What is ERCES and why is it important?

BOABC Conference 2023

TESS ESPEJO
UL Solutions Canada

Speaker

Tess Espejo

Program Manager

Codes and Regulatory Services (CARS)

ULC Inc.

Background

- More than 20 years of experience on standards, codes, and project / program management
- 17 years with ULC Standards managing technical committees
- 2006 to 2019 – member of Standing Committee on Hazardous Materials and Activities (National Fire Code of Canada)
- 2019 to 2025 – member of Standing Committee on Fire Protection (National Building and Fire Codes of Canada)
- Honourary life member – Canadian Fire Alarm Association (CFAA) and member of CANASA, SFPE, CFSA, NFPA, CAFC Codes Committee
- Secretary and project manager, ISO International Workshop Agreement on safety, security and sustainability of cannabis facilities and operations (ISO IWA 37 in 2022)
- Vice Chair, ULC Advisory Council, ULC Security Council and ULC Advisory Group on S1001

Agenda

- Background / history / need
- ERCES in Codes and Regulations
- Canadianizing ERCES requirements
- Development of ULC/ORD-C2524

- ERCES Technology
- Binational UL ERCES Certificate program

Terminology

ERCES (Emergency Responder Communication Enhancement System) - A combination of **interconnected devices** including RF-emitting devices, antennas, cables, power supplies, control circuitry, installed in a location **to improve wireless communication at that location.**

Also known as…

- Bidirectional amplifier (BDA) / amplification system
- In-building radio enhancer
- In-building two-way radio communication enhancer
- Public safety radio building amplification system
- Two-way radio communication enhancement system
- Zone enhancer

Background, history and need

Background

- Resulted in the death of more than 400 first responders, 343 from the World Trade Center alone
- Revealed failure of communication systems during the response
- Responders from different departments / jurisdictions unable to communicate over various radio systems

History / need

Post 911

- NIST was funded by US Congress to conduct building and fire safety investigation
- Forty 40 code changes were adopted including:
  - Increased egress capacity
  - Stairway stability
  - Increased fire resistance for certain types of structural frames
  - **Improved radio coverage within building envelope**

NIST Recommendations

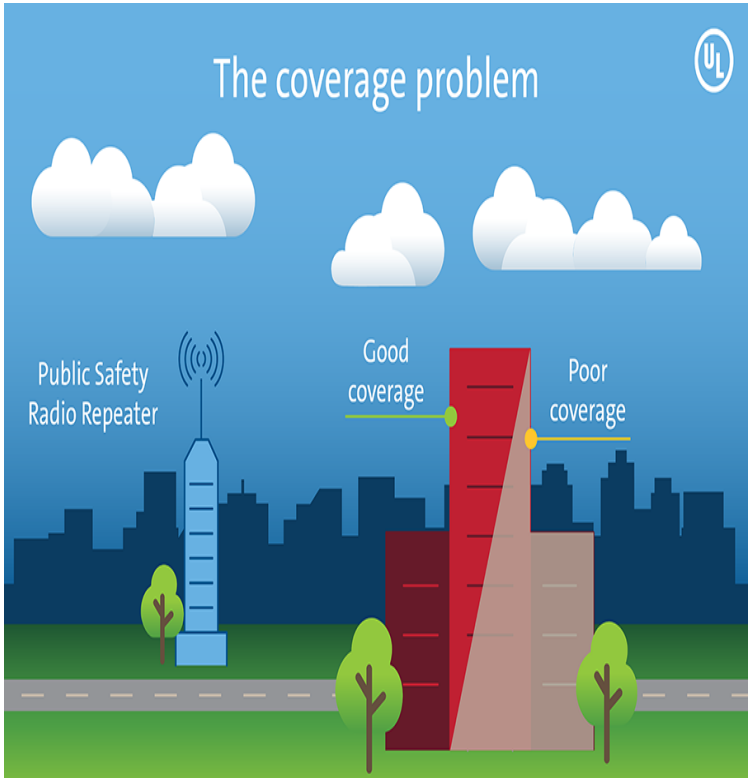
Installation, inspection and testing protocols to ensure that emergency radio communication systems:

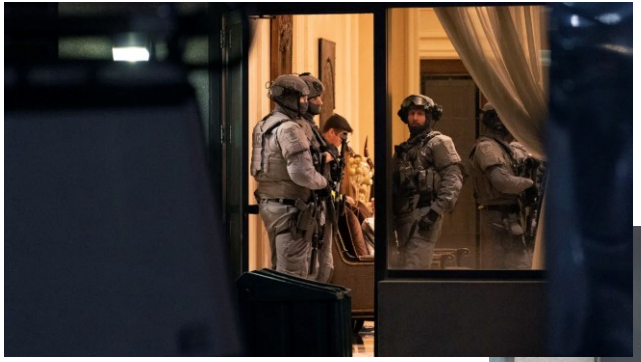
- are effective in and around buildings with challenging radio frequency propagation environment, due to:
  - construction elements such as concrete, rebar, e-glass, metal, sheetrock, energy-saving materials;
  - building configuration; or
  - location (underground, parking, stairwells) etc; and
- can be used to identify, locate, and track emergency responders within indoor building environments and in the field.

Thus… ERCES are Needed

Reliable communications are <u>essential</u> life-safety tools for firefighters and emergency responders!

- Ensures radio signals are able to penetrate into all areas of buildings regardless of construction elements and configuration
- Does not rely on alternate communication equipment or fixed locations for transmission (i.e., firefighters' telephone handsets)
- Current technology allows economical and reliable installation and maintenance of these systems





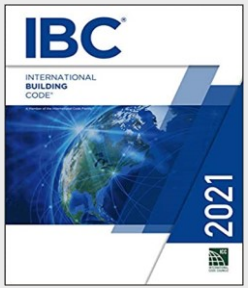

IRVING
POLICE


Tim Hortons

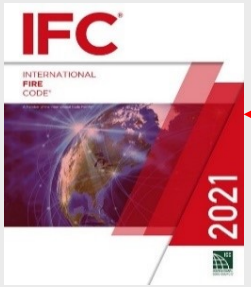
ERCES in Codes and Regulations

ERCES Requirements in US Codes

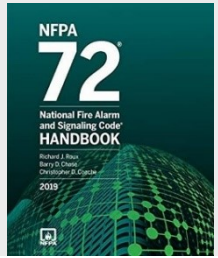
IBC



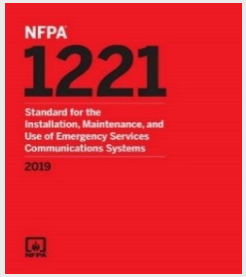
IFC ★ **NFPA 1** ★



NFPA 72



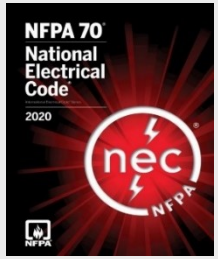
NFPA 1221



NFPA 1225

UL 2524

NEC



US Code requirements

- Covers new and existing buildings *(unless amended by adopting jurisdiction)*
- All buildings to have *approved* radio coverage level for emergency responders throughout the interior of the building at the same level as outside the building
- ERCES equipment, devices and component per ANSI/CAN/UL 2524
- References NFPA 72 and NFPA 1221 (1225) for design, installation and performance requirements
- Testing: acceptance testing, annual, 5-year and DAQ
- Monitoring (supervisory conditions)

ERCES in Canadian regulations

BC by-laws

- Burnaby
- Delta
- Langley
- North Vancouver
- Port Coquitlam
- Port Moody
- Surrey
- Vancouver
- Victoria
- West Vancouver
- White Rock
- *Kelowna*

Other jurisdictions

- Nova Scotia
- University of British Columbia

Other initiatives

- Alberta – Edmonton
- Nova Scotia
- Saskatchewan

Typical ERCES requirements in Canadian regs

- Applies to new or renovated buildings
  - permit construction >$1M
  - Gross area >5000 m^2 or >12m in height
  - Constructed of reinforced concrete, structural steel, metal cladding, reflective or low-emissivity glass
- Adequate radio coverage functioning with public safety communications service provider and city network
  - 3.4 Delivered Audio Quality (DAQ)
  - 90% of general floor area
  - 100% within fire command centers, stairwells, protect-in-place areas, equipment rooms, high-hazard areas, etc.
- Acceptance testing approved by AHJ; annual tests required

Delivered Audio Quality (DAQ) Levels

DAQ 1	Unusable, speech present but unreadable
DAQ 2	Understandable with considerable effort. Frequent repetition due to noise/distortion
DAQ 3	Speech understandable with slight effort. Occasional repetition required due to noise/distortion
DAQ 3.4	Speech understandable with repetition only rarely required. Some noise/distortion
DAQ 4	Speech easily understood. Occasional noise/distortion
DAQ 4.5	Speech easily understood. Infrequent noise/distortion
DAQ 5	Speech easily understood

Nationalizing Canadian ERCES Requirements

Canadianizing ERCES requirements

GOALS:

Nationalize local requirements and Canadianize existing US standards

OPTIONS:

1. Code Change requests to NBC, NFC
2. New standard on installation and servicing of ERCES
3. Standards revision
   - ➢ CAN/ULC-S573, Installation of ancillary devices connected to the fire alarm system
4. Develop ULC/ORD that will eventually be converted into a National Standard

Canadianizing ERCES requirements

1. Code Change Requests to NBC, NFC
   - 2030
2. New standard on installation and servicing of ERCES
   - 2029
3. Standards revision
   - CAN/ULC-S573, Installation of ancillary devices connected to the fire alarm system
     - Submitted, published in 2023
4. Develop ULC/ORD that will eventually be converted into a National Standard
   - Ongoing, published in 2023

Development of ULC/ORD-C2524

About ULC

- Established on August 15, 1920
- An independent third-party product testing, certification, inspection, testing and standards development organization
- Accredited by the Standards Council of Canada (SCC)
- Currently operates as two legal entities in Canada – Underwriters Laboratories of Canada Inc. (**ULC Inc.**) and **ULC Standards**
- Offices/labs in Toronto, Mississauga, Ottawa, Montreal, Edmonton and Vancouver

ULC LISTED HOMOLOGUÉ

ULC

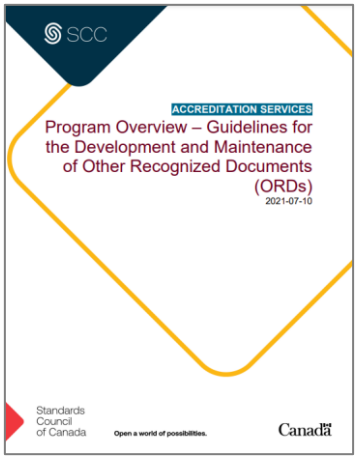
c UL US

UL Solutions

What is an ORD?

ORD – Other Recognized Document

- Document developed by SCC accredited certification body (CB)
- Intended to provide requirements for certification of products, processes and services in regulated areas
- Temporary, for development into Canadian Recognized Standard within 5 years by SCC accredited Standards Development Organization (SDO)
- Validated by Regulatory Authority Advisory Bodies (RAABs)
  - Acknowledge need for the ORD
  - Approve draft by ballot



Proposed ULC/ORD-C2524

TITLE:

Installation and Services for Emergency Radio Communications Enhancement Systems (ERCES)

BALLOTING RAABs: Council of Canadian Fire Marshals and Fire Commissioners (CCFMFC) and Canadian Advisory Council on Electrical Safety (CACES)

TIMELINE:

- 1st Working Draft submitted for comment to stakeholders on March 1, 2023
- 1st Official Draft for RAABs Ballot by **June 1**
- Intended Publication by September 2023

Features of proposed ULC/ORD-C2524

Scope:

- sets forth the minimum requirements for the **installation, operation, inspection and tests** applicable to Emergency Responder Communication Enhancement Systems (ERCES)
- intended to apply to both required and voluntary ERCES

Terms

- EMERGENCY RESPONDER COMMUNICATION ENHANCEMENT SYSTEM (ERCES) - A combination of interconnected devices including RF-emitting devices, antennas, cables, power supplies, control circuitry, installed in a location to improve wireless communication at that location

In Canada, there are various terms being used to refer to ERCES, including **in-building radio enhancer**, **bidirectional / radio amplification system, booster amplifiers, emergency radio amplification** or **zone enhancer**.

Features of proposed ULC/ORD-C2524

Terms

CRITICAL AREAS - Areas designated by the AHJ as essential for occupant and emergency responder life safety and should have the highest level of emergency responder radio coverage *(typically - fire command centres, protect-in-place areas, fire pump rooms, exit stairs, elevators, standpipe cabinets, areas of refuge, etc.)*

DAQ (Delivered Audio Quality) – A measure of speech intelligibility of Land Mobile Radio

Terms

DOWNLINK – The measurement of the signal from the donor site to the radio tower.

UPLINK – The measurement of signal from the radio tower site to the donor site.

NOISE FLOOR – The signal created from adding up all the unwanted signals within a measurement system.

General requirements

- Equipment in accordance with ANSI/CAN/UL 2524
- All system components - designed, installed, tested, inspected, and maintained per manufacturers' installation instructions and the ORD
- ERCES to be supervised by the fire alarm system in accordance with CAN/ULC-S573, Standard for Installation of Ancillary Devices Connected to the Fire Alarm System

Technical requirements

INSTALLATION

- Donor antennas
- Radio coverage
- Signal strength and quality
- Frequencies
- System Components

DOCUMENTATION – standardized forms

TESTING AND INSPECTION

- Initial acceptance testing
- Annual inspection and testing

Technical requirements

- Radio coverage as percentage of floor area*
  - Critical areas shall have 99% floor area radio coverage
  - General areas shall have 95% floor area radio coverage
- Minimum Delivered Audio Quality (DAQ) of 3.4
- Primary and secondary power source (12-hr)
- Acceptance testing
  - Testing personnel acceptable to the AHJ
- Periodic testing – annually and 5-years

Proposed revisions to CAN/ULC-S573

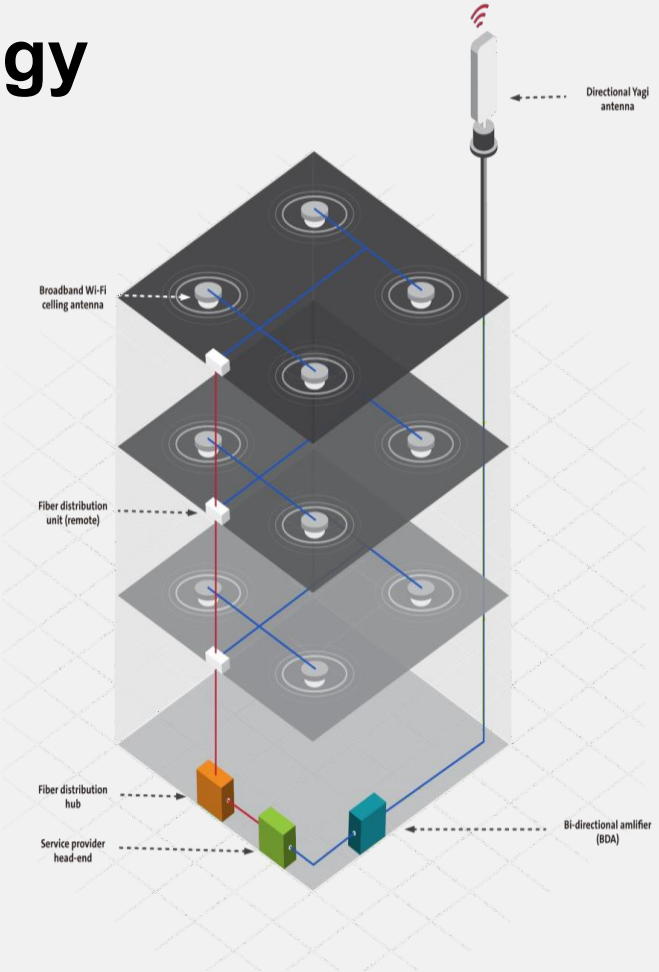
(Standard for the Installation of Ancillary Devices Connected to the Fire Alarm System)

- ERCES shall be supervised by the fire alarm system using compatible interface
- Conditions causing non-latching supervisory signal:
  - A Signal source malfunction;
  - B Active RF-emitting device failure;
  - C Low-battery capacity indication when 70% of the 12-hour operating capacity has been depleted;
  - D Active system component failure; and
  - E Any other fault conditions or trouble signals from the Emergency Responder Communications Enhancement System (ERCES).
- Power supply supervisory signals for each RF-emitting device and active system component:
  - A Loss of primary power supply;
  - B Failure of battery charger.
- The communications link between the fire alarm system and ERCES shall be monitored for integrity.
- Where authorized by the AHJ, a single supervisory input to the fire alarm system is permitted to monitor all system supervisory signals as required

ERCES – Available technology / Sample configurations

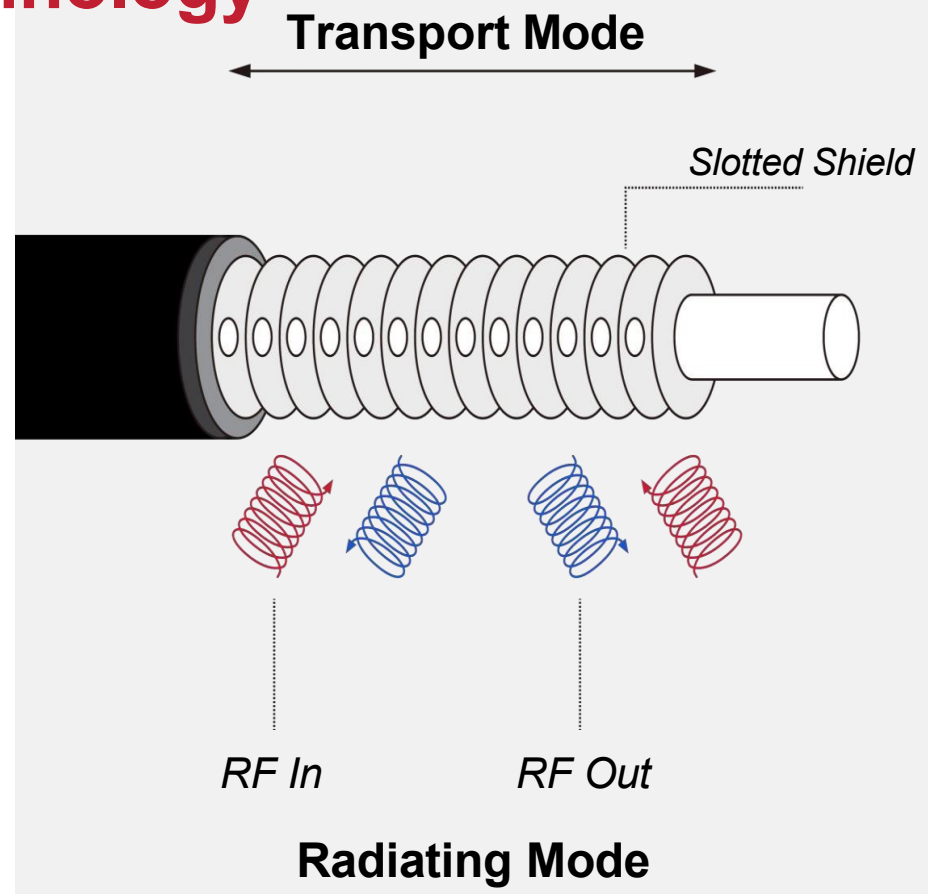
Overview of Available Technology

Distributed Antenna System (DAS)



Overview of Available Technology

Radiating Coax Cable / Leaky Cable



Emergency Responder Radio Coverage System

Engineered System of Antennas & Repeaters Capture, Re-Broadcast + Amplify Public Safety Radio Signal Inside

- ROOFTOP DONOR ANTENNA: Sends/receives signal from nearest Public Safety radio tower
- VERTICAL BACKBONE: Coax/ fiber cable connects active ERRCS equipment in Headend Room to Rooftop Donor Antenna + active equipment to passive components on each floor
- PASSIVE COMPONENTS: Omni-Directional Antennas, splitters, connectors, couplers + coax/ fiber cable distribute signal throughout the building
- ACTIVE EQUIPMENT: BDA, Battery Backup Unit + Alarm Panel located in ERRCS Headend Room

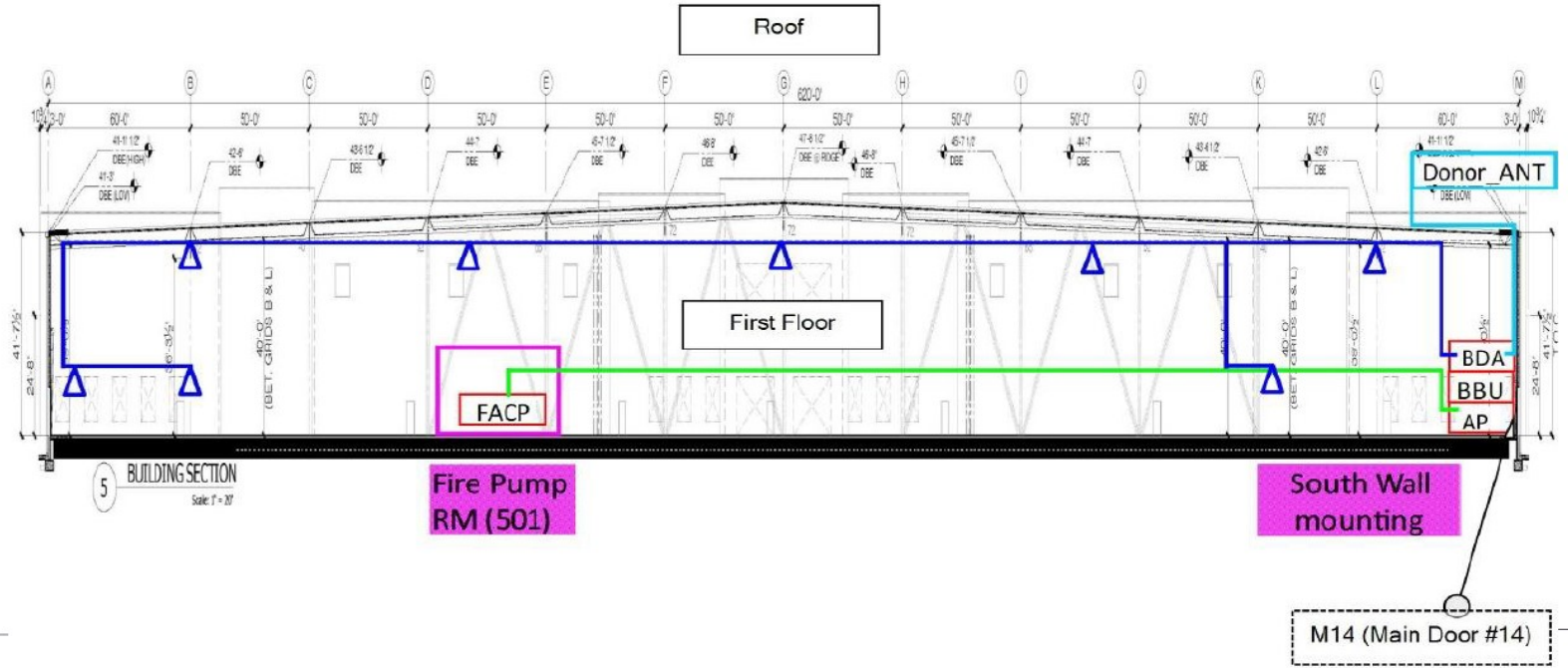
Sample Timeline for ERCES in Construction Phase

- MEET WITH ARCHITECT + ENGINEER: Early Recommendations: Headend Location, Rooftop Donor Antenna, Cable Routes, Timeline + Budget
- CONFIRM AHJ REQUIREMENTS: Contact AHJ Re: Code Enforcement, Technical Requirements, Plan Review, Permit, Inspection, Etc.
- CONFIRM RADIO SYSTEM REQUIREMENTS: Contact PS Radio System FCC Licensee Re: System, Control Channel(s), Frequency(s) + Towers
- CONDUCT RF SIGNAL TESTING: RF Analysis of In-Building Unamplified Signal Coverage + Donor Signal Strength
- PRODUCE SYSTEM DESIGN: Engineered iBwave ERRCS System Design, BOM + Predictive Signal Coverage Model
- SECURE APPROVALS: Plan Review, Permit + FCC Re-Broadcast Authorization: AHJ/Bldg. Dept. + Radio System Admin
- INSTALL SYSTEM: Penetrations, Cable + Active & Passive Components: Donor Antenna, BDA, DAS, BBU, Alarm Panel, Etc.
- CONNECT TO FACP: Fire Alarm Contractor Connects ERRCS Supervisory Alarm Points to FACP
- COMMISSION, START UP + TEST: Commission, Start Up + Post Installation 20 Grid RF Signal Test
- ACCEPTANCE TESTING: Accompany AHJ Inspection/ Acceptance Testing
- CLOSEOUT PACKAGE: As-Built System Design, RF Test Report, Cert. of Compliance, Data Sheets & Owner's Manuals + Warranty
- ANNUAL RE-CERTIFICATION: Yearly System Test + 20 Grid RF Signal Test

Sample Layout

Warehouse/ Distribution Center

700,000 SF; 1 Level



Sample Layout

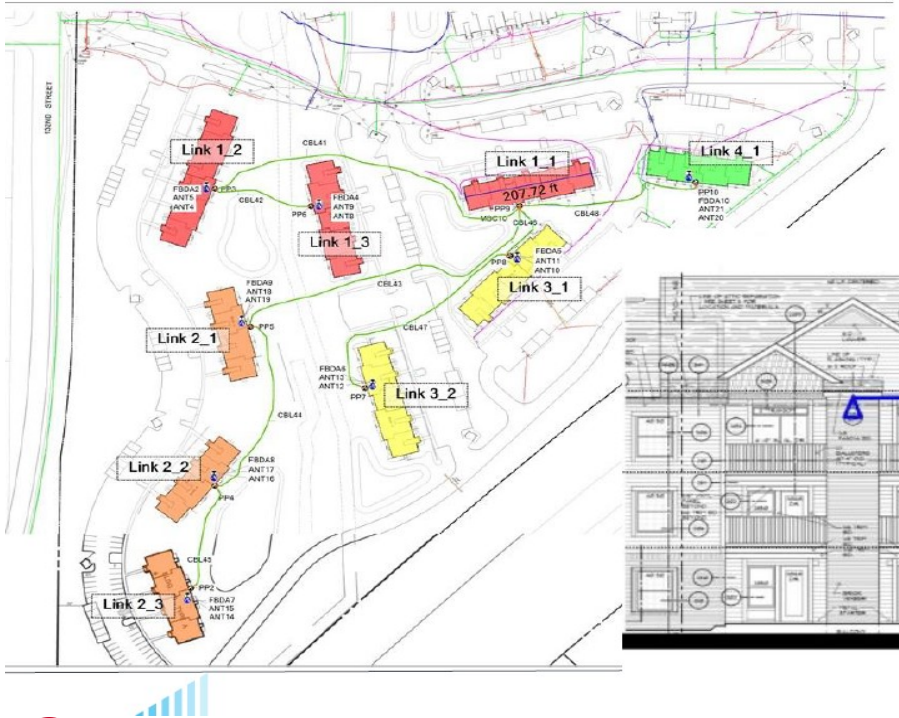
Hotel

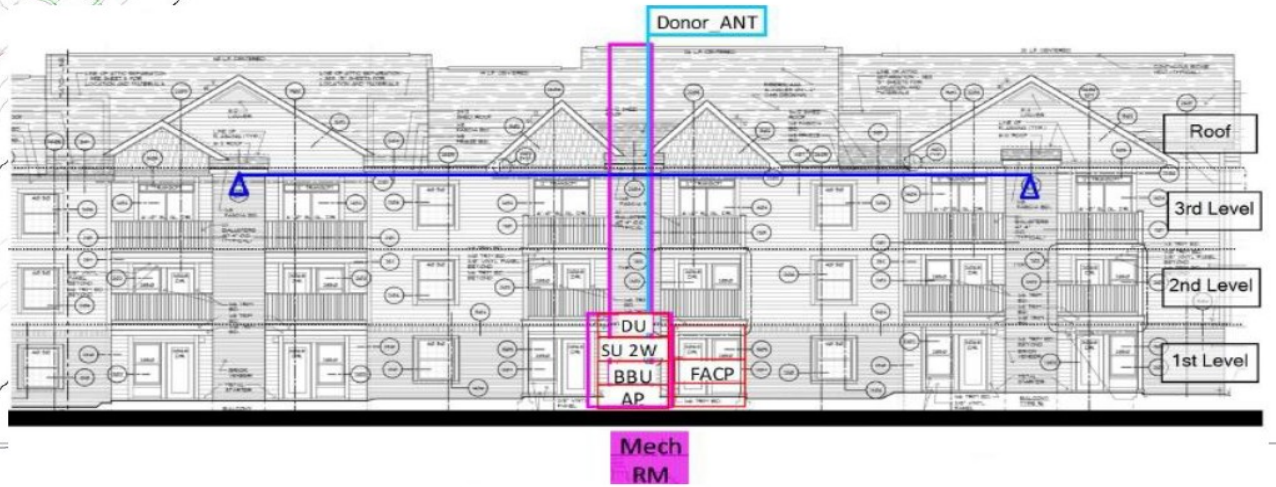
350,000 SF; 23 Levels

Sample Layout

Apartment Campus w/Fiber Infrastructure

16 Building Campus
30,500 SF; 3 Levels (Each Bldg.)





UL ERCES Binational Certificates Program

Codes / regulatory concerns

- Improper ERCES design / installation issues
- ERCES design / installation prior to model codes / standards process
- Acceptance testing ~ floor coverage and DAQ measurement
- Reliability / component failures
- Adaptability to new frequencies

UL Solution - ERCES Certification Program

To ensure reliability:

- Model Code compliance (2021 IFC)
- Standard compliance (NFPA 72 and 1221/1225)
- Equipment certification (UL 2524)

UL Program provides confidence and reliability to stakeholders that ERCES is code compliant after system installation

Program requirements will address:

- Safety testing
- Inspection
- Operational requirements
- Listing of Contractor
- Issuance of System Certification by Listed Company

US jurisdictions requiring UL ERCES Certs

Adopted UL Program

- San Francisco
- San Mateo County
- San Mateo City
- Menlo Park
- East Palo Alto
- City of Atherton

Adopting by EOY 2023

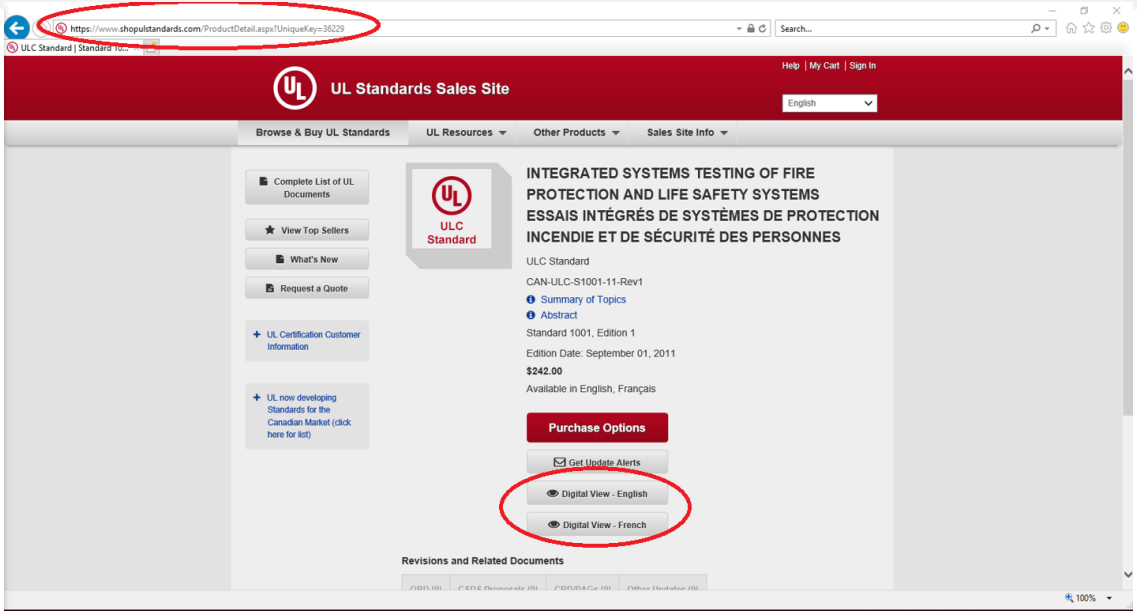
- City of Memphis
- Palm Beach County
- Boca Raton
- Miami Dade
- Redwood City
- City of Austin Tx
- South San Francisco
- Santa Rosa County
- Baltimore County
- Reading
- Lancaster County

Conclusion

- ULC will continue to work on Canadian requirements for ERCES
- ULC will continue to work with stakeholders to publish a robust ORD
- ERCES Certificates program will be developed to assist AHJs and building owners in enforcing code requirements

Free preview of UL/ULC standards

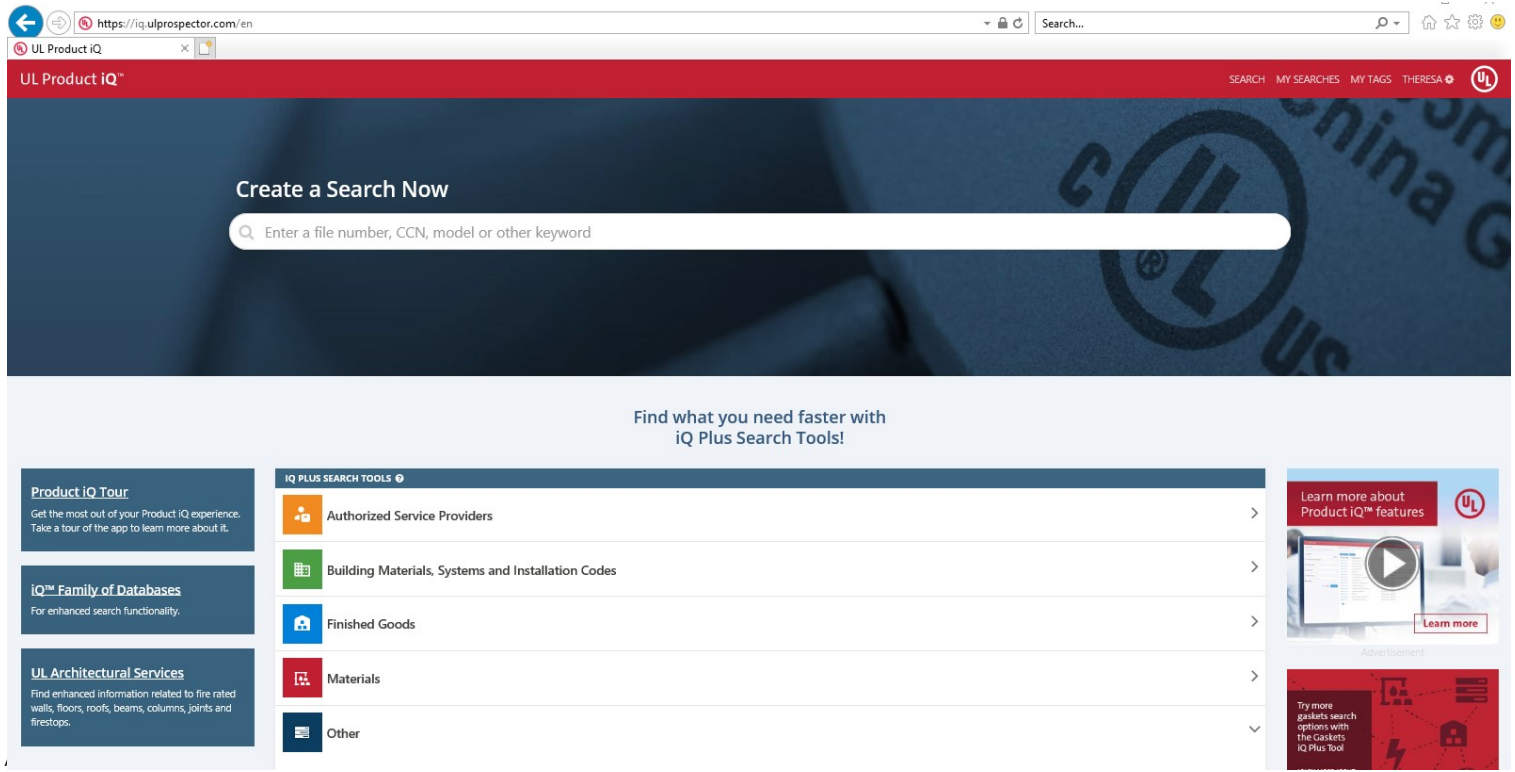
- Go to www.shopulstandards.com
- Browse and select from more than 1700 UL and ULC standards
- Select digital view in English or French
- Register an account
- Read the standard!!



UL Solutions

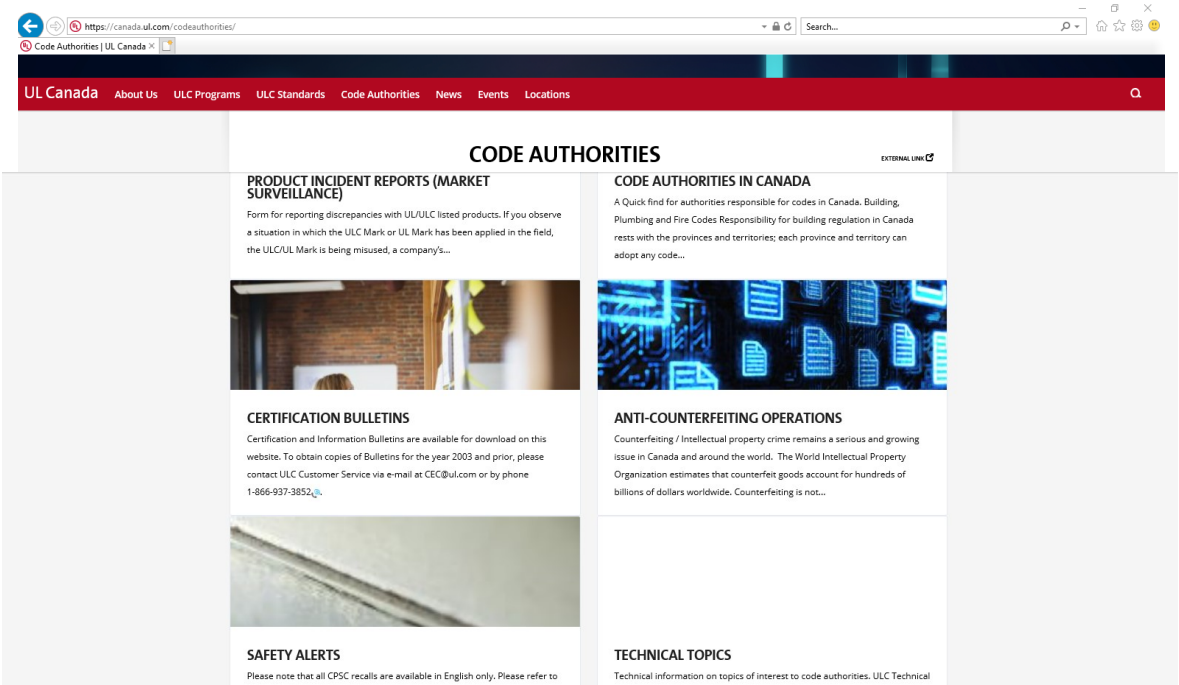
ULC ONLINE RESOURCES

UL PRODUCT iQ RESOURCE CENTRE



ULC ONLINE RESOURCES

UL CODE AUTHORITIES



Thank you

UL.com/Solutions

Safety. Science. Transformation.™