

ULTRA-HIGH FREQUENCIES

going once, going twice...

By Major Patrick Hovis, CD

WOULDNT IT BE GREAT IF ALL THESE SOCIAL NETWORKING TECHNOLOGIES SUCH AS FACEBOOK, TWITTER, YOUTUBE, OR PODCASTING COULD ACTUALLY BE PUT TO PRACTICAL USE? WHY IS IT THAT WE CAN GET UP-TO-THE-MINUTE DETAILS FROM FRIENDS, OR ANY HOLLYWOOD OR MUSICAL PERSONALITY - SUCH AS WHERE THEY ARE, WHAT THEY ARE WEARING, AND WHAT THEY ATE FOR LUNCH - AT OUR FINGERTIPS AND ALMOST ANYWHERE IN THE WORLD, BUT TO COORDINATE A MAJOR EMERGENCY RESPONSE WE STILL HAVE CHALLENGES TO SHARING INFORMATION BETWEEN AGENCIES IN THE SAME AREA? INDUSTRY CANADA WILL BE MAKING A DECISION IN THE NEXT FEW MONTHS THAT COULD HAVE A MAJOR IMPACT ON THIS INTER-OPERABILITY AND INFORMATION SHARING ISSUE.

As of 31 August 2011, the band of radio frequencies in the ultra-high frequency (UHF) spectrum known as the 700 Megahertz (MHz) Band (698–806 MHz) was to be effectively freed up for the rapidly expanding world of mobile broadband communications. Industry Canada is to decide on how to divide this frequency spectrum and whether to auction off the whole band to communications companies or designate portions of the band for the use of public safety agencies, such as police, fire, and ambulance services, as well as emergency management organizations (EMOs) and response organizations, which include the Canadian Forces (CF).

Industry Canada opened a consultation period between 1 December 2010 and 28 February 2011 for interested stakeholders to submit proposals and comments on how best to use this highly valuable range of radio frequencies. As an indication of just how valuable this resource is, in the United States (US) this same process ended in 2009 with the US Federal Communications Commission (FCC) netting \$19 billion from 101 successful bids; their most successful auction process ever for wireless spectrum. They did, however, reserve two 5 MHz sub-bands, 763–768 MHz and 793–798 MHz, for public safety use, or more specifically, for public-private sector partnerships to develop public safety networks. Unfortunately, no successful bids or licence agreements have yet been made and the debate continues as to what to do with these frequencies. As a member of the Radio Advisory Board of Canada (RABC), an association of professional organizations that advises the government and Industry Canada on the use of radio spectrum, the CF, through the Director, Information Management Technology, Products and Services 5 (DIMTPS 5), has voiced its support on this issue by voting in favour of reserving spectrum for public safety use.

So what makes this particular frequency band so important, you may ask? The

700 MHz frequency space, which was previously used to broadcast analog television signals, happens to be the ideal frequency range that balances wide area coverage with high capacity and mobile services. Essentially, this means that the services you may receive on your smartphone, tablet device, or mobile internet universal serial bus (USB) stick could be provided to more people in more places, particularly in remote and mobile places, from fewer antennas or base stations. Since the main infrastructure already exists in most urban areas, the cost to expand or extend mobile communications services to rural or remote areas would be relatively low. As an example, one 700 MHz antenna can cover up to a 20-kilometre radius, compared to four to six antennas for a personal communications service (PCS) or global system for mobile (GSM), which operate in 800, 900, 1800, and 1900 MHz ranges, or up to 20 antennas for WiFi (wireless fidelity) or wireless local area network (LAN) operating in the 2400 MHz range. The 700 MHz frequencies can also penetrate most building surfaces, thereby further reducing costs for in-building infrastructure and coverage.

As one can imagine, this is a highly desirable resource for communication companies that are expected to offer large bids to get as much bandwidth as possible. What is important to the CF is that although we are not formally considered a public safety organization, we are a key stakeholder in emergency management and disaster recovery, and this is an opportunity to have a common communication means that could greatly improve information-exchange efficiency and effectiveness, therefore improving overall emergency preparedness, response, and coordination.

With a dedicated, high-capacity mobile communications means, Canada Command, Regional Joint Task Forces (RJTFs), search and rescue (SAR), military police, and other CF organizations that must coordinate with EMOs or public safety agencies, could use a

common network to share secure and non-secure critical information, such as real-time streaming video, high-definition graphics, and complex applications or databases. They would be able to do this from any smartphone, mobile device, or workstation that complies with the system standard. Currently, such a system or equipment does not exist, but major stakeholders in the public safety domain, such as Public Safety Canada, the Royal Canadian Mounted Police (RCMP), national police, fire and ambulance service associations, and provincial EMOs are developing proposals and business models to introduce this type of system, should the 700 MHz frequencies become available to them. So just as users can update their Facebook pages from their smartphones or computers, police forces, EMOs, and CF operations centres could use a similar type of application to monitor and update severe weather patterns, or terrorist and criminal threats, and send that information out over the public safety network (i.e., 700 MHz channels), thus ensuring the information is instantly shared and available to other interested agencies, specifically to forces on the ground or in the effected area. The overall effect would be improved situational awareness, better coordination, faster reaction times, and ultimately, more lives saved.

One of the major issues in Industry Canada's decision will be coordination or harmonization with US frequencies. The US band plan, meaning the separation of channels for most of the 700 MHz Band, was developed for the US market between 2002 and 2008, based around 6 MHz and 11 MHz channel widths. The problem with this is current wireless devices using the 3rd Generation Partnership Program (3GPP) standards, and the soon-to-be-introduced fourth generation (4G) standards, operate in 5 and 10 MHz channels. As a result, small portions of bandwidth will not be effectively used. Industry Canada must decide if the Canadian 700 MHz Band plan reflects the US plan or is optimized to limit wasted bandwidth. There are significant

economies of scale to be achieved if the US band plan were adopted in Canada, as the North American market could benefit from larger quantities, and therefore similar and lower-cost equipment. However, the US band plan, in addition to the ineffective use of some spectrum, will likely result in interference issues between adjacent channels. Modification options to the Canadian band plan are being considered that harmonize with the US plan to capitalize on the economies of scale, but limit interference and maximize use of the entire spectrum. Another option looks to harmonize with the Asia-Pacific Telecommunity (APT) band plan, which splits the entire band in half, with receive channels in the lower half and transmit channels in the upper half. Although this option is highly flexible, it limits interoperability with the US, which, as all expect, will be a significant factor in the final decision.

In addition to deciding on how to divide the 700 MHz spectrum, Industry Canada will decide whether to designate two 5 MHz channels (10 MHz) or two 10 MHz channels (20 MHz) for public safety use, or auction off the entire band to communications companies who would then lease back special services to public safety organizations. The preferred option from a public safety point of view is, of course, the two 10 MHz channels, as this will provide more bandwidth and therefore higher capacity services than the 5 MHz channels. The two 10 MHz channels also allow for expansion and introduction of future technologies in broadband services, and interoperability of a variety of mobile devices compliant with the 3GPP and 4G standards.

During most emergencies or crisis situations, the local communications infrastructure will essentially be overloaded by the media, the public, and many other interested parties not associated with the emergency management or public safety effort. Since all emergency services' communications and information systems are

now run on a net-centric or network-reliant infrastructure, public safety and emergency management authorities need to find ways to mitigate the effects of system overload. Even though 10 or 20 MHz of frequency space would not be adequate as the sole means to provide voice and data services for an entire emergency response, it could provide a dedicated means for critical information exchange that would not be affected by media or public demands for bandwidth. However, one of the considerations in the decision to designate spectrum for public safety is the effective use of the bandwidth.

In large urban areas, the entire bandwidth of either 5 or 10 MHz channels will very likely be used most of the time for the daily operations of police, fire, ambulance, and other essential services. In rural or smaller urban areas, however, it is understood that the requirement for public safety channels would mainly occur during a relatively large-scale emergency or crisis situation, thereby leaving those channels unused most of the time.

If you are with a communications company, you would probably feel it is best that your firm own the licences for these frequencies in order to provide additional services to rural areas but allow priority access and pre-emption services to public safety agencies during an emergency. If you are with a public safety organization, this may not be preferable, as the special priority services offered by these companies may not meet the emergency requirements. For instance, priority access privileges to a network mean that a call or data transfer request gets moved to the front of the queue to access the network, and anyone who is already on the network remains so and is not affected until they end their call. Pre-emption services, which cut off lowest priority callers in favour of highest priority callers, are also problematic as this service comes at a premium and is primarily meant for high-ranking individuals such as the Chief of the Defence Staff, chiefs of police, or senior officials.

Managing pre-emption services for an entire headquarters or multiple operations centres across government departments is something the communication companies can not yet handle, or may not be willing to undertake due to contracts or network availability agreements with their other clients. If EMOs or public safety authorities are designated as the licence owners of the channels, they will most likely investigate public-private partnerships for effective use of frequencies when not required for emergency management; however, the control of access and activation of emergency measures for those specific channels remains with the government or emergency management authority.

Although not a highly visible or well-understood topic by most, the decision on the 700 MHz spectrum may have a significant and long-term effect on the safety and security of Canadians. All consultations submitted to Industry Canada for this topic are available for public viewing on the department's website. Many people in the public and private sectors now wait anxiously for the final decision. ■

Major (Maj) Patrick J. Hovis is a Reserve Army signals officer currently serving as the J6 Plans at Canada Command Headquarters. Maj Hovis joined the Reserves as an infantryman in 1991, and transferred to the Communications Reserve, under the Reserve Entry Scheme for Officers (RESO) program, in 1997. He has served as a staff officer in Director Knowledge and Information Management (DKIM), Canadian Forces Information Operations Group (CFIOG) Headquarters, Deputy Chief of Staff, J3 Information Operations, Canadian Expeditionary Forces Command (CEFCOM) J5 Information Operations, and Director Information Management Engineering and Integration (DIMEI). Maj Hovis has also been deployed to Operation PALLADIUM and recently to Operation CROCODILE.

Abbreviations

3GPP	3rd Generation Partnership Program
4G	fourth generation
CF	Canadian Forces
EMO	emergency management organization
MHz	megahertz
US	United States