District of North Vancouver
Fire and Rescue Services
2410 Dollarton Highway
North Vancouver, BC V7H 2Y1
DNV.org/fire

DNVFRS - IN-BUILDING ECOMM RADIO AMPLIFICATION SYSTEMS GUIDELINE SUMMARY

Contents

District of North Vancouver Requirements

In-building radio communication systems in the District of North Vancouver are a new requirement for buildings whose construction will cause issues with radio communication for Emergency Responders.

In general, buildings that will impede radio communication include buildings of large area, underground parkades more than 1 level, buildings comprised of concrete and metal structure, and buildings using large amounts of reflective glass. Smaller buildings of wood frame construction with only a single level of underground parking will usually not require any type of radio amplification system.

This document is a work in progress in an effort to assist designers with the process of designing and installing radio systems that enhance the ECOMM radio network. Ensure that you have the latest version before you start your new system design.

All designers must use the latest copies of NFPA 72 “National Fire Alarm Code”, NFPA 1221 “Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems” as a guideline and obtain current copies of all applications and references provided as samples in this document. All attached samples are not documents of the District of North Vancouver and must be sourced from their original creators.

The in-building radio amplification system shall substantially comply with the latest version of NFPA 1221.

Systems installed in the District of North Vancouver must include the following features:

- Installed and approved under a District of North Vancouver electrical permit
- Complies with the most current version of “Technical Specification for In-building Coverage Enhancement System for the E-Comm Public Safety Wireless Network” provided by E-Comm BC
- Active components (e.g. Amplifiers) shall have:
    - NEMA 4 enclosures
    - All amplifier trouble and alarms signals required by NFPA 1221 connected to:
        - The building fire alarm panel for monitoring
- Uninterruptible Power Supply (UPS)
    - CapaDistrict to support the system for 12 hours
    - If the building contains an emergency generator, the battery charger (only) for this system shall be connected
    - UPS trouble signals and alarms required by NFPA 1221 shall be connected to:
        - The building fire alarm panel for monitoring
- A radio system annunciator shall be provided.
    - This can be either a stand-alone panel compliant with NFPA 1221,

OR

- The radio system graphic annunciation may be included on the fire alarm system graphic annunciator if it conforms to the requirements below and is delineated from the rest of the items on the annunciator as shown in figure 1.
    - labeled as “Radio System Status” and including 3 indicator lights and accompanying text (see figure 1) which shall operate as follows:
    - Green (SYSTEM OK): Illuminated when there are no radio system trouble or alarm signals only
    - Yellow (TROUBLE): Illuminated when there is a main AC power or battery charger failure
    - Red (FAIL): Illuminated for all other trouble or alarm signals indicating immediate system failure or low battery capaDistrict

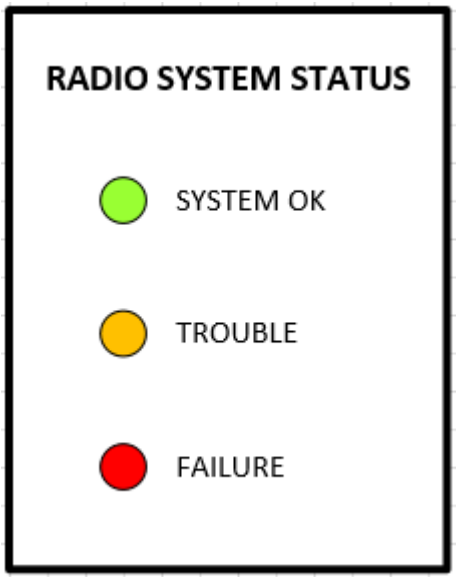

Figure 1: Radio System Annunciator Design

- Design and installation signed off by a registered engineer with radio system design experience (also an ECOMM requirement)

- System description and maintenance requirements added to the Fire Safety Plan for the building (submit proposed content to FireSafetyPlans@dnv.org)

- Licenced with Innovation Science and Economic Development Canada (requires DNV Fire Dept. and ECOMM acceptance)

E-Comm Requirements and Acceptance Process

(This information provided by ECOMM)

#	Document	Comment
1	Application email	Send an email to engineering.services@ecomm911.ca containing a completed copy of the attached authorisation request form.
2	Tracking Number	An automated tracking number is generated and sent back to the requester. This tracking number should be referenced on all subsequent correspondence.
3	Application for Licence to Install and Operate a Land Mobile Station in Canada	The BDA contractor or building owner applies for an Innovation Science and Economic Development Canada (ISED) license. E-Comm requires a copy of the ISED application form. If we have the ISED license application form, we can reference it in our authorisation letter. There have been cases where ISED comes back to us asking for clarification because they don't know which application to associate our authorisation to.
4	BDA Design Package	Once the BDA has been designed, a copy of the full design should be sent to E-Comm at the same mailbox as above.
5	BDA Test Package	Required. The test package should include: A copy of the test plan / report Radio Coverage signed off letter from the District Fire Department. Engineering Certification (Assurance of professional field review and compliance)
6	E-Comm issues Authorisation letter	E-Comm reviews the test report and design. If everything is satisfactory, then we issue a authorisation letter back to the BDA contractor or BDA authorisation requestor and copy ISED in the letter
7	IC issues grant	ISED references our letter back to the application identified in step 3 above and issues the official grant / license to operate. BDA contractor sends a copy of the grant back to-E-Comm so we can close the file.

Useful Links:

Innovation Science and Economic Development Canada (ISED)
https://sms-sgs.ic.gc.ca/eic/site/sms-sgs-prod.nsf/eng/home

Steps for Designing an In-Building Radio Amplification System in the District of North Vancouver

1. Submit a completed E-Comm Application form (see sample at the end of this document) to engineering.services@ecomm911.ca. The form is only available from E-Comm.
   A Tracking number will be assigned by E-Comm for this project, keep this for future correspondence.
2. Submit a completed Innovation Science and Economic Development Canada (ISED) "Application for Licence to Install and Operate a Land Mobile Station in Canada". This license is a federal requirement for all radio systems including in-building amplifiers and has nothing to do with the District of North Vancouver. There is a link to the relevant web site in the previous section of this document.
3. Design your system.
4. Submit the complete design information to North Vancouver District Fire Department at FireSafetyPlans@dnv.org.
   Ensure that all the requirements mentioned in this document have been covered. The purpose of this review is to ensure that the system complies with all the requirements of the DNV Fire Department.
5. Once approved, submit the complete design information to E-Comm for review at engineering.services@ecomm911.ca. Include your tracking number. The purpose of this review is to ensure the system will not interfere with the E-Comm radio system.
6. Obtain an electrical permit to install the system, unless covered by an existing permit.
7. Install the system.
8. Perform testing on the system, ensuring coverage is in compliance with the E-Comm document "Technical Specification for In-building Coverage Enhancement System for the E-Comm Public Safety Wireless Network"
9. Submit the test plan and coverage results to the North Vancouver District Fire Department at FireSafetyPlans@dnv.org. Also include a letter of assurance from a professional engineer with radio system design experience certifying that the system is installed and working as per the design and in compliance with "Technical Specification for In-building Coverage Enhancement System for the E-Comm Public Safety Wireless Network.
10. The North Vancouver District Fire Department will visit the site and do a functional test on the system using E-Comm radios. If the electrical permit has been signed off and everything is in compliance you will receive a letter confirming our acceptance of the system.
11. Submit information from #9, plus the letter from #10 and your tracking number to E-Comm at engineering.services@ecomm911.ca, for review. Once accepted E-Comm will send an approval email with a copy to ISED for approval of the radio system license.
12. Once you receive the ISED license, send a copy to the building owner and also E-Comm at engineering.services@ecomm911.ca to close the file. The license must be posted with the amplifier where it can be checked during the annual Fire Inspection.

Fire Safety Plan Information

Building owners will likely know little or nothing of the in-building radio communication system. It is very important that information is provided by the designer, installer, and fire alarm tech to ensure that the system design and maintenance information is available for the life of the building. This information must be added to the building's Fire Safety Plan. It is the responsibility of the building owner to provide this information, which is required by the BC Fire Code.

Sample Text: (All this text should be modified to match exactly what is in the building)

Description
This building contains a 700MHz public safety radio amplification system which enables the use of Fire Department, Police, and Ambulance ECOMM radios inside this building.
This system must be tested by a qualified radio technician annually to ensure proper operation.
Copies of the system design and acceptance test documents, and all annual testing reports must be kept with the amplifier on site for reference.

Coverage Areas
[P1, P2, Stair 1, …]

Amplifier(s)
[Brand] [Model #] [Description]

Trouble Signals provided on the radio system graphic annunciator, and monitored by the Fire Alarm Panel
-Antenna Failure
-Amplifier Failure
-System Component Failure
-AC Power Loss
-Low Battery (<30% Capa District remaining)
-Radio System Low Battery
-Radio System Failure

Backup Battery System
Overall system run time on battery power only [00] hrs[00] mins
Battery type: [Chemistry]
CapaDistrict (each): [xxx] Ah
Number of Batteries [x]

Donor Antenna
[Brand] [Model #] [Description]
Orientation: [000] Degrees
Elevation: [00] Degrees
Incoming ECOMM Signal (amplifier input): Frequency [000.0000]MHz Strength [00]dBm
Maximum Amplifier Gain: Incoming: [0.0] Outgoing: [0.0]

System Maintenance

The in-building public safety radio amplification system in this building must be tested annually to ensure reliable operation. Tests must be made by a qualified technician with radio system experience acceptable to the fire department.

Tests on the system in this building must ensure that:

- Antennas and cabling are in place and not damaged
- The donor antenna is aligned correctly
- Batteries can provide system operation in the absence of power for at least 24 hours
- Trouble signals are annunciated at the Fire Alarm panel
- Innovation Science and Economic Development Canada License is posted at the amplifier
- The system performs as designed

Signal strength at the time of installation inside Stair 1, with all stairwell doors closed, at the P2 parking level:
Frequency [000.0000]MHz Strength [00]dBm +/- [00]dBm

Any issues found with the system must be repaired as soon as possible. If repairs cannot be made within 1 day, the North Vancouver District Fire Department must be notified that the system is out of service.

Important Note: ***All requirements in this guideline must be met in full and must also comply with the District of North Vancouver Fire Bylaw No. 8514.***

Contact Information:
DNVFRS Public Safety Division – 604-980-7575 or firecom@dnv.org
Building Department – 604-990-2480

Sample Application Forms and Documents

- ECOMM Application Form
- Innovation Science and Economic Development Canada License Application Form
- ECOMM “Technical Specification for Inbuilding Coverage Enhancement”

(See following pages)

E-Comm 9-1-1
Helping to Save Lives and Protect Property

BDA Authorization Application Form

Date of Application			
BDA Contractor Details			
BDA Contractor Company Name			
Contact Name			
Contact Email			
BDA Site Location Details			
BDA Street Address		City	
Latitude	00°00’00”N	Longitude	000°00’00”W
Building Name/Site Description			
Building Developer			
Building Property Manager			
Building Project Name			
BDA Design Details			
Commissioning Date			
Donor Site			
Frequency Band			
BDA Repeater Model			
Donor Antenna Model			
Coverage Antenna Model(s)			
Site Elevation			
Comments:			

Innovation, Science and Economic Development Canada | Innovation, Sciences et Développement économique Canada

Application Number	
◯ New	◯ Change
Account Number	
Licence Number	
Call Sign	

APPLICATION FOR LICENCE TO INSTALL AND OPERATE A RADIO STATION IN CANADA

In accordance with the provisions of the *Radiocommunication Act* and the Regulations made thereunder. LAND, SPACE and EARTH, ALL CATEGORIES except broadcasting, U.S.A. Military and Amateur.

• **Shaded areas for Departmental use only**

1. APPLICANT

COMPANY		
Company Name		
Contact	Year Incorporated	Where Incorporated

INDIVIDUAL
Family Name
Given Names

Language of Correspondence ◯ English ◯ French	◯ Radiocommunication Service Provider ◯ Radiocommunication Carrier ◯ Radiocommunication User	Telephone Number	Facsimile Number
Correspondence Address (Street, Post Office Box, etc.)		E-mail Address	
		Postal Code	

2. FIXED or TRANSPORTABLE STATION DETAILS (also complete the attached Preliminary Environmental Information form IC 2430)

Name of transmitter / receiver site			
Coordinate origins ◯ Topographic map (enclosed) OR ◯ Global Positioning AND ◯ NAD 27 OR ◯ NAD 83		Geographic coordinates of transmitter/receiver site ° ' " Latitude N	° ' " Longitude W
Address or legal land description		Province	
Name of general area of operation (transportable only)			
Geographic coordinates of centre of operational area (transportable only) ° ' " Latitude N	° ' " Longitude W	Approximate radius of operation from the centre (kilometres)	
Are there broadcast antenna structures within 2 kilometres of proposed site? If so, please list them separately. ◯ Yes ◯ No			

3. NATURE OF SERVICE (Taxi dispatching, construction, etc.)

4. FREQUENCIES AND OPERATION

Desired Transmit Frequency or Range	Desired Receive Frequency or Range	Necessary Bandwidth and Type of Emission	Stations (call signs) with which communication is desired. For Earth stations, indicate the satellite(s) and location.	Number of existing / new mobile stations associated with this frequency
A				
B				

5. PARTICULARS OF PROPOSED EQUIPMENT

		Name of Manufacturer	Type or Model	Frequency Range	RF Power Output Rating of Transmitter
A	Transmitter		From: To: MHz		watts
	Receiver		From: To: MHz		
B	Transmitter		From: To: MHz		watts
	Receiver		From: To: MHz		
C	Transmitter		From: To: MHz		watts
	Receiver		From: To: MHz		

6. ANTENNA SYSTEM DETAILS

		Manufacturer and Model of Antenna	Antenna Pattern	Antenna Gain (dB)	Type of Transmission Line and Length (metres)	Azimuth Main Lobe	Beamwidth	Polari-zation	Height of Antenna Above Ground (metres)	Height of Antenna Structure Above Ground (metres)	Ground Elevation Above Mean Sea Level (metres)
A	Transmitter										
	Receiver										
B	Transmitter										
	Receiver										
C	Transmitter										
	Receiver										

7. LIST TRANSMITTER - RECEIVER ANCILLARY COMPONENTS, i.e. ISOLATOR, DUPLEXER, CAVITY FILTER...

		Name of Manufacturer	Type or Model	Insertion Loss	Function
A	Transmitter				
	Receiver				
B	Transmitter				
	Receiver				
C	Transmitter				
	Receiver				

8. POWER COMPUTATIONS + RECEIVING SYSTEM LOSSES AND GAINS

		Transmitter Power (dBW)	Transmission Line Loss (dB)	Other losses, e.g. Duplexer, Cavity, etc. (dB)		Power into Antenna (dBW)	Apply Antenna Gain (dB) (See Section 6)	Effective Radiated Power (dBW)	Effective Radiated Power (watts)
				Connectors	Filter Components				
A	Transmitter								
	Receiver								
B	Transmitter								
	Receiver								
C	Transmitter								
	Receiver								

9. I certify that the statements made in this application are complete and correct to the best of my knowledge, that the radio equipment used is of a type certified for use in Canada and that the station(s) will be used only for the purposes authorized by the Minister of Industry and the Regulations made under the *Radiocommunication Act*. I further certify that I am eligible to hold a radio station licence and, if required, the antenna structure will be marked in accordance with the recommendations of Transport Canada.

Name (Print) _____ Applicant's Signature _____ Date (YYYY-MM-DD) _____

IT IS A PUNISHABLE OFFENCE TO MAKE A FALSE STATEMENT. PLEASE MAIL TO THE NEAREST DISTRICT OFFICE OF INDUSTRY CANADA.

Technical Specification for Inbuilding Coverage Enhancement System for the E-Comm Public Safety Wireless Network

For inbuilding enhancement systems, adequate radio coverage shall include all of the following:

(a) System access and "Delivered Audio Quality" (DAQ) of 3.4 or better (speech understandable without repetition, some noise or distortion may be present) for communication between a portable (handheld) radio using a simple flexible whip antenna ("rubber ducky") and E-Comm transmitting/ receiving sites:

(i) within the building, for a minimum of 97% of the area of each floor of the building, including underground areas such as for parking; and

(ii) within the building, for 100% of fire command centres, stairwells, protect-in-place areas, lobby refuge areas, equipment rooms and high-hazard areas

(b) As an aid to system design, DAQ 3.4 has been measured by NTIA (U.S. Department of Commerce, National Telecommunications and Information Administration) to be approximately equivalent to 22 dBs (22 dB SINAD) for analogue signals modulated with a 1 kHz tone at 1.5 kHz deviation, and to 2% BER (Bit Error Rate) for P25 digital signals. It may also be approximately equivalent to a received signal level of -109 dBm (0.8 microvolts across a 50-ohm load), in the absence of other signals that may affect the receiver. Good design should provide a margin of not less than 10 dB to allow for uncontrolled variables.

(c) The radio frequency range to be supported is 798-824 MHz (700 MHz and 800 MHz uplink to E-Comm base station receivers), 768-776 MHz (700 MHz downlink to portable radio receivers), and 851-869 MHz (800 Mhz downlink to portable radio receivers). If signal amplifiers are used, they shall include filters that will protect the amplifiers from overload and the system from interference of out-of-band signals. If "channelized amplification system" is used to provide the radio coverage inside the tunnel and stations, then there will be 10 RF channels (BW=12.5 kHz) in 700 MHz band and 16 RF channels (BW=25 kHz) in 800 MHz band, programmed in the Amplification System. Channelized amplification system is preferred over the wide band amplification system, since it does not "decrease" the power per carrier with more "in-band" carriers.

(d) The radio signal within the building/tunnel (provided by the Amplification System) should not interfere with the radio signal outside of the building/tunnel (provided by Ecomm radio site), since this would result in TDI (Time Domain Interference). Interference is defined as a degradation caused by the BDA operation which results in a requirement for an increase in E-Comm's signal-to-noise ratio of more than 3dB in areas outside the building.

Where a building or structure is required to provide an Amplification System to achieve adequate radio communication coverage, such system shall include any of the following that are sufficient to achieve the required coverage:

(a) Passive antenna systems or radiating cable systems;

(b) Internal multiple antenna systems with uni-directional or bi-directional amplifiers as needed;

(c) Voting receiver systems; or

(d) Any other system acceptable to E-Comm (such as those using H-VAC distribution), as signified in writing on a case by case basis.

If any part of the installed Amplification System contains an electrically powered component, the system shall be equipped to operate on an independent "Uninterruptible Power Supply" (UPS), using a battery and/or generator system, for a period of at least four hours without external input or maintenance. The UPS shall automatically charge the batteries in the presence of external power. The UPS shall provide a monitored alarm signal to indicate failure of primary power, failure of the UPS system power output, and/or discharge of the batteries. Silencing of this alarm shall be the responsibility of the person maintaining the equipment.

The amplification system (BDA) should be engineered, installed and tested by a qualified contractor and require Industry Canada licensing.