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VANOC Spectrum Management **Spectrum Management Communications Plan**

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1.1 Executive Summary

The 2010 Winter Games will dramatically increase demand on RF Spectrum given over 2,000 additional Radio Frequency (RF) devices that will require coordination and licensing. In preparation for the increased demand, VANOC and Industry Canada have been working together to effectively manage the RF resources for Olympic Family members for the period of January 1, 2010 to March 31, 2010.

As part of the federal government's support for Vancouver's bid for the 2010 Winter Games, the Minister of Industry committed to meeting the radio frequency needs of the Vancouver Organizing Committee for the 2010 Olympic and Paralympic Winter Games (VANOC). As specified in the *Radiocommunication Act*, the Industry Minister is responsible for managing the use of the radio frequency spectrum in Canada. Industry Canada (IC) takes great care to ensure minimal interference for all users of assigned spectrum and specifies clear equipment standards to ensure that all equipment is compatible. When assigning spectrum, IC conducts detailed technical analyses to ensure compatibility between different communications systems. Last but not least, to ensure the users have fair access to radio spectrum, IC exercises its power to identify, locate and resolve radio interference.

VANOC will manage the Spectrum Management Operations Plan and act as the single point of contact between all Olympic Family members and Industry Canada. Industry Canada's practice for radio authorizations specifies location, frequency, bandwidth, modulation and power but does not include any technical parameters associated with channel access control. To minimize interference among users on the same frequency, VANOC will employ and manage tone-coded squelch (TCS)/private line. VANOC will also manage the channel assignments for wireless microphones in each venue or zone to increase the likelihood of concurrent operation without interference.

Starting December 1, 2008, all Olympic Family users can apply for radio frequencies utilizing the web based VANOC Rate Card Ordering System (ratecard.vancouver2010.com), which will remain open till December 11, 2009. All spectrum users are encouraged to apply early as limited radio resources are available. After the Rate Card user has submitted their frequency request VANOC will levy a coordination fee of \$150.00 per frequency. Industry Canada will process the frequency application and once approval has been granted the authorized Rate Card user will receive their temporary frequency authorization. Beginning June 2009, the Rate Card user will be notified via e-mail and will be able to download a copy of their Industry Canada authorization and any applicable additional coordinating instructions specified by VANOC.

From the period of January 1, 2010 to March 31, 2010, VANOC will institute procedures to validate and label all radio frequency equipment brought by users into the Olympic and Paralympic venues. This is done to minimize interference during events by controlling where equipments operate. On arrival in Vancouver or Whistler, all radio equipment will need to be authorized for use at an Equipment Validation Centre by a validation technician. During this validation process, the technician will match the equipment against an authorization list and affix a label that specifies access into the venues.

During the Games, reports of interference within the venue will be directed through the VANOC Technology Help Desk to the Venue Telecom Communications Manager, or to the spectrum liaisons within each venue for action. The Help Desk will record each complaint on a ticket and assign a priority level (P1, P2, or P3) based on established criteria.

1.2 Background

Radio frequency (RF) energy can neither be seen, heard nor felt: it behaves in accordance with the laws of physics and its behaviour is not always intuitive. RF assignment and coordination is a necessity and a priority as it ensures the safety and security of life and property, assures regulatory compliance, and optimizes broadcast delivery and quality. It is also an essential and complex part of Vancouver 2010 Olympic and Paralympic Winter Games management.

Effective spectrum management and RF coordination are critical to empowering an extraordinary Games experience. A robust, comprehensive and diligently executed Spectrum Management Plan is necessary in order to ensure interference-free radio spectrum, unimpeded media broadcasts and continued effectiveness of emergency and support services.⁽¹⁾

(1) Extracted from the Spectrum Management Strategy, June 2006

1.2 Forward

This plan has been developed with the help of Industry Canada, VANOC, Olympic/Paralympic Radio Users Committee, Olympic Broadcasting Services Vancouver (OBSV) and other related organizations. Spectrum management continues to grow and become even more critical for successful Games-time operations as broadcaster requirements constantly change as a result of the increased demand for wireless devices.

As the federal regulator, Industry Canada will provide authorizations for all RF devices and stipulate equipment operational parameters. VANOC will act as the single point of contact for all Olympic Family spectrum users by providing coordination and Games-time operational procedures.

The goals of VANOC spectrum management are to:

- protect emergency communications
- protect life and safety
- ensure that spectrum and spectrum reuse strategies are made available for:
 - Olympic Broadcasting Services Vancouver (OBSV)
 - National Olympic Committees (NOCs)
 - National Paralympic Committees (NPCs)
 - Accredited Rights-Holding Broadcasters (RHBs)
 - Accredited non-rights holding broadcasters
 - Accredited press
 - VANOC radios for internal operations
 - IOC and sponsors
- partner with incumbent organizations to aid in frequency coordination
- work with Industry Canada to help ensure effective enforcement resolution of any interference problems

To achieve these goals, spectrum management will form relationships with:

- Royal Canadian Mounted Police
- E-COMM
- Department of National Defense (DND)
- Industry Canada
- Integrated Security Unit — Vancouver (ISU-V)
- Western Washington Communications Interference Committee
- Society of Broadcast Engineers
- Western Canada Association of Broadcasters
- UBC/SFU
- Radio amateurs

2.1 Challenges

Demands on the RF spectrum increase with the number of devices that will be introduced into the Vancouver and Whistler environment. Planning, communications and diligence are required to make frequency coordination work. Spectrum management, by nature, is a complex and difficult activity. The terminology, legal and technical considerations can be confusing. Radio spectrum demand is increasing because of rapidly changing technology. This will make spectrum management a critical component during the Vancouver 2010 Winter Games.

It is projected that the Vancouver 2010 Olympic and Paralympic Winter Games will generate in excess of 2,000 applications for spectrum assignments that will require licensing and coordination. It is estimated (based on previous Games) that over 80 per cent of these applications will come from the broadcaster community.

From Industry Canada's perspective, the size and scope of the spectrum services required for the Games far exceeds the department's local spectrum management capacity. Due to the 2010 Winter Games, the current licensed radio population will grow by more than 50 per cent in the next eighteen months: This is in addition to the many more consumer wireless devices that will be in use. Requests for radio licences will increase from the normal 1,200 annually to more than 3,200 in the year prior to the Games.

Based on experience, the following elements must exist for the RF coordination effort to succeed:

- knowledge of operations, environment, and technology
- trust within the entire team
- partnering with municipal, provincial and federal government agencies, and others
- planning and problem solving
- communication between all involved parties
- teamwork and co-operation between users
- Working well under pressure
- precision
- flexibility to deal with the unknown

3.1 Frequency Coordination Process

In partnership with Industry Canada, VANOC will manage the spectrum as follows:

- a) ensure that spectrum is made available, and users can apply for authorization in advance of the Games (see Section 5);
- b) ensure that only authorized and properly validated/labeled equipment operate in radio controlled venues (see Section 6); and
- c) locate and resolve interference complaints as efficiently as possible (see Sections 7 and 8)

3.2 Coordination in Vancouver and Whistler

The Vancouver/Whistler areas are extremely congested in terms of radio usage. VANOC, in partnership with Industry Canada, will make all attempts to make the best use of the available radio spectrum. This will allow for greater frequency reuse for users that are physically separated by a few kilometres while operating within a small area.

Industry Canada's assignment practice specifies location, frequency, bandwidth, modulation and power but does not include any technical parameters associated with channel access control. To minimize interference among users on the same frequency, tone-coded squelch (TCS)/ private line (PL) must be employed and will be co-ordinated by VANOC.

VANOC will also co-ordinate the channel use for wireless microphones in each venue or zone to increase the likelihood of concurrent operation without interference. VANOC will identify the applications that need channel access and stipulate the appropriate type of channel access control and update the users accordingly. The Program Manager will share frequency and/or channel assignment information with incumbents and non-rights holders as necessary to reduce the likelihood of Games-time interference.

3.3 Coordination for Low-Power Devices in Vancouver and Whistler

For low-power broadcast production equipment (under 5 watts — for example, wireless microphones) the frequency reuse zones are defined as:

Non Competition Facilities:

- a. *Olympic Stadium (BC Place)*
- b. *Main Media Centre*
- c. *Whistler Broadcast and Press Center*

Olympic Winter Games City Venues

- a. *Cypress Mountain*
- b. *Canada Hockey Place*
- c. *Pacific Coliseum*
- d. *Vancouver Olympic Centre*
- e. *Richmond Oval*
- f. *UBC Thunderbird*

Olympic Winter Games Venues, Mountain (Whistler)

- a. *The Whistler Sliding Centre*
- b. *Whistler Creekside*
- c. *Whistler Olympic Park*



Spectrum usage zones — city venues

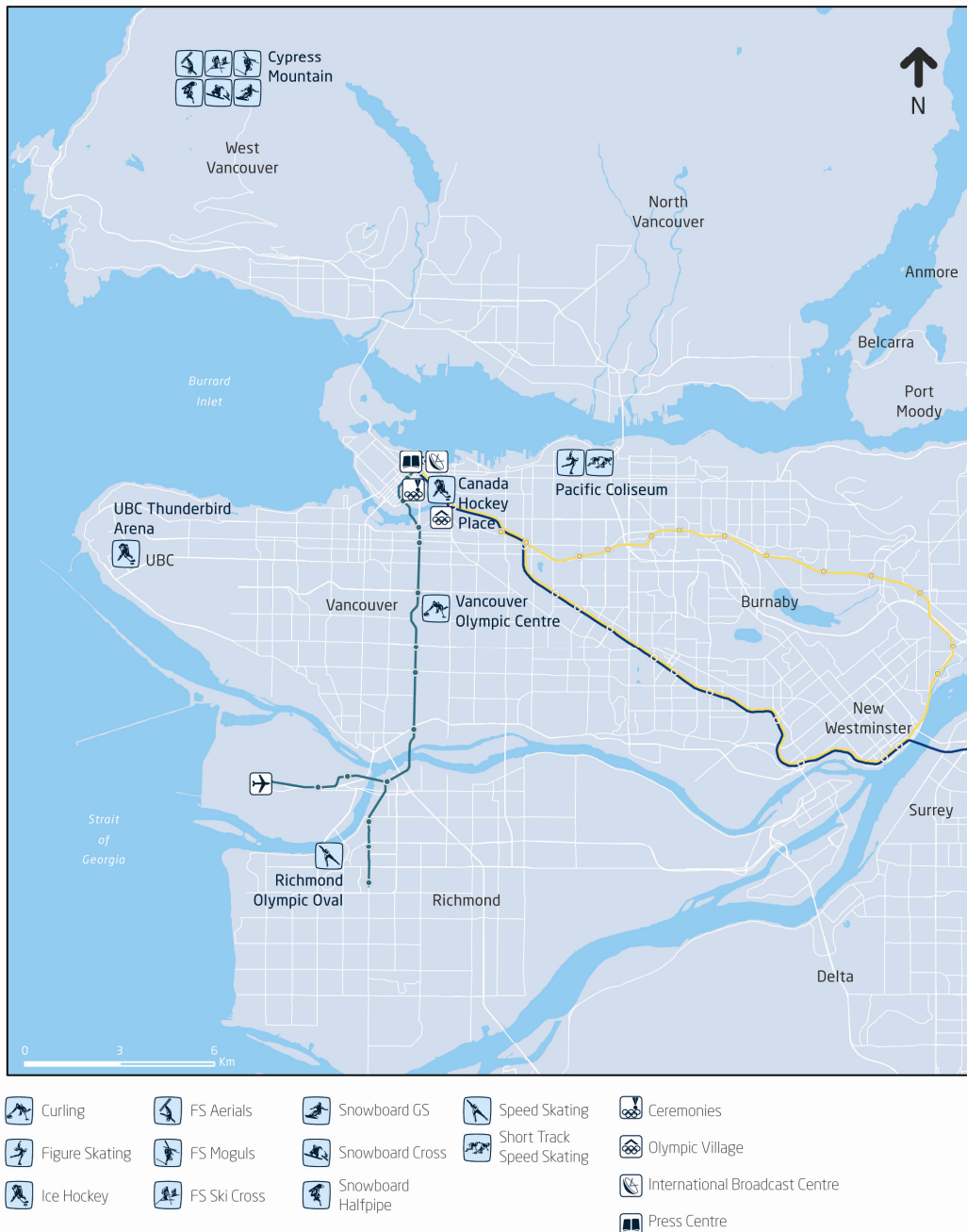


Figure 3.1
Vancouver 2010 low-power spectrum zones - City

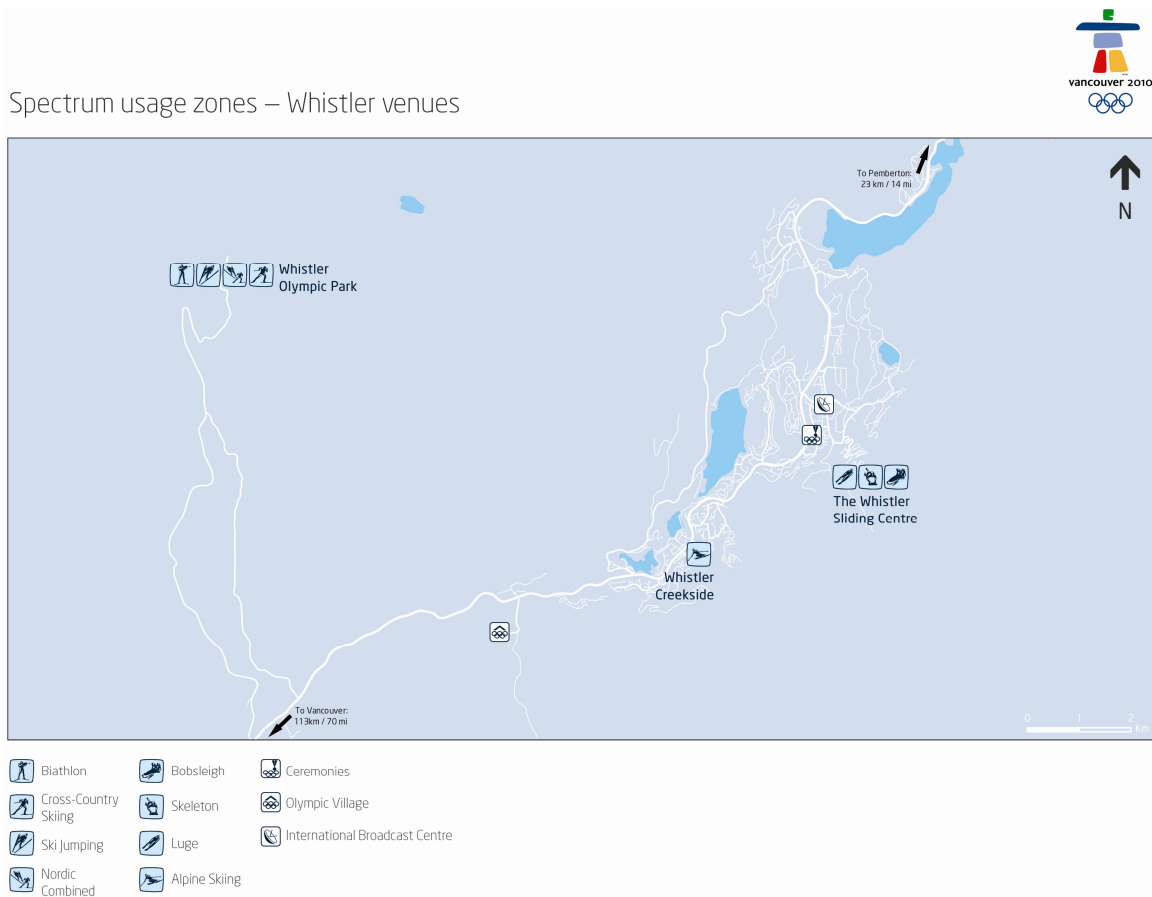


Figure 3.2
Vancouver 2010 - low-power spectrum zones - Mountain

3.4 Coordination in Vancouver and Whistler – High-Power Equipment and Wide Area Usage

For high power (greater than 5 watts) and wide area usage, the frequency reuse zones are defined as:

- a) Whistler-wide area
- b) Whistler Olympic Park (Callaghan Valley)
- c) Vancouver Wide Area

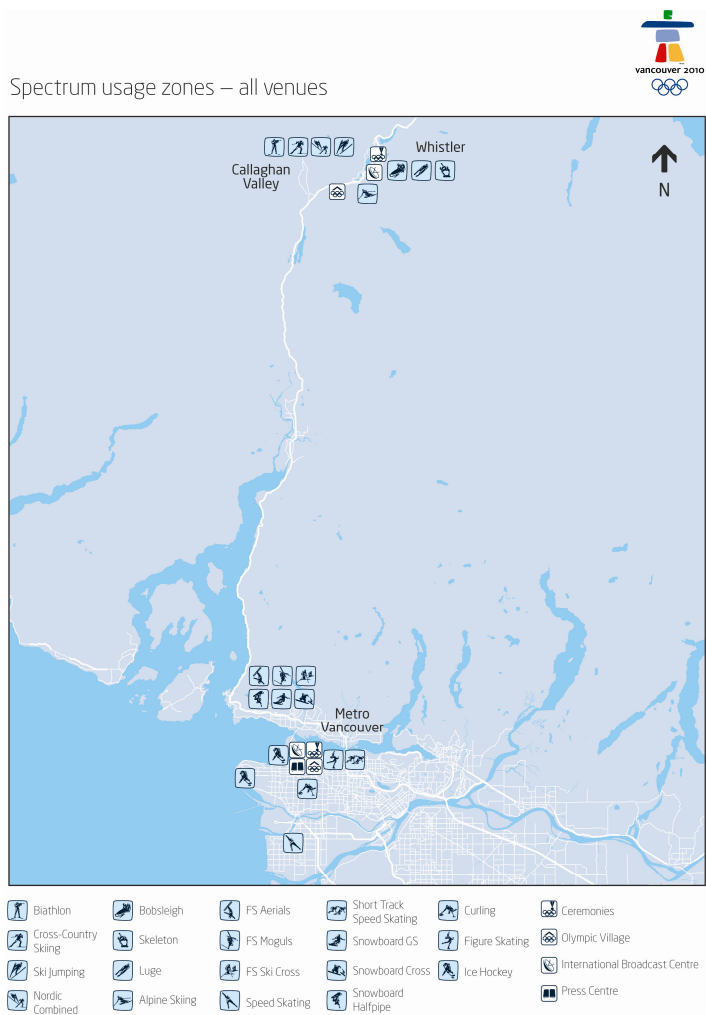


Figure 3.3
Vancouver 2010 - High-power spectrum zones - All

4.1 Rights Holder/Non-Rights-Holder Broadcaster Guidelines

A Rights-Holding Broadcast organization is a group of world broadcasters which has paid a fee for the exclusive rights to broadcast the Vancouver 2010 Olympic and Paralympic Winter Games in their home countries. These users will be accredited and will have access to live coverage of the Games from inside the sports venue.

Non-rights-holding broadcasters are eligible organizations that have not been granted the exclusive television and/or radio rights by the IOC to broadcast the Olympic Games in a particular territory. Non-rights-holding broadcasters will not normally have access to coverage of the Games from inside a venue; however, they do have the right to cover news stories outside of a venue. Non-rights-holding broadcasters will not be required to undergo VANOC testing and validation and will not be charged coordination fees as they will be using spectrum outside a venue. Non-rights-holding broadcasters must, however, comply with Industry Canada's requirements. They are requested to contact Industry Canada directly (<https://sd.ic.gc.ca>).

Under certain circumstances, non-rights holders may be accredited at the Olympic Games, at the discretion of the IOC, under the category of ENR (non-rights-holding broadcast organization). These users would have access to the spectrum web portal for frequency coordination requests. As a non-rights-holding broadcast organization, the organization and every individual appointed by the organization will have restricted venue access during the 2010 Winter Games, as defined in the IOC's news access rules.

All users are required to operate within their specific authorized frequency band or frequency(ies). If users are found to be operating on an unauthorized channel, they will be required to stop transmitting and tune to their authorized channel or apply for one immediately. Repeat violators may be subject to regulatory enforcement actions by Industry Canada and/or revocation of accreditation by VANOC. Every effort will be made to ensure coordination between non-rights-holding broadcasters and rights-holding broadcasters.

Spectrum management documents and information are available through VANOC's spectrum website at spectrum.vancouver2010.com. VANOC will invite both rights-holding and non-rights-holding broadcasters to regular meetings to ensure clear communications and coordination.

5.1 Spectrum Application Portal

Starting December 2008, Olympic Family members will be able to apply for radio spectrum utilizing the web based VANOC Rate Card Ordering System (ratecard.vancouver2010.com). For fix point-to-point links from 960 MHz to 24 GHz, please contact the VANOC program manager directly at spectrum@vancouver2010.com. Applications from non-Olympic Family members, and for radio use outside of the above period specified shall be submitted directly to Industry Canada (sd.ic.gc.ca).

Spectrum requests received through the portal will be directed to Industry Canada for processing, while spectrum co-ordination requests will be directed to the VANOC program manager for action. Industry Canada will make assignments, specifying operating parameters including frequency, bandwidth, transmitter power etc. VANOC will co-ordinate of the spectrum use inside venues by specifying the channels for wireless microphones and squelch tone for land mobile radios etc. After a spectrum request application has been processed, Industry Canada will notify the VANOC program manager whether an application has been approved or refused. The program manager will act as liaison between the applicant and Industry Canada to recommend appropriate options should the application be refused.

Industry Canada and VANOC spectrum manager will constantly adjust and optimize assignments and co-coordinate parameters to accommodate the applicants in each of the two ordering periods. The users will receive their radio authorization only after the closing of the ordering period. Depending on the volume and flow of incoming applications, especially those submitted just before the closing of the ordering period, it may take up to five months for IC and VANOC to process and optimize all applications received in the ordering period. See Section 5.3 for details.

5.2 Spectrum Authorization and Coordination Fee

After the Rate Card user has submitted their frequency request VANOC will levy a coordination fee of \$150.00 per frequency. Industry Canada will process the frequency application and once approval has been granted the authorized Rate Card user will receive their temporary license to operate radio frequency.

Payment of the VANOC coordination fee will be through the VANOC Rate Card Ordering System portal. Frequency and channel assignments will not be issued until payment has been received. Users cannot sell, trade, loan, or re-assign channels. Assigned frequencies and

channels can be used only within coordinated zones.

The coordination fee charged by VANOC will help to defray some of the total expense for the spectrum management program. The total fees collected are expected to be substantially less than VANOC's total cost for the RF coordination effort. Fees will also help to reduce spectrum warehousing by applicants. Spectrum users utilizing their RF device at multiple locations can apply for additional coordination via the VANOC spectrum website (<http://spectrum.vancouver2010.com>) by completing the additional spectrum accreditation form. There will no on fee levied for this additional coordination and efforts will be made to utilize the same frequency and channel assignment.

Payment of the coordination fee does not convey any entitlement to spectrum, nor does the acceptance of the coordination fee impart any contractual duty or liability on the part of VANOC.

5.3 Spectrum Application Timeline

Ordering Period	Timeline	Comments
Broadcaster Order Period (Excel document)	Dec 1 st 2008 to Dec 11 th 2009	Broadcasters can begin to submit applications for spectrum allocation through the broadcaster excel document (distributed through OBSV)
Web Portal Ordering Period	December 1, 2008 to May 31, 2009	As of December 1, 2008 users can apply for spectrum using the VANOC Rate Card order portal system. Users applying in this period have the best chance of getting the frequencies they apply for, and will receive their authorizations before October 30, 2009.
Cut-Off Period	August 1, 2009 – August 31, 2009	Customers are not able to modify or place new orders (with the exception of confirming orders that were changed by a customer service representative or Function Administrator). The web order portal system will be frozen during this period
Late Ordering Period	June 1, 2009 – July 31, 2009 September 1 - December 11, 2009	Late ordering terms, conditions and prices are in effect from June 1, 2009 through to July 31, 2009 and September 1, 2009 through to December 11, 2009. Please note that the Rate Card order portal system will be closed from Aug 1, 2009 through to Aug 31, 2009. <i>Users applying in the late ordering periods run a much higher risk of not getting the frequencies they apply for. Industry Canada and VANOC will try their best to ensure that users applying before July 31, 2009 will receive their authorizations by December 31, 2009. Users applying after September 1, 2009 may not receive their frequency authorizations in time for the Games due to the overwhelming frequency demands in the Vancouver and Whistler area. All frequency users are encouraged to apply as soon as possible for frequency authorization and coordination.</i>
Cut-Off Period 2	December 12, 2009 – January 26, 2010	Customers are not able to modify or place new orders (with the exception of confirming orders that were changed by a CSR or Function Administrator).
Games Time	January 27, 2010 – March 24, 2010	Customers cannot order directly from the website (they will order directly from Rate Card desk). However, they can view existing orders.
		Timelines are the same for the Paralympic Games. The exception is the ordering of select items at the Rate Card kiosk (tbd).
		No new orders can be placed by customers. Customers can view orders for invoicing status, check out, et cetera.
Post Games	From March 25, 2010	Users to contact industry Canada directly.

5.4 Spectrum Availability

VANOC has worked with Industry Canada to ensure that enough radio frequency resources can be made available to meet the increased needs of all users during the 2010 Winter Games. In the event that users request more spectrum than is available in a given band, VANOC will attempt to fairly and equitably co-ordinate spectrum among competing users, while working to optimize the world broadcast coverage of the Vancouver 2010 Olympic and Paralympic Winter Games.

Priority will be given to Rights Holding Broadcasters, however effort will be made to accommodate all users. As discussed in Section 5.3, users placing orders before May 31, 2009 will have the highest chance of getting the frequencies they apply for.

Industry Canada and VANOC will use their best efforts to serve all users; however, not all spectrum requests and spectrum co-ordination requests may be approved. Where possible, Industry Canada and VANOC will recommend options (for example, other frequencies, or rental radios) to users should their requests be denied.

6.1 Equipment Validation Process

To minimize interference during Games time, a means of controlling what equipment operates within a specific venue is required. Upon arrival in Vancouver or Whistler, users will need to bring their equipment to an Equipment Validation Centre (users are encouraged to bring along a copy of their authorization documents). The Validation Team will perform validation checks, and validated equipment will be affixed a tag/label that will control its specific access into venues. The venue acronym along with a unique identifier scheme will be included on the tag. These visual identifiers will allow Venue Operations (access control, security screening, and technology) staff to quickly validate a device.

At the Validation Centre, the Validation Centre team will visually examine radios to ensure they match the specifications as outlined in the radio licence issued by Industry Canada. They will also conduct random checks to confirm that power output, frequency, channel separation, sideband and tone squelch by matching the Industry Canada authorization and VANOC conditions. The steps involved in this random validation are:

1. The spectrum validation tech will do a “look up” for all the channels that the user has been assigned and confirm that the contact information is up to date.
2. Radios will be connected to a wattmeter and 50 ohm dummy load. A sample of the RF will be routed to a spectrum analyzer. The analyzer will be set to wide-band mode with the centre frequency at the operating channel of the device under test. The radio equipment will be monitored during the power on and power off sequence to verify the frequency and channel assignment(s). In addition, the analyzer will be used to identify spurious emissions outside of the normal or assigned transmission parameters.

Equipment parameters must meet the following criteria that will be specific to the equipment type:

- Frequency: +/- xxx Hz.
 - Bandwidth: +/- xxx Hz.
 - Power output: +/- 10%
 - Out-of-band emissions: xxx dB down outside of band
3. If equipment fails the initial inspection, a second test will be done to verify the results. Devices which fail the second test will not receive any equipment tag/label. The user of the device will be directed to the venue Help Desk where options will be provided or offered.
 4. Upon completion, a label will be affixed to the validated radio equipment.

6.2 Equipment Validation Centres for RHB

Venue Cluster Coordinators will establish Equipment Validation Centres at the following locations:

- a) International Broadcast Center / Main Press Center, to be established in time for the Main Media Center soft opening (January 12 to March 21);
- b) Whistler Media Centre, to be established in time for soft opening (January 12 – March 21);

VANOC will dispatch validation teams to provide on-site validation service to users with large numbers of radio equipment. For further information please contact spectrum@vancouver2010.com

6.3 Equipment Entering a Venue

All radio equipment entering a venue will be inspected at the media entrance. The equipment may be X-rayed and equipment bags will be searched. Radio equipment will be checked for the proper validation labels. The VANOC Spectrum team will liaise with Security Integration staff to ensure that venue security and access control staff is aware of the equipment coding scheme. **Only properly tagged equipment will be allowed use inside venues.** Users without proper authorizations will be directed to contact the VANOC program manager. Equipment that is not properly tagged may be allowed into the venue; however, the antenna will be removed and sealed to render the equipment unusable and the unauthorized equipment will be tagged "DO NOT USE."

Compliance teams will be present at the venue prior to and during broadcast times to ensure that only properly tagged equipment will be operated within a venue.

7.1 Reports of Radio Interference in Radio-Controlled Venues

Reports of interference within the venue shall be directed to the VANOC Technology Help Desk. The Help Desk will record the complaint in a ticket, prioritize it based on established criteria and assign a priority level (P1, P2, or P3). The Help Desk will then forward the ticket to the venue telecom manager (VTCM). Direct reports of interference made through the VTCM must be routed through the Help Desk for ticket creation and tracking.

The VTCM will confirm that the ticket contains an appropriate level of detail, including frequency, location and contact information as a minimum. The VTCM will ensure that the complainant has a valid authorization, confirm the priority level assigned by the Help Desk and determine whether the issue may be due to a non-serviceable radio or radio network problem. Any tickets that cannot be identified as a technical problem will then be passed to Industry Canada as a possible interference issue.

The VTCM will interact with Industry Canada's on-duty operations manager in Vancouver or Whistler as appropriate. Industry Canada's operations manager will prioritize incoming radio communication investigation events and assign Industry Canada mobile teams and associated resources to the ticket. Industry Canada may request and use the assistance of the VTCM to facilitate access to certain areas of the venue. Upon successful mitigation (as agreed to by Industry Canada's on-duty operations manager and the venue telecom manager), the VTCM will close the associated Help Desk ticket.

7.2 Priority of Tickets

A P1 ticket is the highest priority and will be assigned resources over P2 and P3 tickets. A P1 ticket is radio communication interference causing the user intermittent communications or no communications which impacts the broadcast communications feeds or the operation of a sports event. Industry Canada will respond to P1 tickets within one hour of receiving the information from the VTCM during event times. The VTCM will provide status updates to the Technology Operations Centre (TOC) every hour until the ticket is closed.

A P2 ticket is the second highest priority and will be assigned resources over P3 tickets. A P2 ticket is radio communication interference resulting in degraded system performance. Industry Canada will respond to P2 tickets within two hours of receiving the information from the VTCM during event times. The VTCM will provide status updates to TOC every two hours until the issue is resolved.

A P3 ticket is the lowest priority level and may be assigned resources only when there are no P1 or P2 tickets outstanding. VANOC retains responsibility to deal with P3 tickets, although Industry Canada may choose to commit resources to them on VANOC's request. A P3 ticket is a radio communication interference to radio licence-exempt equipment including:

- Family radio service (FRS)
- General mobile radio service (GMRS)
- Other Licence-exempt radio devices

Interference complaints sent directly to Industry Canada from public safety and security agencies will take precedence over the above prioritizations.

8.1 Radio Interference

Radio communication interference has the potential to affect the safety of the users of the radio system receiving interference and to disrupt the operations of an event as well as the broadcast operations covering the event. The priority in resolving radio communication interference is to identify the source of the interference and eliminate it.

8.2 Interference Resolution

For an interference source identified within a VANOC venue affecting an authorized user inside or outside the venue, the program manager will co-operate with Industry Canada to carry out the appropriate corrective action. Should Industry Canada or VANOC trace the interference source to an unauthorized operation, the range of options available to Industry Canada includes education of the user to obtain voluntary compliance; issuance of a determination of harmful interference order; issuance of a *Contraventions Act* ticket; or plain view seizure or prosecution under the *Radiocommunication Act*. VANOC's range of options includes education of the user to obtain voluntary compliance, temporary forfeiture of the interference-causing equipment and revocation of authority or the credentials of the user.

For an interference source identified outside a VANOC venue affecting an authorized user within the venue, Industry Canada alone will decide on the appropriate course of action. VANOC will not provide coordination for Non-Rights Holders outside the venues. Such users are reminded to apply for radio frequency assignment through Industry Canada's Spectrum Direct website (<https://sd.ic.gc.ca/>)

8.3 Liability

Industry Canada will endeavor to assign, and VANOC will undertake to coordinate, frequencies so as to minimize or eliminate interference. Neither VANOC nor Industry Canada can guarantee the availability or quality of spectrum, and cannot be liable for any damages that may result from radio frequency interference. By applying for and receiving RF coordination, the applicant expressly waives any and all claims against VANOC and Industry Canada arising out of frequency assignment and coordination efforts. This includes, but is not limited to, claims for damages from radio frequency interference, and/or claims arising out of the denial of requested spectrum. The applicant expressly waives any entitlement to consequential or incidental damages.

9.1 Equipment Transmit/Receive Frequencies

The following is a list of frequencies that users may consider for use during the Olympics:

Service	Frequency	Authorization
Wireless Camera:	Frequency > 470 MHz and Frequency < 15 GHz	VIA VANOC RateCard
Handheld Radio Service	Frequency > 30 MHz and Frequency < 960 MHz	VIA VANOC RateCard
Microwave Mobile:	Frequency > 960 MHz and Frequency < 15 GHz	VIA VANOC RateCard
Telemetry and Telocommand :	Frequency > 30 MHz and Frequency < 960 MHz	VIA VANOC RateCard
Fixed Link 1:	Frequency > 406 MHz and Frequency < 960 MHz	VIA VANOC RateCard
Fixed Link 2:	Frequency > 960 GHz and Frequency < 24 GHz	Contact VANOC Spectrum Management Directly
Fixed Link 3:	Frequency > 24 GHz and Frequency < 80 GHz	VIA VANOC RateCard
Interrupted Foldback System:	Frequency > 72 MHz and Frequency < 108 MHz or Frequency > 406 MHz and Frequency < 512 MHz	VIA VANOC RateCard
Interpretation Service System:	Frequency > 72 MHz and Frequency < 108 MHz or Frequency > 406 MHz and Frequency < 512 MHz	VIA VANOC RateCard
Intercom System:	Frequency > 406 MHz and Frequency < 960 MHz	VIA VANOC RateCard
Land Mobile Radio Service:	Frequency > 30 MHz and Frequency < 960 MHz	VIA VANOC RateCard
Wireless Microphone:	Frequency > 138 MHz and Frequency < 174 MHz or Frequency > 470 MHz and Frequency < 608 MHz or Frequency > 614 MHz and Frequency < 764 MHz or Frequency > 770 MHz and Frequency < 794 MHz or Frequency > 800 MHz and Frequency < 806 MHz	VIA VANOC RateCard
Family Radio Service	Frequency from 462.5625 MHz to Frequency 467.7125 MHz	Not required. See Section 9.3 for operating restrictions.
General Mobile Radio Service	Frequency from 462.550 MHz to Frequency 467.7125 MHz	Not required. See Section 9.4 for operating restrictions.
Multi-Use Radio Service	Frequency: 151.820 MHz, 151.880 MHz, 151.940 MHz, 154.570 MHz, and 154.600 MHz	Not permitted. See Section 9.5 for details.
Wireless LAN	802.11 b/g – 2.4 GHz	Not required, but must obtain co-ordination from VANOC. See Section 9.9

See Appendix A for a description of the various services.

9.2 Hand-Held and Portable Radio Systems

The primary land mobile radio band for the Vancouver 2010 Olympic and Paralympic Winter Games is between 470 MHz and 512 MHz. Currently there is no Canadian standard radio system plan for these frequencies; however, a Tx/Rx separation of 5 or 6 MHz will be assigned for repeaters. The other frequency bands available shall be in accordance with the *Industry Canada Spectrum Management and Telecommunications Policy Standard Radio System Plans – Technical Requirements for Land Mobile and Fix Radio Services Operation in the Bands:*

SRSP-500 Bands 138-144 MHz and 148-174 MHz

SRSP-501 Bands 403.1-430 MHz and 450-470 MHz

SRSP-511 Bands 764-770 MHz and 794-800 MHz

SRSP-502 Bands 806-821 / 851-866 MHz and 821-824 / 866-869 MHz

Radio equipment specifications will be assessed using RSS-119 as a guide.

VANOC encourages the use of radio private line and tone-coded squelch and will co-ordinate their use. VANOC will accept applications for systems that do not use tone-coded squelch/private line radios; however, radio systems that do not utilize PL or TCS will not be protected from nuisance interference.

9.3 Family Radio Service Radio Parameters

Family Radio Service (FRS) is licence-exempt in Canada. There is no requirement for users to apply to Industry Canada for assignment or VANOC for co-ordination. No interference protection will be afforded to users, who are expected to co-operate amongst themselves to minimize interference. The following 14 simplex channel carrier frequencies are available for use:

Channel	Frequency (MHz)
1	462.5625
2	462.5875
3	462.6125
4	462.6375
5	462.6625
6	462.6875

Channel	Frequency (MHz)
7	462.7125
8	467.5625
9	467.5875
10	467.6125
11	467.6375
12	467.6625
13	467.6875
14	467.7125

Non-voice communication is only permitted for selective calling or tone-operated squelch to establish or continue a voice communication, digital data transmission of location information or text messaging, and is subject to the following restrictions:

1. An FRS unit may transmit tones to make contact or to continue communications with a particular FRS unit. If the tone is audible (greater than 300 Hz), it may be transmitted continuously for no longer than 15 seconds at a time. If the tone is inaudible (300 Hz or less), it may be transmitted continuously only while the user is talking.
2. The FRS unit may transmit digital data containing location information, or requesting location information from one or more other FRS units, or data containing a brief text message to another specific FRS unit. Digital data transmissions must be initiated by a manual action or command of the user. However, an FRS unit receiving an interrogation request may automatically respond with its location. Digital data transmissions shall not exceed 1 second, and shall be limited to one transmission within a 30-second period. However, an FRS unit may automatically respond to more than one interrogation request received within a 30-second period.
3. The peak frequency deviation shall not exceed ± 2.5 kHz. The limiter shall be followed by a low-pass filter to remove unwanted harmonics.

The authorized bandwidth for an FRS unit is 12.5 kHz.

Output Power

The maximum permissible transmitter output power for an FRS unit under any operating conditions is 0.5 W effective radiated power (ERP). The radio shall be equipped with an integral antenna.

9.4 General Mobile Radio Service Operational Parameters

General Mobile Radio Service (GMRS) is licence-exempt in Canada. There is no requirement for users to apply to Industry Canada for assignment or VANOC for co-ordination. No interference protection will be afforded to users, who are expected to co-operate amongst themselves to minimize interference. The following 15-channel carrier frequencies are available for use:

Channel	Frequency (MHz)
1	462.5500
2	462.5625
3	462.5750
4	462.5875
5	462.6000
6	462.6125
7	462.6250
8	462.6375
9	462.6500
10	462.6625
11	462.6750
12	462.6875
13	462.7000
14	462.7125
15	462.7250

Non-voice communication is only permitted for selective calling or tone-operated squelch to establish or continue a voice communication, digital data transmission of location information or text messaging, and is subject to the following restrictions:

1. A GMRS unit may transmit tones to make contact or to continue communications with a particular GMRS unit. If the tone is audible (greater than 300 Hz), it may be transmitted continuously for no longer than 15 seconds at a time. If the tone is inaudible (300 Hz or less), it may be transmitted continuously only while the user is talking.

2. The GMRS unit may transmit digital data containing location information, request location information from one or more other GMRS units, or contain a brief text message to another specific GMRS unit. Digital data transmissions must be initiated by a manual action or command of the user. A GMRS unit receiving an interrogation request, however, may automatically respond with its location. Digital data transmissions shall not exceed 1 second, and shall be limited to one transmission within a 30-second period. However, a GMRS unit may automatically respond to more than one interrogation request received within a 30-second period.

Output Power

A GMRS transmitter may transmit with a maximum power of 2.0 W effective radiated power (ERP).

Restrictions

- GMRS units shall not be designed to interconnect to the public switched network.
- GMRS units shall not be designed to transmit data in store-and-forward packet operation mode.
- GMRS units shall not provide the user with the capability to receive on GMRS channels 16 to 23.

9.5 Licenced Low Power Devices — Wireless Microphones

The largest single use of spectrum at the Games will be for the wireless microphone. Use of wireless microphones will be assessed in accordance with the Industry Canada Radio Standards Specification — Low Power Licenced Radiocommunication Devices (RSS-123).

Interference occurring between wireless microphones is difficult to resolve; therefore, an exact database maintained by VANOC is required. Users are required to operate on authorized channels only. Any changes to use of wireless microphones (for example, frequency, location) at Games time must be approved by VANOC Spectrum Management. VANOC should also be notified if a particular system will not be used, so the approved channel can be used by another broadcaster, if required.

Wireless microphones using the VHF band are discouraged. The spectrum from 154 MHz to 216 MHz is inherently unsuitable for wireless microphone. This is due to the high noise floor, the extensive use made of the 150 MHz to 174 MHz frequency band by two-way radio systems and broadcast transmission in the 174-216 MHz band.

The power output of wireless microphones shall be limited to 1 watt in all bands. Channel bandwidth is limited to 200 kHz.

9.6 Fixed Link (1 GHz to 24 GHz)

Fixed link (point-to-point from 960 MHz to 24 GHz) is typically used in broadcasting for beauty cam. Due to the complex nature of this technology all requests must directly go through the VANOC Program Manager at spectrum@vancouver2010.com who will coordinate the request directly with Industry Canada.

9.7 Earth Stations – Uplink

All fixed-satellite service earth stations must use a satellite approved for use in Canada. Canadian satellites are approved for use by means of a licence issued in accordance with the procedure described by Industry Canada Client Procedures Circular 2-6-02 (CPC-2-6-02), Licensing of Space Stations in Service other than the Amateur Satellite Service and the Broadcasting Satellite Service in planed Bands. The use of foreign satellites will be permitted where the satellite meets the main assessment criteria for satellites authorized by World Trade Organization (WTO) members, as specified by Industry Canada in *Annex D of Radio System Policy 008 (RP-008), Policy Framework for the Provision of Fixed-Satellite Services*.

Temporary authorization of Satellite News Gathering (SNG) earth stations or the coverage of a news event in Canada is permitted. Special provisions have been made with the United States, to allow “roaming” of American terminals in Canada which use American satellite station facilities. Based upon an operational and technical arrangement established by an exchange of diplomatic letters, SNG earth stations of a foreign administration could be authorized to operate in Canada, using a foreign satellite station, subject to the following provisions:

- The applicant must provide evidence that the earth station is currently licenced by its administration to operate on satellite space stations approved for use in Canada.
- The earth station must use transmission facilities of an approved satellite station.
- The earth station must comply with Canadian spectrum allocation, spectrum policies, and technical and operational requirements.

All broadcasters applying SNG Ku band uplinks outside of VANOC radio controlled venues will need to apply directly to Industry Canada for coordination. Please visit <http://spectrum.vancouver2010.com> and complete the SNG Ku band uplink application document.

9.8 Wireless Cameras (WC)

Wireless camera practice and etiquette govern the set-up and operation of a broadcast feed. Inside the venue users are required to use their authorized channels. Any changes to use of wireless cameras at Games time must be approved by VANOC Spectrum Management. VANOC should be notified if a particular system will not be used so the approved channel can be used by another broadcaster.

Wireless camera operation outside the venue will be subject to cooperation among users; all non-rights holders must be licenced with Industry Canada.

9.9 Multi-Use Radio Service Radios

Multi-use radio service (MURS) is a two-way radio service using five frequencies in the VHF spectrum (151.820 MHz, 151.880 MHz, 151.940 MHz, 154.570 MHz, 154.600 MHz). These devices **will not** be permitted to operate in Canada during Games time.

9.10 Licence-Exempt Wireless LAN Devices

During Games time VANOC will be providing wired Internet service, and as a supplementary service, wireless internet (WIFI) service in certain high-traffic locations such as the Olympic and Paralympic Villages, Main Press and Media Centres and others. Within the Net Zone wireless hotspots, no user, under any circumstance, will be permitted to operate their personal WIFI routers. WIFI routers will be permitted to operate in designated zones that are not covered by the Olympic Net Zone wireless internet (example – private offices)

Users bringing in their own WIFI services must operate within the 5 GHz wireless device band utilizing the 802.11a networking standard. Users will not be able to operate within the 2.4 GHz spectrum (802.11 b/g/n), and selected channels in 5 GHz (802.11 a/n). VANOC will stipulate the SIDH and channel assignment.

While VANOC will not be responsible for WIFI interference problems, all efforts will be made to limit potential interference issues. Users-bringing their own WIFI equipment must submit the *Private Wireless Router Access Form*, which is located at:

<http://spectrum.vancouver2010.com>.

Please note that because this is a licence exempt frequency band, there will be no frequency coordination fee for WIFI services. A list of NetZone WIFI coverage zones will be made shortly and posted to the spectrum webpage at <http://spectrum.vancouver2010.com>

Appendix - Wireless Equipment

Wireless Camera

Hard or hand-held cameras operated by a host or rights-holding broadcaster using an onboard battery powered transmitter for the purpose of transmission of video, audio and control signals. These signals may be either analogue or digital in nature.

Microwave Mobile Link

Temporary link between two points, used for carrying broadcast quality video, audio and data signals. This equipment is used by broadcasters and timing systems.

Satellite Uplink

Uplink between an earth station, Hub or VSAT and a satellite, used for transmitting broadcast quality video/audio and data signals, C/KU/KA bands, video signals, data, voice uplinks for broadcast or other use. The expectation is that these systems will be centred in a common location/satellite farm for Vancouver and a similar location/farm in the Whistler area. Industry Canada will require a letter from the satellite provider, a copy of the home authorization and if the satellite users are utilizing C band uplink, and a letter indicating coordination between terrestrial users.

Satellite Downlink

Downlink (TVRO) facilities for the reception of a satellite signal (no licence required).

Fixed Link 1 (FL1)

Temporary link between two points (for example, part of a link between an OB site and a studio), used for carrying broadcast quality audio, video and data signals that uses spectrum from above 406 MHz and below 960 MHz

Fixed Link 2 (FL2)

Temporary link stations typically used for a beauty cam shot between 1 GHz and 24 GHz that must be submitted directly to VANOC. Please contact VANOC at spectrum@vancouver2010.com.

Fixed Link 3 (FL3)

Temporary link between two points (for example, part of a link between an OB site and a studio), used for carrying broadcast quality audio, video and data signals that uses spectrum from above 24 GHz and \leq 80 GHz.

Hand-Held Radio System (HRS)

Licensed hand-held radios (walkie-talkies) used over a short coverage area for carrying voice with no repeater. These devices will be utilized by broadcasters, visiting teams and sponsors for localized voice communications.

Portable Radio System (PRS)

Licensed hand-held radios (walkie-talkies) used over a short coverage area for carrying voice with a repeater or base station. These devices will be utilized by broadcasters, visiting teams and sponsors for localized voice communications.

Interrupted Foldback System:

Body-worn, miniature professional receiver with earpieces for personal monitoring of single or dual channel soundtrack. An audio sub-system allowing on-air personnel ("talent") to receive the normal program audio mixed with audio cues from the production director or their assistants, via headphones or ear monitors.

Interpretation Service System

Interpretation/conference systems, one-way communications with no licence required for the receivers.

Microwave Mobile Link

Temporary link between mobile-to-mobile or mobile-to-fixed terminals. Examples are, hand-held camera with separate body-worn transmitter, power pack and antenna or transmission system employing radio transmitter.

Intercom Systems

One-way systems used for communicating the instructions of the director instantly to all those concerned in the production; these include presenters, interviewers, cameramen, sound operators, lighting operators and engineers.

Telemetry and Telecommand

Radio links for the remote control of cameras, other program-making equipment, telemetry and signalling that are used by broadcasters, visiting teams and sponsors for localized data communications.

Wireless Microphone

Hand-held or body-worn professional microphones with integrated or body-worn transmitter.

Appendix — VANOC Staffing Plan

The following section will outline the staffing plan required to execute the Spectrum Management Operations Plan for both before and during the 2010 Winter Games. The workforce will be comprised of paid employees, professional consultants and volunteers.

PROGRAM MANAGER — SPECTRUM

- Oversees and manages all aspects of the Spectrum Management Operations Plan.
- Develops and stages a communication plan aimed at educating the Olympic Family
- Educates Olympic Family on policy and procedures including Industry Canada requirements pertaining to RF equipment and its operation while in Canada
- In conjunction with Industry Canada:
 - manages RF coordination
 - locates spectrum for the Games
 - defines spectrum reuse zones based on RF propagation
 - manages scopes, designs and develops an application portal
- Develops processes and procedures required to:
 - manage and deliver equipment parameters that are outside of the Industry Canada licensing process
 - control equipment being brought into and operated in specific venues
- Liaises with Industry Canada and report on:
 - spectrum application process
 - volume of applications
 - progress and delays
 - escalation of spectrum conflicts
- Games time liaison with Industry Canada on all reports of harmful interference and escalate as required

MOUNTAIN AND CITY REGIONAL SPECTRUM SUPERVISORS

- Assist spectrum manager in planning, coordination and equipment validation
- Manage validation procedures set by VANOC and Industry Canada
- Develop in-venue procedures
- Train volunteer staff
- Assist in coordination of low power devices (wireless microphones)

- Games-time liaison with various groups not limited to:
 - Industry Canada
 - DND
 - RCMP
 - David Atkins Productions
 - Venue users
 - OBSV
 - E-COMM
 - Radio amateurs
 - Olympic Family members
- Mediate spectrum conflicts
- Monitor interference complaints
- Assist in real-time coordination for non-rights holders

CITY / MOUNTAIN BROADCAST COORDINATORS (VARIOUS LOCATIONS)

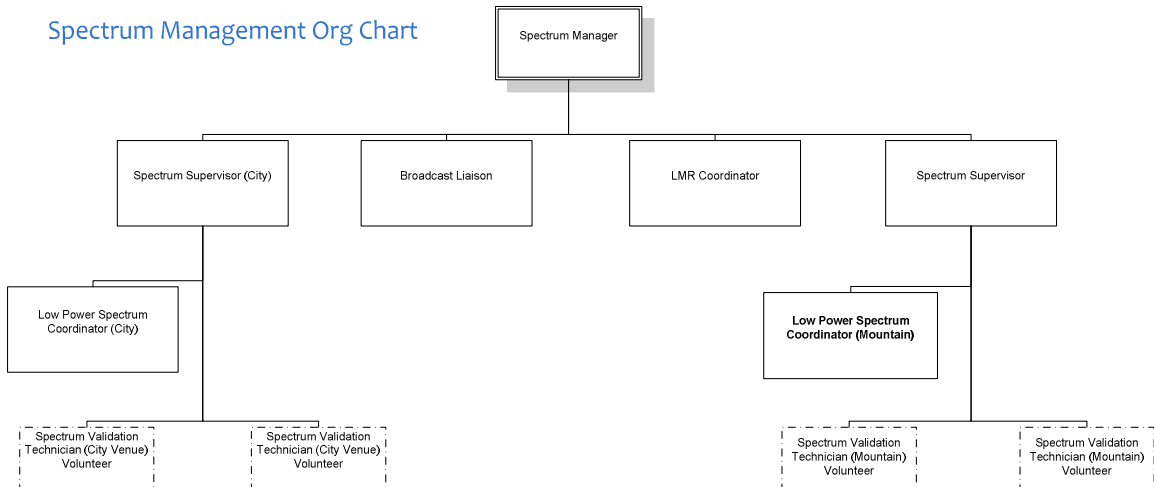
- Respond to and mitigate interference complaints
- Assist various users with spectrum requirements
- Assist with venue RF rehearsals
- Patrol venue looking for non-validated radios
- Help users with RF-related issues
- Monitor venue spectrum during broadcasts
- Liaise with rights holders
- Assist Industry Canada with compliance

EQUIPMENT VALIDATION VOLUNTEERS (VARIOUS LOCATIONS)

GAMES TIME

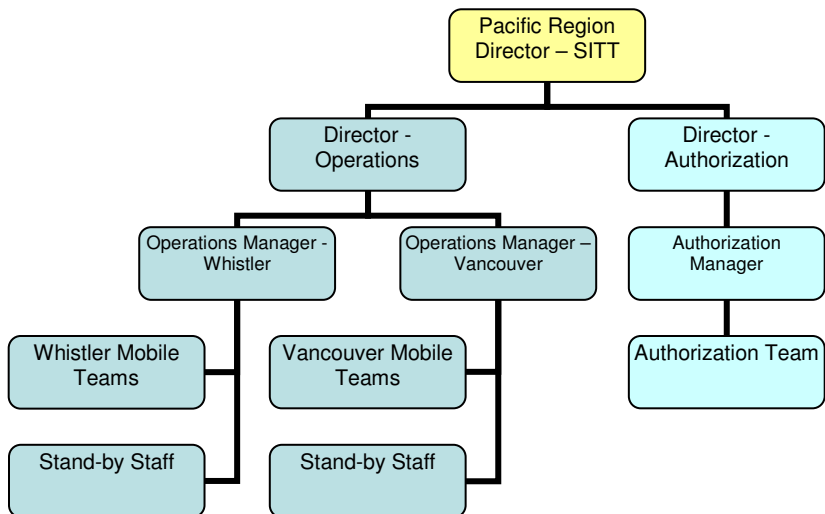
- Perform validation test
- Verify frequency assignments and equipment authorization
- Assist users with radio equipment setting
- Apply equipment validation label
- Assist during venue RF rehearsals
- Verify RF spectrum complaints and escalate as necessary

Spectrum Management Org Chart



Industry Canada

During Games time, Industry Canada will have mobile teams and managers on duty to investigate and resolve interference. Depending on needs, Industry Canada may also have a liaison officer on duty in the Broadcast Centre or the VANOC Technology Centre. The on-duty Industry Canada operations manager will interface with the VANOC Spectrum Manager.



TERMS

DTV: Digital Television

DL: Fixed Satellite Downlink

ENG: Electronic News Gathering

EMI: Electromagnetic Interference

EIRP: Effective Isotropic Radiated Power

ERP: Effective Radiated Power

FRS: Family Radio Service, unlicensed service for two-way communications

FL: Fixed Link

GHz.: Gigahertz, one billion cycles per second

HRS: Hand-Held Radio Service

IFB: Interruptible Foldback — an earpiece used by talent to hear cues from the director

IC: Industry Canada

ISB: International Sports Broadcasting

ISS: Interpretation Service System

LPTV: Low Power Television

MIC: Wireless Microphone

MHz.: Megahertz, one million cycles per second

ML: Microwave Link

MML: Mobile Microwave Link

NEC: National Electrical code

NIST: National Institute of Standards and Technology

NR: Non-Rights holders

OSA: Olympic Spectrum Authority

UL: Satellite Uplink

PRS: Land/Mobile Radio system

RF: Radio Frequency energy

RFR: Non-Ionizing Radio Frequency radiation

RPU: Remote Pickup Unit

STA: Special Temporary Authority

STL: Studio Transmitter Link

TC: Telemetry and Telocommand

WC: Wireless Camera