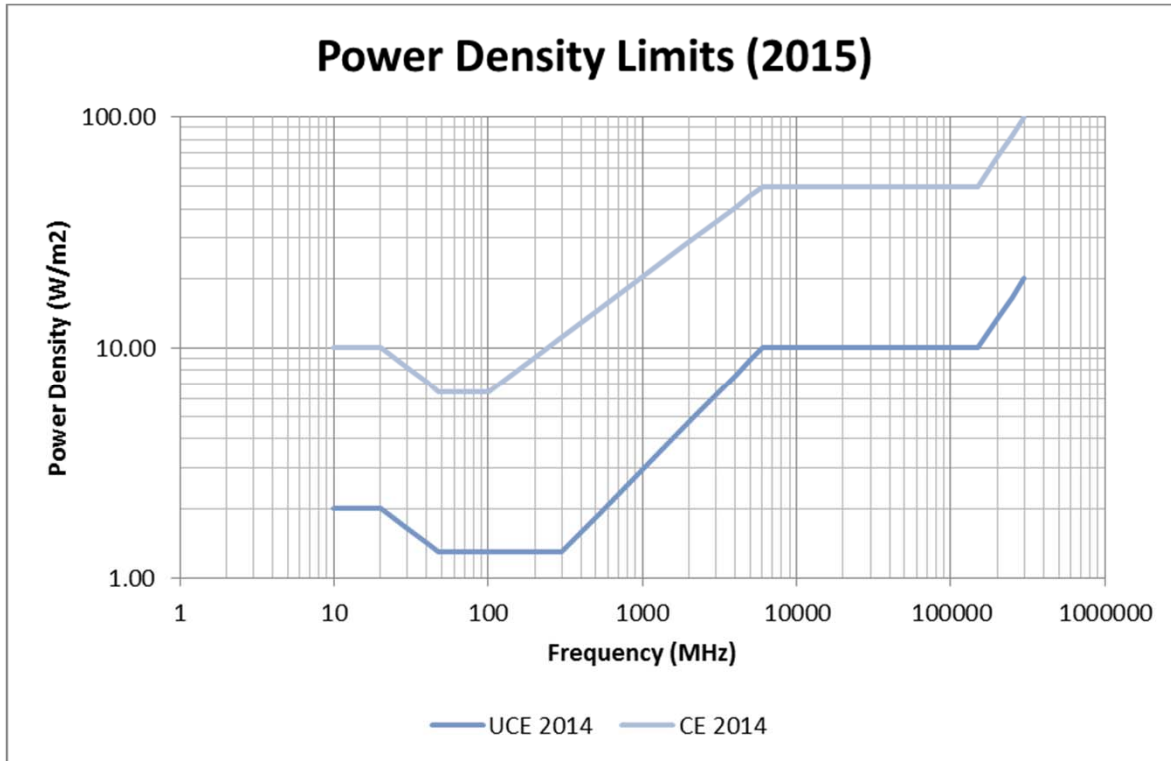
Furthermore, all our results are expressed as a percentage of Safety Code 6 limits, which is the usual representation for multi-frequency environments. In this representation, all values below 100% represent exposures compliant with Safety Code 6 limits while values above 100% represent exposures exceeding those limits.



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Additional explanations on Safety Code 6 (2 of 3)



References

The analysis and the resulting document have been prepared in compliance with the applicable reference documents:

- Safety Code 6 (2015) « Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz » Health Canada
- GL-01 « Guidelines for the Measurement of Radio Frequency Fields at Frequencies from 3 kHz to 300 GHz » Industry Canada
- GL-8 « Guidelines for the Preparation of Radio Frequency (RF) Exposure Compliance Reports for Radio communication and Broadcasting Antenna Systems » Industry Canada
- CPC-2-0-20 « Radio Frequency (RF) Fields — Signs and Access Control » Industry Canada



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Additional explanations on Safety Code 6 (3 of 3)

Microwave antennas


The accepted approach for microwave parabolic antennas is to consider these antennas as radiating the entirety of their energy in a well-defined beam and not contributing to the levels of RF energy present outside of this beam. Therefore, the only consideration regarding a parabolic reflector is to avoid worker presence in front of the reflectors.

Cellular and mobile radio antennas

This type of antennas is represented using the Visual EMF or IXUS software. These tools simulate the distribution of energy in the near and far field of the antenna and give with great precision the area where exposure levels exceed Health Canada (Safety Code 6) levels.

Broadcast antennas

Broadcast antennas are analysed using a separate simulation tool, designed specifically to take into account the complexities of large, high-power antennas. This approach uses the antennas horizontal and vertical radiation patterns, frequency, ERP and individual radiating element patterns and location to simulate a realistic power density distribution around each of the radiating elements.

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Possible software used for simulation



The simulation is performed by constructing a three-dimensional model of the site and then adding all transmitting antennas. Some antenna models are provided with the software, others had to be created from the radiation patterns that may be available on Industry Canada or on manufacturers' web sites. Antenna characteristics, such as frequency, radiated power and position are then entered into the software. The simulation then gives a representation of the radiation for each antenna and the size of the zones which require restricted access. The study only simulates the propagation of the signal free space and does not consider the surrounding obstacles or the absorption of the signal by these obstacles. A tree attenuates the signal by a factor of 4 to 5 times, while a wall attenuates the signal by a factor of at least 10 times. In short, we are only simulating the worst case. The simulation may show higher field levels than there would be in reality since the simulation always uses maximum power parameters and considers all antennas as operating simultaneously.



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