



# Connecting Canadians:

Wireless Antenna Tower  
Siting in Canada

cwta

Association canadienne  
des télécommunications sans fil

Canadian Wireless  
Telecommunications Association

acts

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*Improved coverage meets the  
needs of Canadian consumers.*



# Connecting Canadians: Wireless Antenna Tower Siting in Canada

Wireless networks rely on base station antennas to operate. As communities demand new or improved wireless service, local carriers respond to this need by installing new network equipment. Often this requires building a wireless antenna structure, commonly called a tower.

Improved coverage meets the needs of Canadian consumers, who have come to rely on wireless networks for voice communication and always-on access to the Internet wherever they go. Improved wireless coverage also means better access to emergency services such as fire, police or ambulance, and greater business development opportunities as corporate services are enhanced. The availability of high quality, robust and reliable wireless networks results in significant direct and indirect benefits to all Canadians. In 2009, Canada's wireless industry contributed \$41.2 billion to the Canadian economy and resulted in the employment of more than 261,200 Canadians. Strong wireless networks are building blocks for all sectors of the economy and must be considered a competitive advantage for Canadian communities.

The erection of an antenna structure may raise concerns in a community about aesthetics or property values, or about the safety of exposure to radiofrequency electromagnetic fields from towers. This brochure provides basic information about the rigorous procedures used to select a site and build a tower, and answers some key questions about health and safety issues. For more thorough information, consult the resources section at the end of this guide.

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# Building a New Tower



## Why a New Tower?

Carriers continue to build and expand their networks in response to the tremendous consumer demand for wireless phone and Internet services. Today, more than 25 million Canadians have a mobile phone or wireless device, a number that continues to experience significant growth annually. People often take the availability of wireless service for granted and expect that their wireless carrier will provide coverage anywhere and everywhere they live, work or play. Indications are that this demand will continue to grow as Canadians' reliance on wireless communications at home and in the workplace increases. Indeed, the wireless communications products and services, used daily by police, EMS, firefighters and other first responders, are an integral part of Canada's safety infrastructure.

Every year, Canada's wireless carriers spend over \$1 billion in capital improvements to their networks. In 2009 alone, the industry spent more than \$2.95 billion in network improvements. The industry has cumulatively invested well over \$25 billion in building Canada's world-class wireless infrastructure.

A large portion of this investment is spent improving network availability, both in terms of coverage and capacity. Increasing network coverage extends the reach of the network to new areas. Increasing capacity allows more users within the existing footprint of the network and provides faster transmission speeds for wireless data services. As more users access the network and use up the capacity of each existing antenna site, "holes" begin to appear in the network that become "dead zones" for users. The only way to overcome this problem is to fill-in these holes with additional antennas. Both additional coverage and capacity are needed to ensure networks are available reliably to all users.

Canadian wireless carriers are facing considerable challenges in delivering network capacity to their subscribers. The number of subscribers continues to grow, and the amount network traffic generated by each user is growing rapidly. Canadians are among the world's highest adopters of smartphones and tablets. These devices are best able to take advantage of Canada's high quality mobile broadband networks and use considerably more network resources than traditional mobile phones. A smartphone uses the capacity of as many as 24 "regular" mobile phones and a tablet uses the capacity of as many as 122 mobile phones. The rise of mobile data consumption is a global phenomenon and forecasts show that data traffic is set to double each year to 2014. Additional antenna sites are absolutely essential to meet this incredible demand.

Canadians expect reliable, high quality wireless service wherever they are. As much as 40%-50% of mobile data is consumed at home. In order to meet this demand, wireless facilities need to be located closer to residential areas than ever before.

Radio antennas, associated equipment and supporting structures are the fundamental components of a radiocommunication system that provide the connection from each wireless device to the rest of the communications network. Without them, none of the services that Canadian individuals, businesses and governments have come to depend on would exist.

Across Canada, there are approximately 13,000 wireless antenna sites. For comparison purposes, the United Kingdom, in an area less than 1/5 of Canada's coverage area, has approximately 52,000 sites.

### **The Site Selection Process**

When a requirement for a new site has been identified, the wireless carrier begins evaluating the options in an area based on radio frequency characteristics. These frequency characteristics are influenced by: the local terrain, existing structures, the number of subscribers, distance from existing sites, the availability of existing structures (buildings, other towers, etc.), and the availability of a willing landlord.

The first step is to look for existing structures such as building rooftops, water towers, hydro corridors, or towers belonging to other carriers or other utilities. Such sites are considerably more cost effective and the time to service is reduced. The use of existing structures generally results in a smaller impact on local surroundings. However, finding an existing structure with the suitable location or height may not always be possible. Around 40% of the antenna sites in Canada are located on structures other than purpose-built towers.

Colocating on existing towers may reduce the number of new towers, but colocation also results in taller, more robust towers to accommodate additional antennas and cabling, as well as additional equipment shelters at the base of the tower. Some municipalities actually prefer smaller, individual towers to one massive, but collocated tower, and in some instances, municipalities have formally expressed a preference for single-use towers. Some carriers have also employed infrastructure sharing agreements to reduce the need for additional sites. When all of these strategies are considered, approximately 60% of all antenna sites in Canada are shared in one way or another. Sites are only selected after thorough analysis of expected coverage outcomes based on field measurements and predictions combined with customer requirements. Upon selecting a preferred site, a carrier will begin the approval process.

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# The Antenna Approval Process

## Jurisdiction

Any discussion of tower approval procedures requires an understanding of the jurisdictional issues and the facts upon which jurisdiction is based. Canada's federal government has exclusive and comprehensive jurisdiction over the area of radiocommunication and telecommunications. The Privy Council determined in its decision about regulation and control of radiocommunication in Canada, that the Parliament of Canada has exclusive jurisdiction to regulate and control radiocommunication. Provincial Courts of Appeal (such as British Columbia and Ontario) have followed the Privy Council's decision without reservation. National jurisdiction over telecommunications, including the authorization of radiocommunication facilities, is a common characteristic of the regulatory structures of all countries having advanced radiocommunication networks.

Industry Canada is responsible for regulating radiocommunication in Canada, including authorizing the installation of radiocommunication towers and sites. This authority is derived from the *Department of Industry Act*, which describes the powers and duties of the department and the minister, and the *Radiocommunication Act*, which specifically provides the authority to approve antenna supporting structures. Indeed, the most recent authoritative review of Industry Canada's policies governing the siting of radiocommunication facilities, the 2004 Townsend report, recommended that the legislative authority to regulate tower sites "should remain exclusively with the Government of Canada."

## Regulations Governing Wireless Antenna Siting

As a condition of licence, all wireless carriers must follow the procedures outlined in two Industry Canada Client Procedure

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Circulars, one that speaks to land use consultation and the other to colocation. In exercising its authority, Industry Canada makes use of the input and expertise of other federal departments and agencies.

Similarly, the design and construction of antenna sites are subject to federal requirements. Antenna components must also comply with Transport Canada's antenna structure clearance rules and procedures.

Finally, like all radiofrequency emitting equipment, antenna sites must adhere to Health Canada's Safety Code 6, which specifies the limits of human exposure to radiofrequency electromagnetic fields.

### **Local Land-Use Authorities**

As a result of the federal jurisdiction of telecommunications operations, traditional municipal land-use planning controls such as zoning by-laws, site-plan control, development approvals, and building code requirements are rendered inoperative. In other words, the prohibition, restriction or regulation of land for its use as a wireless telecommunications facility would not be the authority of the municipality or other land-use authority.

Nonetheless, Industry Canada requires anyone who is planning to install or modify an antenna system that doesn't meet certain criteria to consult with the local land-use authority and/or local public where appropriate, or to follow the protocol adopted by the land-use authority. Industry Canada generally considers that once a participating land-use authority is contacted, the consultation process should be concluded within 120 days.

Canada's wireless industry has worked with many communities to develop protocols that clarify local expectations and preferences and define the procedures for wireless carriers. These collaborative protocols allow land-use authorities to provide meaningful input on antenna sites and provide consistent and timely processes for wireless carriers.

For the vast majority of antenna sites, the procedures and processes in place have worked well in meeting the needs of communities, individuals, wireless carriers and their subscribers.

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# Health and Safety Issues

*Wireless devices emit and receive non-ionizing electromagnetic waves. These waves are not comparable at all to the ionizing type such as gamma and X-rays that can be potentially harmful to humans.*

## **Electromagnetic Waves and Fields**

Mobile phones and the base stations that form mobile phone networks, just like all radio systems, function because they are able to send, receive and manipulate radiofrequency (RF) electromagnetic waves.

Electromagnetic waves are a form of energy that consists of time-varying electric and magnetic fields (EMFs). Electric fields are produced by forces of electric charges, and magnetic fields are produced when electric charges are in motion. When an appliance is plugged in, an electric field is produced around the appliance; when the appliance is turned on and the electrical current is flowing, a magnetic field is produced.

Electromagnetic radiation is all around us. The principal natural source of electromagnetic radiation on earth is the sun. Natural electromagnetic energy (i.e. sunlight) is necessary for photosynthesis in plants. Since electricity was introduced to our cities and homes more than a century ago, man-made sources have accounted for most of the electromagnetic radiation in our environment. Anything that uses electricity to operate, including everyday household electrical devices such as hair dryers, electrical ovens, fluorescent lights, microwave ovens, stereos and computers, emit EMFs of varying intensities.

Wireless devices emit and receive non-ionizing electromagnetic waves at frequencies below those of the visible light portion of the electromagnetic spectrum. These electromagnetic waves are of the same type used to broadcast radio and television services. They are not comparable at all to the ionizing type such as gamma and X-rays that have frequencies above those of visible light and that can be potentially harmful to humans.

An important characteristic of electromagnetic waves is the manner in which they propagate. The amount of energy in an electromagnetic wave diminishes greatly as you get further from the source of the wave. For example, doubling the distance from the source transmitter reduces the received field strengths by about one-half. Even relatively a short distance away from an antenna site, the associated electromagnetic energy can be quite low. Studies have shown that wireless phone emissions represent less than 25% of the ambient RF emissions in an urban area.





In 2002, Industry Canada conducted a study examining the level of RF fields in the City of Toronto, where the highest concentration of radio systems exists in Canada. The study took measurements at 61 locations around the city and found that on average, ambient RF field levels are 0.14% of the exposure limits specified in Health Canada's Safety Code 6 (705 times less). The study also found that wireless phone transmissions represented only 9% to 24% of measured RF energy.

In 2003, the Radiation Protection Services branch of the Environmental Health Division of the BC Centre for Disease Control conducted measurements of RF fields in 21 communities in British Columbia. These measurements found that the maximum level of exposure measured for any of the locations was 3000 times lower than the limits specified in Health Canada's Safety Code 6. The study also reported that many of the measurements had power densities of 1 million times below the exposure limits.

Similarly, Health Canada conducted measurements of ground level emissions near wireless phone base-station installations in the City of Ottawa. Results of those measurements showed that exposure levels observed at residences closest to a tower site are typically thousands of times below the exposure limits in Safety Code 6.

A 2008 Industry Canada survey in Colwood, B.C. found that exposure levels in the vicinity of all broadcast towers on Triangle Mountain were well within the Safety Code 6 limits for both workers and the general public – and less than 1% of the overall emissions present were attributable to wireless phone signals.

### **Jurisdiction over Health and Safety of Antenna Installations**

To ensure that RF exposures to the Canadian public meet all safety regulations, Industry Canada, the federal regulator responsible for the approval of RF equipment and performing compliance assessments, has chosen Health Canada's Safety Code 6 as its exposure standard. Even though the exposure limits in Safety Code 6 are used in Industry Canada's radiocommunication and broadcasting regulations, it should be noted that Health Canada has no regulatory role in the licensing, siting and compliance of radiocommunication and broadcast transmitters. In the area of the safety of these devices, Health Canada acts primarily as the principal health advisor to Industry Canada.

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*Health Canada  
conducts laboratory  
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external research on  
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Other Health Canada activities in the electromagnetic area include:

- developing guidelines for the protection of the general public and workers from exposure to EMFs.
- conducting research in the assessment of EMF exposure levels in residential and workplace environments.
- conducting laboratory studies and monitoring external research on the biological effects of EMFs.
- setting regulations for the safe use of microwave ovens and enforcing their compliance.
- advising government departments and agencies, industry, and the general public on exposure to EMFs.

### **Safety Code 6**

The guideline that has been chosen by Industry Canada as their exposure standard for the regulation of mobile phones, base stations, Wi-Fi technologies and other radiocommunication transmitters is Safety Code 6. This safety code is one of a series of guidelines Health Canada has produced on the safe use of devices that emit radiation. Safety Code 6 has been adopted by many organizations across Canada and referred to in a number of regulations, including the Canada Occupational Safety and Health regulations. The exposure limits given in Safety Code 6 have been established after reviewing all scientific studies on the health effects of RF energy exposure and also considering international exposure standards. Health Canada last published a revised edition in 2009.

Industry Canada has made compliance with Safety Code 6 mandatory. As a condition of licence, wireless phone licensees must ensure that:

*“...radio stations are installed and operated in a manner that complies with Health Canada’s limits of human exposure to radio frequency electromagnetic fields for the general public including the consideration of existing radiocommunication installations within the local environment.”*

In fact, Industry Canada requires all proponents and operators of radio installations to ensure that all sites comply with Safety Code 6 at all times.

The validity or adequacy of Safety Code 6 is not subject to consultation under Industry Canada’s antenna siting process.

# Antenna Tower Information Resources

**Industry Canada: CPC-2-0-03 – Radiocommunication and Broadcasting Antenna Systems**

[www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08777.html](http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08777.html)

**Industry Canada: CPC-2-0-17 – Conditions of Licence for Mandatory Roaming and Antenna Tower and Site Sharing and to Prohibit Exclusive Site Arrangements**

[www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09081.html](http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09081.html)

**Industry Canada: Antenna Towers in Your Community: Frequently Asked Questions (in support of CPC-2-0-03 – Radiocommunication and Broadcasting Antenna Systems)**

[www.ic.gc.ca/epic/site/smt-gst.nsf/en/sf08788e.html](http://www.ic.gc.ca/epic/site/smt-gst.nsf/en/sf08788e.html)

**Industry Canada: Wireless Communication and Health**

[www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09591.html](http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09591.html)

**Health Canada and Industry Canada FAQ on Radiofrequency (RF) Energy and Health**

[www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08792.html](http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08792.html)

**Health Canada: Safety Code 6 – Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz.**

[www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio\\_guide-lignes\\_direct-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-eng.php)

**Health Canada: Information about base stations**

[www.hc-sc.gc.ca/ewh-semt/radiation/cons/stations/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/radiation/cons/stations/index-eng.php)



**RFcom.ca – Operated by the University of  
Ottawa’s McLaughlin Centre for Population  
Health Risk Assessment**

RFcom.ca is a valuable source of information on the state of the science around the health effects of EMF. This Internet-based information resource is managed by an independent Science Panel that reviews and reports on the most recent research studies about wireless technology and health from around the world. It includes a primer on electromagnetic frequencies, wireless phones and an up-to-date bibliography of scientific journal articles on the health effects of EMF.

[www.rfcom.ca](http://www.rfcom.ca)

**World Health Organization**

The WHO EMF Project provides information about electro-magnetic fields, including potential health effects of exposure.

[www.who.int/peh-emf/en/](http://www.who.int/peh-emf/en/)

**WHO Electromagnetic fields and public health:  
Base stations and wireless technologies**

<http://www.who.int/mediacentre/factsheets/fs304/en/index.html>

**WHO Electromagnetic fields and public health:  
mobile phones**

<http://www.who.int/mediacentre/factsheets/fs193/en/index.html>



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