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Radio Systems Policy

# **Policy Principles for Public Safety Radio Interoperability**

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## 1. Intent

This document is published to facilitate radio interoperability in the development and deployment of public safety radiocommunication systems. The intent of this policy is to (a) provide definitions of radio interoperability and other associated terms; (b) outline certain radio technology solutions; and (c) describe Industry Canada's policy principles with respect to facilitating and enabling radio interoperability. The Department will use this document when considering radio spectrum intended for public safety use.

## 2. Introduction

Public safety agencies rely heavily on the ability to communicate with each other by radio, or to be interoperable, in planned and unplanned situations and emergencies. In recent years, the need for radio interoperability has been identified in the public safety community.

The issue of radio interoperability is a broad and complex matter. Technology is critical for improving radio interoperability; however, it is not the only element required for interoperable communications. Developed with practitioner input by the U.S. Department of Homeland Security's SAFECOM program,<sup>1</sup> the Interoperability Continuum identifies five crucial success elements that must be addressed to achieve a sophisticated interoperability solution: governance, standard operating procedures (SOPs), technology, training and exercises, and usage of interoperable technologies.<sup>2</sup>

Industry Canada has a legislative mandate to ensure the orderly development and efficient operation of radiocommunication. In this policy, the Department will address the issue of radio interoperability as it relates to the area of technology, including radio frequency/spectrum issues.

Historically, many law enforcement, fire and emergency medical agencies across Canada have deployed customized public safety radiocommunication systems using various equipment standards that provide local or limited regional coverage. Furthermore, public safety radio systems have been deployed across a range of frequency bands from 150 to 800 MHz, with few radios being able to operate across the entire range. This diverse and complex communications infrastructure for the public safety community creates additional challenges for the other elements of interoperability, namely, governance, standard operating procedures for the different types of usage situations, training of personnel, and exercises to ensure full functionality. Success in these elements is essential to the proper use and implementation of technology.<sup>2</sup> However, they are not related to spectrum management and come under the responsibility of the user and other government departments or levels of government. Consequently, this document does not address these elements.

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<sup>1</sup> SAFECOM is a communications program of the Department of Homeland Security. SAFECOM provides research, development, testing and evaluation, guidance, tools and templates on interoperable communications-related issues to local, tribal, state and Federal emergency response agencies.

<sup>2</sup> U.S. Department of Homeland Security, *Interoperability Continuum - A tool for improving emergency response communications and interoperability*, <http://www.safecomprogram.gov/SAFECOM/interoperability/default.htm>.

### 3. Background

The Department has worked with the public safety community over the past years to improve radiocommunication for public safety agencies. In this regard, it has sought to address radio interoperability, open equipment standards, and access to spectrum resources in new bands. In May 1990, the band 821-824/866-869 MHz was designated solely for public safety use in Spectrum Utilization Policy 30-896, Part I, ([SP 30-896, Part 1](#)), *Spectrum Allocation and Utilization in Certain Bands in the Range 30.01-896 MHz*. In addition, Standard Radio System Plan 502 ([SRSP-502](#)), *Technical Requirements for Land Mobile and Fixed Radio Services Operating in the Bands 806-821/851-866 MHz and 821-824/866-869 MHz*, outlines five channels that were identified for use on a shared basis by organizations in Canada and the U.S. for the purpose of mutual aid. These five channels were required, by authorization and equipment certification, to use the Continuous Tone-Coded Squelch System (CTCSS), a barely audible 156.7 Hz tone transmitted during voice communications, to ensure public safety agencies had the capability for national and cross-border communications.

Canada Gazette Notice [DGTP-004-05](#), *Proposals and Changes to the Spectrum in Certain Bands Below 1.7 GHz*, indicated that the band 220-222 MHz was intended for radio applications such as public safety, railway and utility telemetry operations. Standard Radio System Plan 512 ([SRSP-512](#)), *Technical Requirements for Land Mobile and Fixed Radio Services Operating in the Band 220-222*, identifies 15 channels that are available for mutual aid.

With the modernization of radiocommunication infrastructures, new spectrum has become available to address some critical public safety needs. For example, the transition to digital television has created an opportunity to open exclusive priority spectrum in the 700 MHz band for public safety use. For more information, consult Standard Radio System Plan 511 ([SRSP-511](#)), *Technical Requirements for Land Mobile Radio Services Operating in the Bands 764-770 MHz and 794-800 MHz*. Within the designated spectrum, specific channels were identified for use by organizations in both Canada and the U.S. on a shared basis for the purpose of interoperability. These channels are required, by authorization and equipment certification, to use the Project 25 set of standards.

In July 2004, the Department updated Spectrum Utilization Policy 3-30 GHz ([SP 3-30](#)), *Revisions to Spectrum Utilization Policies in the 3-30 GHz Frequency Range and Further Consultation*, designating the band 4940-4990 MHz for fixed and mobile systems in support of public safety. The details of the spectrum policy, eligibility, technical and licensing provisions to allow early implementation by public safety agencies of critical broadband systems in the band 4940-4990 MHz, are specified in Spectrum Utilization Policy 4940 MHz ([SP 4940 MHz](#)), *Spectrum Utilization Policy, Technical and Licensing Requirements for Broadband Public Safety in the Band 4940 MHz*. In this policy, the Department recognized that, in order to allow radio interoperability between public safety agencies, consideration must be given to planning, coordination, standards, technology and spectrum requirements. As a result, applicants are required to submit to the Industry Canada district director, a radio interoperability plan that includes agencies operating within their jurisdictional area, as well as those in overlapping or adjacent jurisdictional areas.

### 4. Consultation

In June 2006, the Department released a consultation paper to seek comments on proposed guidelines that outlined definitions and different levels of radio interoperability between public safety agencies. In addition, the paper proposed methods that the Department may use to ensure the capability of public

safety systems to meet the appropriate level of radio interoperability (see *Canada Gazette Notice SMSE-005-06*). The Department received 19 responses. Many commended the Department for making radio spectrum available to public safety and for its interest in fostering radio interoperability measures.

The majority of responses indicated general support for the definitions proposed by the Department. Most respondents also suggested that the Department should recognize and take into consideration the other professions not normally associated with the first responder community, such as transportation (air, rail and road), public utilities, radio amateurs, environmental agencies, customs and immigration.

The responses generally indicated that the “levels” proposed in the paper were an indication of the various technical options/methods to facilitate radio interoperability. Most did not agree that the levels fit within a particular hierarchy of increasingly better capabilities. Many noted that each level had its own benefits and deficiencies, depending on the operational requirements and the situation. Concern was expressed that a hierarchical system could be used to mandate specific interoperability solutions without giving consideration to the technical, operational or financial impacts of such mandates.

With respect to implementing radio interoperability guidelines, seven substantive comments were received concerning this question. These respondents agreed that the general approach of requiring the radio systems/equipment to demonstrate a capability of meeting a prescribed level of radio interoperability through a condition of authorization, as outlined in Option 3 of the consultation paper, was worth pursuing further. The respondents also noted that the level of radio interoperability that a system must meet for new spectrum should be established in consultation with the public safety community. Some noted that the specified level may not meet the operational needs of particular agencies in every given situation and/or may place a burden on the public safety agency. Therefore, the Department was cautioned that any form of guidelines or provisions in the rules should be flexible and that consideration should be given to the technical, operational, geographic and financial matters.

Subsequent to the consultation, the Department participated at many meetings of the Canadian Interoperability Technology Interest Group (CITIG), a group dedicated to furthering Canadian public safety interoperability. With the support of Public Safety Canada, this group is facilitating the development of the Canadian Communications Interoperability Plan (CCIP). Taking this into account, the Department considers it timely to release its policy principles on this subject.

## **5. Definitions**

### **5.1 Public Safety Definitions**

The Department defines the term “public safety” as services or applications related to the preservation of life and protection of property. This definition is consistent with descriptions used in previous policy and technical standards related to public safety.<sup>3</sup> The Department further defines the categories of users or agencies that may be eligible for licensing in designated public safety spectrum as follows:

Category 1 – police, fire and emergency medical services;

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<sup>3</sup> Spectrum Utilization Policy 30-896 MHz, Part 1, *Spectrum Allocation and Utilization in Certain Bands in the Range 30.01-896 MHz* (Part 1), May 1990; Standard Radio System Policy 502, Issue 4, *Technical Requirements for Land Mobile and Fixed Radio Services Operating in the Bands 806-821/851-866 MHz and 821-824/866-869 MHz*.

Category 2 – forestry, public works, public transit, hazardous material clean-up, border protection,<sup>4</sup> and other agencies contributing to public safety; and

Category 3 – other government agencies and certain non-government agencies or entities.

The term “public safety agencies” generally refer to Category 1 and 2 collectively. That is, Category 1 and 2 agencies generally support the principle of preserving life and protecting property. Category 3 agencies may not be directly related to the preservation of life and protection of property. The Department may amend the above categorization of users through a future public consultation.

The hierarchy of agencies, as described by the categories above, is applied in the radio licensing process to outline priority access to spectrum designated or made available for public safety use.

The Department also encourages public safety agencies to establish network-sharing partnerships to increase efficiencies and facilitate interoperability. These partnership agreements for shared systems are generally at the discretion of public safety agencies.

## 5.2 Radio Interoperability Definitions

When discussing public safety radio interoperability, the Department will refer to the following definitions and associated terms:

***Radio interoperability:*** *The capability of a public safety agency to communicate by radio (either directly or via a network) with another public safety agency, on demand (planned and unplanned) and in real time.*

The communications link may involve any combination of mobile radio terminals and fixed radio equipment (e.g. repeaters, dispatch positions, data resources). The points of communication are dependent on the specific needs of the situation and any operational procedures and policies that might exist between the agencies involved. The communications link may be classified as either of the following two types:

***Infrastructure independent:*** *The communications link occurs between mobile radio terminals over a direct radio frequency path. An example is portable-to-portable tactical communications at the scene of an incident.*

***Infrastructure dependent:*** *The communications link requires the use of equipment other than mobile radio terminals for the establishment of the link and for complete operation. Some examples include a communications link in which a repeater station is deployed; a communications link which provides full system coverage for a visiting mobile radio terminal within a host-trunked radio system; or a communications link which provides interconnectivity between two or more otherwise incompatible radio systems, by bridging the radio signals and/or appropriate signalling functions at some central point.*

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<sup>4</sup> Since the creation of Public Safety Canada (PSC), customs among other functions are the responsibility of the Canada Border Services Agency (CBSA). Consequently, the descriptor has been changed to reflect the mandate of CBSA.

To be radio interoperable, the communications link, whether infrastructure dependent or independent, must satisfy one or both of the following radio interoperability characteristics:

***Multi-jurisdictional:*** *Wireless communications involving agencies that have different or overlapping geographical areas of responsibility. Some examples include a fire agency from one city communicating with a fire agency from another city; federal or provincial police forces communicating with a city police force; and the federal police force communicating within its divisional offices in another province or with a police force in the United States.*

***Multi-disciplinary:*** *Wireless communications involving two or more different agencies. Some examples include a police agency communicating with a fire agency and a parks agency communicating with an emergency medical services agency.*

In addition to the multi-jurisdictional and multi-disciplinary radio interoperability characteristics, the Department recognizes that there are different operating environments for public safety that impose different requirements on the use of public safety applications and therefore on the spectrum required.

#### ***Radio Interoperability Operating Environments:***

- *day-to-day operations*
- *planned events*
- *large unplanned events and disaster relief operations*

## **6. Radio Interoperability Technology Solutions**

There are generally five identifiable technological means for inter-agency communications by radio:<sup>5</sup>

- (i) exchanging (swapping) radios
- (ii) using gateways between independent systems
- (iii) sharing channels
- (iv) sharing proprietary systems
- (v) sharing standards-based systems

The radio interoperability technology solutions listed in this section will provide a “toolbox” for the Department to consider when establishing policy, licensing and/or technical conditions for future public safety spectrum use. The items are equally valid as technological means for inter-agency communications, and future consultations may provide other solutions. These technology solutions are also applicable to private systems, public carrier and other commercial systems, the terrestrial component of satellite systems, or drop-in type infrastructures that provide radiocommunication for public safety applications.

These items do not address other non-spectrum management-related issues of radio interoperability, such as governance and funding, standard operating procedures, training and exercises, and usage. These come under the responsibility of the user and other government departments or levels of government.

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<sup>5</sup> Hawkins, Dan. *Law Enforcement Tech Guide for Communications Interoperability, A Guide for Interagency Communications Projects*, U.S. Department of Justice, Office of Community Oriented Policing Services, 2006, p. 29.

The Department intends to encourage and is open to other technology approaches that can provide a greater level of radio interoperability between public safety users.

### **6.1 Exchange Radios at the Incident Scene/Guest Radio provided by Host**

Personnel from different agencies exchange user radio equipment when they arrive at the incident site. One agency may provide all responders from various agencies with a radio. Personnel would most likely use these radios for basic communications with the other responders.

### **6.2 Gateway/Network**

Two separate radio systems are interconnected by deploying a capability that receives a transmission on one radio system and retransmits it on a different radio system on the same frequency band or on a different frequency band. The architecture can range from simple mobile repeaters to complex gateway communications systems. Existing infrastructure, such as the Internet or the public switched telephone network (PSTN), may also be leveraged.

### **6.3 Shared Channels with a Common Standard**

Shared frequencies with a common standard are used for direct communications between user radio equipment. Radio equipment may be certified in accordance with a common technical standard for these channels. Such channels, sometimes referred to as “mutual-aid channels” or “interoperability channels,” can be shared between multiple jurisdictions or disciplines.

### **6.4 Shared Systems (Proprietary or Standards-based)**

Shared systems involve the use of a single radio network/system infrastructure to provide multi-disciplinary and/or multi-jurisdictional service in a given area. In a proprietary shared radio network/system, all users must use the same technology. Common standards-based shared systems provide the ability for multiple systems to directly interconnect, or allow user radio equipment direct access to a host system.

## **7. Policy Principles to Facilitate Radio Interoperability**

The Department has studied the radio interoperability situation in several frequency bands to understand how to facilitate a more coordinated approach to achieve spectrum efficiency, promote radio interoperability and ensure the orderly development of radio facilities for public safety. It is generally recognized that the most effective way of achieving radio interoperability, as described in Section 6.4, is the use of common standards-based radio systems by all public safety agencies in the broadest geographical area, whether these systems are owned by the public safety agencies or provided by service providers on contract. Although this may be seen as ideal, it is not always feasible, considering the vast array of public safety agencies and their different operational, security and geographic requirements.

Based on the body of comments to the Department through various consultations and forums, the Department concludes that it is appropriate to establish suitable benchmarks to encourage public safety agencies to consider radio interoperability at the planning stages of their radio systems. Furthermore, the Department expects that there will be radio interoperability requirements for any new spectrum for

public safety. Therefore, any spectrum to be designated or made available<sup>6</sup> for public safety use will be authorized with specific licensing and/or technical conditions to enable radio interoperability. The Department further expects radio networks/systems and/or equipment intended for use in this spectrum to be capable of meeting an appropriate radio interoperability requirement. This radio interoperability requirement will be established through consultation for the specific spectrum in question.

For the above reasons, the Department is establishing the following principles:

- specific radio interoperability requirements for the spectrum to be designated or made available for public safety use will be established through public consultation;
- use of radio spectrum by public safety is subject to demonstrating that the proposed radio system/network and/or equipment is capable of meeting established radio interoperability requirements set forth in the appropriate standards (e.g. Standard Radio System Plan or Radio Standard Specification); and
- the definition of public safety and the categorization of users, as described in Section 5.1, will be used to outline priority access for the spectrum to be designated or made available for public safety use.

## **8. Implementation**

Recognizing the need for flexible standards and the goal to promote and facilitate public safety interoperable radiocommunication, the Department will apply the following process:

- (a) When spectrum is to be designated or made available for public safety,<sup>6</sup> the Department will consult on the radio interoperability requirements of public safety for this spectrum.
- (b) The consultation should address which radio interoperability technology solution (as described in Section 6) is appropriate to facilitate the radio interoperability requirements within the spectrum in question. For technology solutions described in sections 6.3 and 6.4, the consultation should also address, but need not be limited to, the appropriate technical standard, if required, and whether the standard applies to the system/network infrastructure or to the user equipment, or both.
- (c) From the responses to the consultation, the Department will determine the radio interoperability requirements that the radio network/system or equipment must be capable of meeting or implementing in the spectrum.

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<sup>6</sup> This may include spectrum already in use by public safety where there is a requirement to improve radio interoperability.

(d) This radio interoperability requirement and related information may become a condition of radio authorization and/or may be included in applicable and relevant departmental documents.<sup>7</sup>

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<sup>7</sup> Relevant Industry Canada documents to describe a condition of authorization could include the licence with an applicable statement, a Standard Radio System Plan (SRSP) or a Radio Standard Specification (RSS).