



NECA • BICSI
SUMMIT 2022

Public Safety 101 & ERCES

Fires, Natural Disasters, and Active Shootings:
Looking at In-Building Systems Through a Public
Safety Lens

Prepared by:
Dennis J. Burns
Director, Public Safety - ADRF
Board President – Safer Buildings Coalition



Agenda Topics

Fires, Natural Disasters, and Active Shootings: Looking at In-Building Systems Through a Public Safety Lens

- Public Safety Landscape
 - History of Public Safety Communications
 - Glossary / Acronyms
- Who is the Safer Buildings Coalition
- Public Safety Opportunity
 - ERCES and Life Safety Systems
- Codes/Standards/Regulations driving the market
 - IFC / NFPA 1, 101, 72, 1221, 1225 / UL / FirstNet
- Public Safety Frequencies & Repeater Classes
- Public Safety System Architecture
- Stakeholders and Steps for Successful System Deployment



NECA • BICSI
SUMMIT 2022

Public Safety Landscape



History of Public Safety Communication

- 1852: First fire box was installed using telegraph technology
- 1896: National Fire Protection Association (NFPA)
- 1923: First two-way radio developed in Australia
- 1940s: Motorola two-way radio widely used in WWII
- 1950s: Two-way radio market shifted to Fire, Police and EMS
- 1973: First cellular phone call
- 1997: International Building Code published
- 1999: Wireless Communications and Public Safety Act was passed
- 2009: First Model Code Language for In-Building Public Safety Radio: Appendix of the IFC and NFPA



Glossary

- ERCES/ERRCS/ERRS/ESCS: Emergency Responder Communication Enhancement Systems / Emergency Responder Radio Coverage Systems / Emergency Responder Radio Systems / Emergency Services Communication Systems
- DAS: Distributed Antenna System
- DAQ: Delivered Audio Quality
- PS-DAS: Public Safety DAS
- PS LTE: Public Safety LTE
- BDA: Bi-Directional Amplifier / Repeater
- AHJ: Authority Having Jurisdiction
- FirstNet: First Responder Network Authority is an independent government authority with a mandate to provide specialized communication services for public safety on LTE Band 14
- FACP – Fire Alarm Control Panel
- NFPA: National Fire Protection Association
- IFC: International Fire Code
- GROL: General Radio Operators License



The Safer Buildings Coalition



3 Pillars of
In-Building
Public Safety
Communications:



01

Mobile 911 Calls Must Get Out with Location Accuracy



02

Mobile Mass Notifications Must Reach Building Occupants




03

First Responder Communications Must Work



Public Safety ERCES Opportunity

- The FCC estimates that an improvement of one minute for 9-1-1 response time would save 10,000 lives in the US each year
 - >80% of 911 calls are generated from a cell phone  >65% from cell in-building!
- Evolution of NFPA & IFC fire codes will continue to drive demand
 - New codes will also create confusion & opportunities
- There are more than 6.2 million commercial buildings in the US today!
 - Growth of 6% to 8% per year
- In-building public safety DAS will double by 2021 and revenue will increase to \$1.7 billion with largest spend in North America
- BDA's will outpace traditional Life Safety Security market within 3 years
- The DAS/BDA market is growing at 17%-20% per year
- Public Safety will help drive new commercial cellular opportunities
- Public Safety is a 'MUST HAVE & REQUIRED' by most AHJ's today



ERCES (Public Safety DAS)

What is it?

- An In-Building Emergency Responder Communication Enhancement System ensures that radio signals are able to penetrate into all areas of buildings, including areas that are especially difficult for RF to penetrate such as stairwells, elevators, basements, and thick-walled or shielded. A typical passive ERCES consists of a BDA, donor antenna, coaxial cable, splitters, couplers, and server distribution antennas throughout the facility

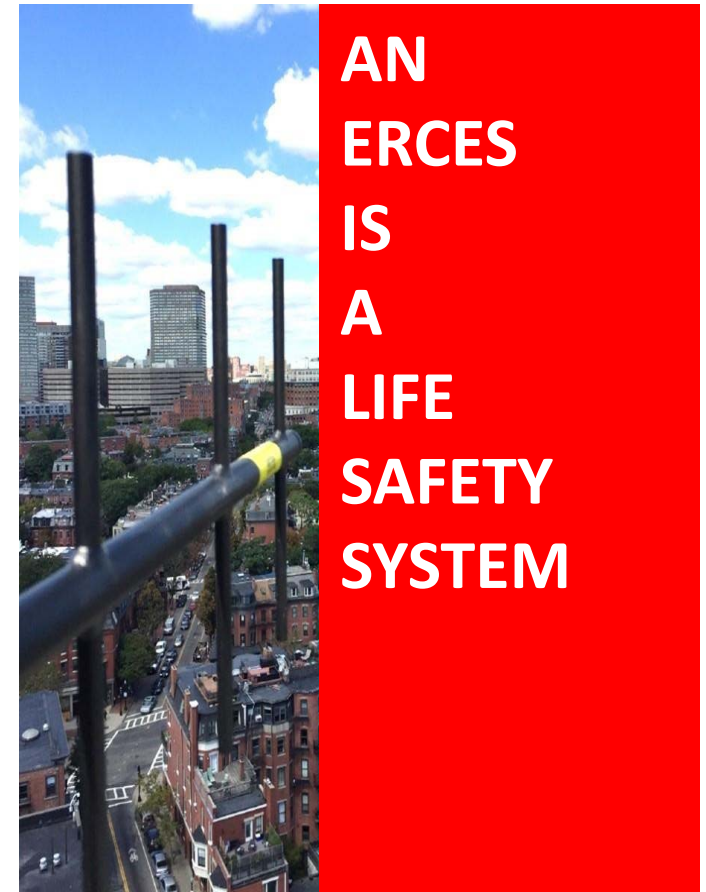
What is need?

- Radio signals have limited propagation through various materials. Factors include how deep inside a building the receiver may be, wall composition, whether a building has energy saving “low-e glass” or other energy saving cladding, the specific frequencies in use (low frequencies penetrate better).
- In order to meet local codes enforced by local AHJ/FM (Authority Having Jurisdiction/Fire Marshal) buildings need to comply with either IFC, NFPA code year or requirements enforced by local AHJ
- IFC (Section 510) , NFPA 72(Chapter 24), 1221(Section 9.6) and NFPA 1225 Model codes being enforced by AHJ



ERCES – Emergency Responder Communication Enhancement System

- **Code Driven Requirements for all buildings new and existing. New codes equals new revenue opportunities!!**
- **Local AHJ-Fire Marshal Specifications**
 - AHJ/Jurisdictions have different interpretations and requirements
- **Typically purchased with Fire Alarm**
 - Installed and tested by qualified, factory certified & licensed technicians
 - Inspected by AHJ/Code Official
- **Supervised by the building's fire alarm system**



Where Are New Buildings Being Constructed?

Total Construction Forecast by 2024 Across Verticals

(In Billions)



Where are dollars being spent?

Life Safety, Fire & Security Spending in 2020 by Vertical

(In Millions)



Codes, Standards and Regulations



***IFC
510***



***72
1221
1225***



***Federal
Part 20
Part 90***



***State
and
Local***



***60950
2524
62368***

Public Safety Codes and Standards for ERCES

- **IFC Code Section 510 – Contains key ERCES Requirements**
- **NFPA 1 – Fire Code, Life Safety for Public and First Responders**
- NFPA 72 – Fire Alarm and Signaling Code
- NFPA 1221 – Survivability & Standard for the Installation Maintenance and Use of Emergency Responder Systems
- NFPA 1061, Standard for Public Safety Telecommunications Personnel Professional Qualifications
- **NFPA 1225 - Standard for Emergency Services Communications (1221 & 1061)**
- NFPA 101 – Life Safety Code
- FCC Part 90 Rules (FCC.gov)
- UL 2524 – In-building 2-Way Emergency Radio Communications Enhancement Systems
- Local Code Amendment Publications



Technical requirements

The technical requirements for design, installation, commissioning, inspection testing and maintenance are included in the IFC, NFPA 1 and NFPA 1221 (1225) are summarized as follows:

- Typical system operation is continuous or automatic.
- Requires specified signal strength into and out of the building with a Delivered Audio Quality (DAQ) of 3.0.
- Note: DAQ is simply a qualitative measurement of voice intelligibility or clarity.
- Design and operation must be specifically designated for use as an in-building emergency responder communication enhancement system by the manufacturer.

Delivered Audio Quality (DAQ)

The DAQ scale includes a scale ranging from 1 to 5, with 1 being unusable audio output and 5 being perfect.

DAQ 1: Unusable. Speech present but not understandable.

DAQ 2: Speech understandable with considerable effort. Requires frequent repetition due to noise or distortion.

DAQ 3: Speech understandable with slight effort. Requires occasional repetition due to noise or distortion.

DAQ 3.4: Speech understandable without repetition. Some noise or distortion present.

DAQ 4: Speech easily understandable. Little noise or distortion.

DAQ 5: Perfect. No distortion or noise discernible.

Technical requirements – reliability

- **ERCES are Life-Safety Systems.** Systems must meet specific survivability requirements to ensure it will continue to operate during a fire
- The system must have redundant power sources and stand-by or back-up power to operate at 100% capacity for at least 12 hours
- The system's performance and reliability must be tested upon installation and always maintained operational
- The system must be monitored through the building's fire alarm system for all required audible and visual alarms
- An annual ERCES inspection is also required



NFPA 72 & 1221 – Section 9.6

Emergency Services Communications Systems

NFPA CODES	NFPA 72 - 2013	NFPA 1221 - 2016	NFPA 1221 - 2019
In-Building Solution Required	NFPA 1 Section 11.10	NFPA 1 Section 11.10	NFPA 1 Section 11.10
Pathway Survivability for Coaxial Cable Required	2 Hour for Riser Coaxial Cable – Sec. 24.3.6.8	2-Hour for Riser Coaxial Cable - Sec. 9.6.2.1.3	Backbone Cable Routed Through Enclosure Matching Bldgs. Fire Rating Sec. 9.6.2.3
Plenum Rated Coaxial Cable Required	Yes, Riser & Feeder Coaxial Cable Sec. 24.3.6.8	Yes, Riser & Feeder Coaxial Cable – Sec. 9.6.2.1.1.1	Yes, Backbone & Antenna Distribution Cables Sec. 9.6.2.1
Lightning Protection Required	Not addressed in Section 24.5.2	Yes, In accordance with NFPA 780 – Sec. 9.6.3	Yes, Section 9.6.3 Installed per NFPA 780
Isolation of Donor Antenna Required	Yes, 15 db – Sec. 24.5.2.3.3	Yes, 20 db – Sec. 9.6.9	Yes, 20 dB Above System Gain Sec. 9.6.9
Battery Backup Required	12 Hours – Sec. 24.5.2.5.2	12 Hours – Sec. 9.6.12.2	12 Hours Battery or Generator Section 9.6.12.2
Signal Strength & Area Coverage Required	-95 dBm – Sec. 24.5.2.3 90% General – Sec. 24.5.2.2.2 99% Critical – Sec. 24.5.2.2.1	DAQ 3.0 - Sec. 9.6.8 90% General - Sec. 9.6.7.5 99% Critical - Sec. 9.6.7.4	DAQ 3.0 - Sec. 9.6.8 90% General - Sec. 9.6.7.4 99% Critical - Sec. 9.6.7.3
Monitoring By Fire Alarm Required	Yes – Sec. 24.5.2.6	Yes – Sec. 9.6.13	Yes – Sec. 9.6.13 & Chapter 10 of NFPA 72
Cabinets for Equipment & Battery Backup Required	Yes, NEMA 4/NEMA 4X – Sec. 24.5.2.5.2	Yes, NEMA 4/NEMA 4X – Sec. 9.6.11.2	Yes, NEMA 4/4X & NEMA 3R for Batteries Sec. 9.6.11.2
Monitor Antenna Malfunction Required	Yes, Donor Antenna – Sec. 24.5.2.6(2)(a)	Yes, Donor Antenna – Sec. 9.6.13.1(2)(a)	Yes, Donor Antenna – Sec. 9.6.13.2.1(5)
System Acceptance/Testing	Section 24.5.2.1.2 & 14.4.10	Section 9.6.4, 11.3.9 & 11.3.9.1	Section 9.6.4, 11.3.9 & 11.3.9.1
Listing of Equipment	Not Specifically Addressed	Not Specifically Addressed	Specific Listing Requirement TBD by the AHJ

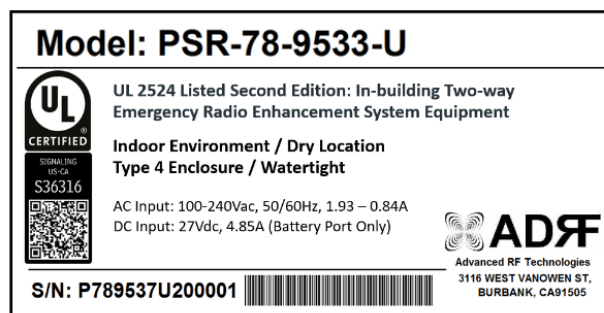
IFC – Section 5.10-ERRCS

Emergency Responder Radio Coverage Systems

IFC CODES	IFC - 2015	IFC - 2018	IFC - 2021
In-Building Solution Required	Sec. 510.1	Sec. 510.1	Sec. 510.1
Pathway Survivability for Coaxial Cable Required	Not Specifically Addressed in Section 510. Referenced in 2013 NFPA 72 Sec. 24.3.6.8	Yes, Section 510.4.2. Reference to NFPA 1221. ** Also See NFPA 1221 TIA 16-2	Yes, Section 510.4.2. Reference to NFPA 1221.
Plenum Rated Coaxial Cable Required	Not Specifically Addressed in Section 510. Referenced in 2013 NFPA 72 Sec. 24.3.6.8	Yes, Sec. 510.4.2. Reference to NFPA 1221	Yes, Section 510.4.2 Reference to NFPA 1221
Lightning Protection Required	Not Specifically Addressed in Section 510	Yes, Sec. 510.4.2 Per NFPA 780 as Referenced in NFPA 1221	Yes, Sec. 510.4.2 Per NFPA 1221 Sec. 9.6.3 Installed per NFPA 780
Isolation of Donor Antenna Required	Not Specifically Addressed in Section 510	Yes, 20 db – Sec. 510.4.2.4 (4)	Yes, 20 db – Sec. 510.4.2.4 (4)
Battery Backup Required	24 Hours – Sec. 510.4.2.3	12 Hours – Sec. 510.4.2.3 or 2- Hours Battery w/ Emergency Generator	12 Hours – Sec. 510.4.2.3 or 2- Hours Battery w/ Emergency Generator
Signal Strength & Area Coverage Required	-95 dBm – Sec. 510.4.1 95% General – Sec. 510.4.1 99% Critical – Not Specifically Addressed in Sec. 510	DAQ 3.0 - Sec. 510.4.1.1 95% General - Sec. 510.4.1 99% Critical - Sec. 510.4.2 Reference to NFPA 1221	DAQ 3.0 - Sec. 510.4.1.1 95% General - Sec. 510.4.1 99% Critical - Sec. 510.4.1
Monitoring By Fire Alarm Required	Not Specifically Addressed in Sec. 510 – See 2013 NFPA 72	Yes – Sec. 510.4.2.5	Yes – Sec. 510.4.2.5
Cabinets for Equipment & Battery Backup Required	Yes, NEMA 4 – Sec. 510.4.2.4 (1) & (2)	Yes, NEMA 4/NEMA 3R – Sec. 510.4.2.4 (1) & (2)	Yes, NEMA 4/NEMA 3R – Sec. 510.4.2.4 (1) & (2)
Monitor Antenna Malfunction Required	Not Specifically Addressed in Section 510	Yes, Donor Antenna – Sec. 510.4.2.4(4)	Yes, Donor Antenna – Sec. 510.4.2.4(4)
System Acceptance/Testing	Section 510.5.3	Section 510.5.3	New – Section 510.5.4 Annual – Section 510.6.1
Listing of Equipment	Not Required by Section 510	Not Required by Section 510	Yes, Section 510.4 (UL 2524, 2 nd edition)
Mounting of Donor Antenna	Not Specifically Addressed	Not Specifically Addressed	Section 510.5.1

UL 2524 Overview

- Covers products used for in-building 2-way Emergency Responder Communication Enhancement Systems (e.g. repeater, transmitter, receiver, signal booster components, remote annunciators and operational consoles, power supply, and battery charging system components) installed in a location to improve wireless communication at that location.
- Does not cover passive RF components which are defined in the standard as “any device that RF passes through that does not have an active electronic component that requires external power. This includes, antennas, splitters, couplers, coaxial cable and connectors. Passive components cannot amplify RF signals.”



NECA • BICSI
SUMMIT 2022

Recent Code Updates



510.1 Emergency responder communication coverage in new buildings.

Existing in-building, two-way emergency responder communication coverage for emergency responders shall be provided in all new buildings. In-building, two-way emergency responder communication coverage within the building shall be based on the existing coverage levels of the public safety communication systems utilized by the jurisdiction, measured at the exterior of the building. This section shall not require improvement of the existing public safety communication systems.

510.2 Emergency responder communication coverage in existing buildings.

Existing buildings shall be provided with existing in-building, two-way emergency responder communication coverage for emergency responders as required in [Chapter 11](#).

510.4 Technical requirements.

Equipment required to provide in-building, two-way emergency responder communication coverage shall be provided in accordance with [UL 2524](#). Systems, components and equipment required to provide the in-building, two-way emergency responder communication coverage system shall comply with [Sections 510.4.1](#) through [510.4.2.8](#).



510.5.3 Minimum qualifications of personnel.

The minimum qualifications of the system designer and lead installation personnel shall include both of the following:

- 1.1. A valid FCC-issued general radio operators license.
- 2.2. Certification of in-building system training issued by an *ettv*szih organization or *ettv*szih school, or a certificate issued by the manufacturer of the equipment being installed.



11.10* Two-Way Radio Communication Enhancement Systems.

11.10.1 - In all new and existing buildings, minimum radio signal strength for fire department communications shall be maintained at a level determined by the AHJ.

11.10.2 - Where required by the AHJ, two-way radio communication enhancement systems shall comply with NFPA 1221.

11.10.3 - Where a two-way radio communication enhancement system is required and such system, components, or equipment has a negative impact on the normal operations of the facility at which it is installed, the AHJ shall have the authority to accept an automatically activated responder system.



18.2.1*

Where an in-building emergency responder communications enhancement system is used, the design of the system shall be approved by the AHJ and the frequency license holder(s).

18.3.2* Oscillation Detection and Control.

Signal boosters used in emergency responder communications enhancement systems shall have built-in oscillation detection and control circuitry to reduce gain and maintain operation.

18.3.4 Communication Antenna Density.

18.3.4.1*

In-building emergency responder communication enhancement systems shall be designed to minimize the near-far effect.

18.3.4.2

In-building emergency responder communication enhancement system designs shall include a sufficient number of distribution antennas(density) to address reduced gain conditions.

18.3.4.3

Where an in-building emergency responder communication enhancement system is required and such system, components, or equipment has a negative impact on the normal operations of the facility at which it is installed, the AHJ shall have the authority to accept an automatically activated responder system.



18.6 Non-Interference and Non-Public Safety System Degradation.

18.6.1*

No in-building emergency responder communications enhancement system capable of operating on frequencies or causing interference to frequencies assigned to the jurisdiction by the licensing authority of the country of jurisdiction shall be installed without prior coordination and approval of the AHJ and the frequency license holder(s).

18.6.2

The building owner or authorized agent shall suspend and correct equipment installations that degrade the performance of the public safety communications system or emergency responder communications enhancement system.

18.6.3*

Systems that share infrastructure with non-public safety services shall ensure that the coverage and performance of the public safety communications channels are not degraded below the level of performance identified in Sections [18.8](#) and [18.9](#), regardless of the amount of traffic carried by the non-public safety services



20.3 Operational Testing

- Annual operational tests to verify system performance each year – Entire section detailing what needs to be done each year and what to test



18.12 System Components.

18.12.1* Component Approval, Certification, and Listing.

18.12.1.1

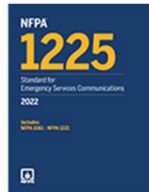
RF-emitting devices and cabling used in the installation of in-building emergency responder communications enhancement systems shall be approved by the AHJ and the frequency license holder.

18.12.1.2

All RF-emitting devices shall have the certification of the radio licensing authority of that country and be suitable for public safety use prior to installation.

18.12.1.3

All repeaters, transmitters, receivers, signal-booster components, remote annunciators and operational consoles, power supplies, and battery charging system components shall be listed and labeled in accordance with UL 2524, ~~Wxerhev\$sv\$Mrfymrk\$1[e}\$Iq ivkirk}\$Vehns\$sq q ymgexr\$ Irlergiq irx\$}wxiq w.~~



18.13 Power Sources.

At least two independent and reliable power sources shall be provided for all RF-emitting devices and any other active electronic components of the system: one primary and one secondary.

18.13.1 Primary Power Source.

The primary power source shall be all of the following.

- (1) Supplied from a dedicated branch circuit
- (2) Permanently connected
- (3) Compliant with RJTE ;6
- (4) Protected from overvoltage

18.13.2 Secondary Power Source.

The secondary power source shall consist of one of the following:

- (1) A storage battery dedicated to the system with 12 hours of 100 percent system operation capacity
- (2) An alternative power source of 12 hours at 100 percent system operation capacity as approved by the AHJ
- (3) A 2-hour standby battery and connection to the facility generator power system, providing the facility generator power system can support the complete system load for 12 hours



18.12.3 Component Requirements.

18.12.3.3

Backbone cables and backbone cable components installed in buildings that are fully protected by an automatic sprinkler system in accordance with NFPA 13 shall not be required to have a fire resistance rating.

18.12.3.4*

Backbone cables and backbone cable components installed in nonsprinklered buildings, in buildings that are partially protected by a sprinkler system, or in high-rise buildings shall be protected from attack by fire in accordance with one of the following:

- (1) Use a cable with a listed fire-resistance rating in accordance with the following:
 - (1) Where the primary structural frame of a building is required to have a fire-resistance rating of 2 hours or more or is classified as heavy timber construction, the minimum fire-resistance rating shall be 2 hours.
 - (2) Where the primary structural frame of a building is required to have a fire-resistance rating of less than 2 hours, the minimum fire resistance rating shall be 1 hour.
 - (3) Where the primary structural frame of a building does not require a fire-resistance rating, a fire resistance rating shall not be required.



18.12.3 Component Requirements.

18.12.3.1

All cables shall be installed in accordance with Chapters 7 and 8 of RJTE ;4.

18.12.3.2

Mechanical protection of work and raceways for coaxial cables shall comply with Article 820 of RJTE ;4.

18.12.3.3

Backbone cables and backbone cable components installed in buildings that are fully protected by an automatic sprinkler system in accordance with NFPA 13 shall not be required to have a fire resistance rating.

18.12.3.4*

Backbone cables and backbone cable components installed in nonsprinklered buildings, in buildings that are partially protected by a sprinkler system, or in high-rise buildings shall be protected from attack by fire in accordance with one of the following:

- (1) Use a cable with a listed fire-resistance rating in accordance with the following:
 - (1) Where the primary structural frame of a building is required to have a fire-resistance rating of 2 hours or more or is classified as heavy timber construction, the minimum fire-resistance rating shall be 2 hours.
 - (2) Where the primary structural frame of a building is required to have a fire-resistance rating of less than 2 hours, the minimum fire resistance rating shall be 1 hour.
 - (3) Where the primary structural frame of a building does not require a fire-resistance rating, a fire resistance rating shall not be required.

- (2) A protected enclosure or area shall have a fire-resistance rating in accordance with the following:
 - (a) Where the primary structural frame of a building is required to have a fire-resistance rating of 2 hours or more or is classified as heavy timber construction, the minimum fire-resistance rating shall be 2 hours.
 - (b) Where the primary structural frame of a building is required to have a fire-resistance rating of less than 2 hours, the minimum fire resistance rating shall be 1 hour.
 - (c) Where the primary structural frame of a building does not require a fire-resistance rating, a fire resistance rating shall not be required.





BY THE NUMBERS

The **only** dedicated communications platform in the country that brings first responders:



Always-on, 24x7 priority and preemption across voice and data communications



*A physically separate network core **fully dedicated** to public safety*

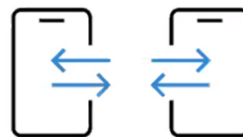


*Government oversight and accountability from the **FirstNet Authority***

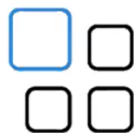
Updated: 1/26/2022

©2022 AT&T Intellectual Property. FirstNet and the FirstNet logo are registered trademarks of the First Responder Network Authority. All other marks are the property of their respective owners.

3M+
FirstNet connections



19.5K+
Public safety agencies and organizations subscribed



190+
apps in the FirstNet App Catalog



370+
FirstNet Ready® devices

AMERICA'S PUBLIC SAFETY NETWORK

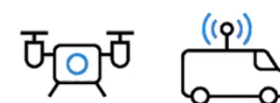
2.71M
Square miles of LTE coverage nationwide



~100K
Square miles of LTE coverage added in 2020



100+ Dedicated deployable network assets, including Flying COWs™ and FirstNet One.



95%+
Band 14 coverage completion; well ahead of schedule



800+
Solutions deployed for public safety in 2021





NFPA 1225 – 2022 Edition

- 18.11* Frequencies.
- The in-building emergency responder communications enhancement system shall be capable of transmitting on all radio frequencies, as required by the AHJ, and be capable of using any modulation technology in current use by the public safety agencies in the jurisdiction.
- A.3.3.63 Frequencies.
- Emergency service agencies utilize many different frequencies and modulation technologies to communicate. Frequencies and modulation technologies might include, but not be limited to wavebands, such as very high frequency (VHF), ultra high frequency (UHF), 700/800 MHz, broadband, long-term evolution, etc. When evaluating in-building emergency responder communications enhancement system coverage capabilities, it is important to identify all frequencies and modulation technologies being utilized by and assigned to the public safety agencies of the jurisdiction as detailed in Section 18.11. For example, in the US, the public safety agencies in a jurisdiction might have an 800 MHz trunked land mobile radio system and might also utilize broadband services as a method of their on-scene communications. This could include the nationwide public safety broadband network supported by the FirstNet Authority and other broadband commercial carrier networks.



NFPA 1225 – 2022 Edition

Q: Is there anything in the code that specifically prohibits shared infrastructure between LMR and LTE systems?

A: No.

18.6.3*

Systems that share infrastructure with non-public safety services shall ensure that the coverage and performance of the public safety communications channels are not degraded below the level of performance identified in Sections 18.8 and 18.9, regardless of the amount of traffic carried by the non-public safety services.

UL 2524 Standard

Overview of ANSI/CAN/UL 2524:2019

Bi-National ANSI/SCC Standard

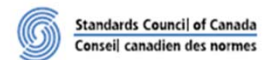


**ANSI/CAN/UL
2524:2019**

JOINT CANADA-UNITED STATES
NATIONAL STANDARD

STANDARD FOR SAFETY

In-building 2-Way Emergency Radio
Communication Enhancement Systems



UL 2524 technical requirements

Scope:

Covers products such as a repeater, transmitter, receiver, signal booster components, remote annunciators and operational consoles, power supply, and battery charging system components used for ERCES installed in a location to improve wireless communication at that location.

Note:

UL 2524 includes additional critical safety and performance requirements not found in UL 60950/UL 62368.

Visit: www.ul.com/ERCES



UL 2524 technical requirements



Performance – Operation:

- Loss of normal AC power *
- Battery charger failure *
- Loss of battery capacity (to 70% depletion) *
- Donor antenna disconnection *
- Active RF emitting device malfunction *
- System component malfunction, other than passive RF component, which affects system performance *
- Donor antenna malfunction **

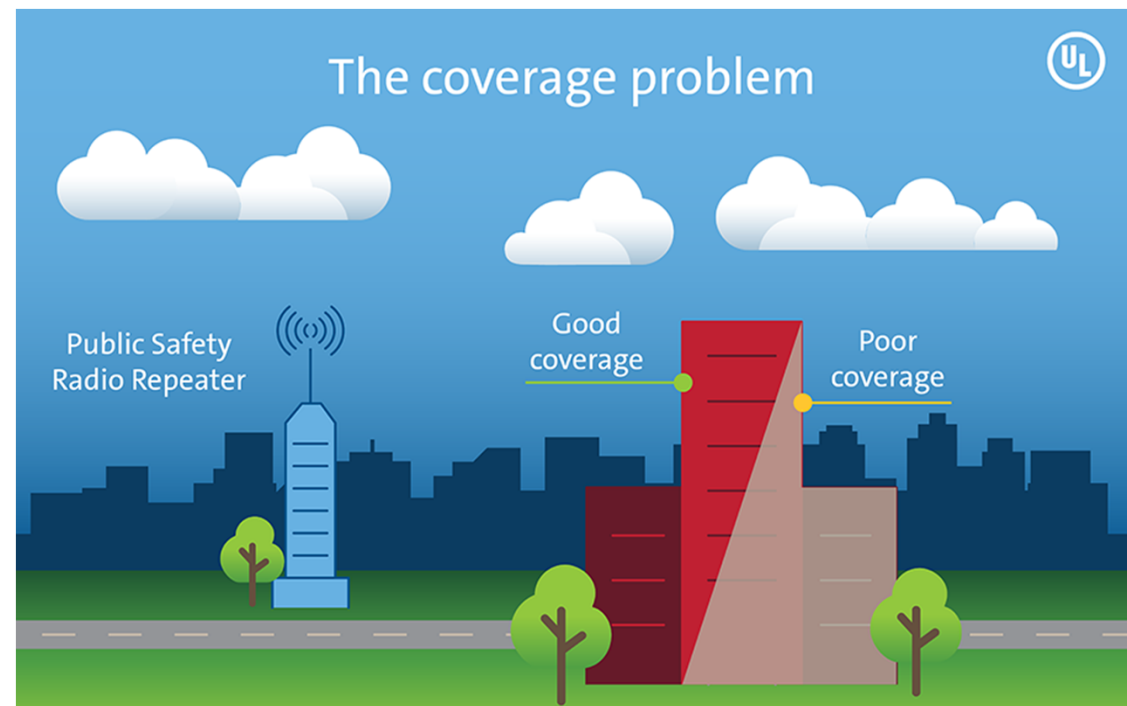
* = Visual and audible annunciation within 200 seconds of fault

** = Visual and audible annunciation within 24 hours of fault

UL 2524 technical requirements

Performance – Operation:

- Confirm capability of simultaneously supporting both analog and digital communications
- Bidirectional amplifiers shall have oscillation detection and control functionality
- Design must minimize “near far effect”
- Confirm the maximum propagation delay, in microseconds, for a maximum rated system configuration





UL 2524 technical requirements

Reliability:

- Variable Voltage Operation Test
- Variable Ambient Temperature and Humidity Tests
- Charging Current Test
- Transient Testing



UL 2524 construction requirements

Type 4 or 4X enclosure for all repeater, transmitter, receiver, signal booster components, external filters, and battery system components

Rechargeable standby batteries are permitted to be contained in enclosures that comply with the requirements for a Type 3R

The system shall be sufficiently modular to have the capability to support revised and/or additional system frequencies within the same frequency band of the bi-directional amplifier supplied to maintain radio system coverage as it was originally intended without the need to replace the system.

Products intended to be connected to the branch circuit supply are to be provided with a means for permanent connection to the branch-circuit supply. A product intended for permanent connection to the branch circuit supply is to have provision for mechanically protecting the supply conductors

Code Updates and Changes

- Impacts of noise within system – SBC “Call to Action” with new “No Noise Task Force” - No Noise requirement has been added to NFPA 1225 – 2022 Edition
- NFPA 1225 moved to 5-year code cycle / IFC and NFPA 1 will remain at 3-year code cycle
 - Note: requested change back to 3-year code cycle was rejected and remains at 5-year
- Many Jurisdictions mandating existing buildings must comply with new code requirements and not just new buildings
- Many Jurisdictions now require ERCES to be UL 2524 Certified
- Many Jurisdictions authorizing new sections of NFPA 1225 for pathway even though the state might be on an older version of model fire code - Equivalency
- 2024 IFC Draft contains minimum square footage requirement of 12,000 square feet for ERCES
- NC approved statewide code change: all new buildings >7.5k sq’ must have ERCES coverage



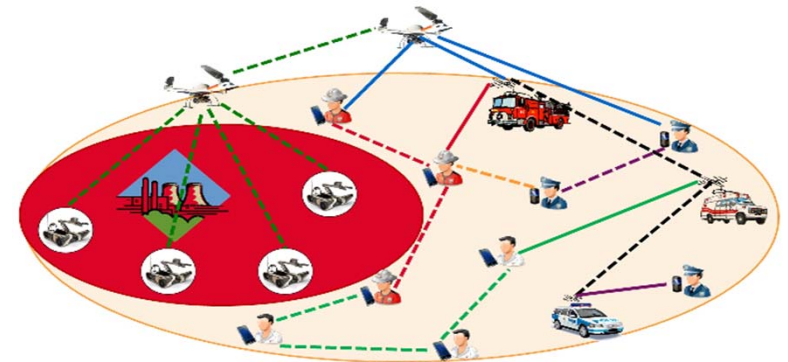
NECA • BICSI
SUMMIT 2022

Public Safety Frequency Bands

Public Safety Frequencies

- Similar to commercial spectrum ownership and operation, the frequencies used by public safety groups and first responders will vary depending on the state, market, and/or county. Each system will be operating one or more of the following frequencies:

Freq.	Downlink	Uplink
VHF	136-174 MHz	
UHF	380-512 MHz	
700 MHz PS	758-775 MHz	788-805 MHz
800 MHz PS	851-861 MHz	806-816 MHz
900 MHz PS	929 – 942 MHz	896 – 903 MHz



Public Safety Frequencies

- **VHF/UHF**
 - Set up for many narrowband channels as small as 6.25KHz
 - Unlike 700MHz and 800MHz, the Tx (Downlink) and Rx (Uplink) channels don't have a designated frequency range. They can be spread out and interleaved across the frequency band
- **700 MHz(SMR)/PS LTE & FirstNet**
 - 20 MHz (10 DL/10 UL) of 700 PS Band has been allocated for FirstNet, providing uniform LTE coverage for many critical organizations. The roll out of this service is in full swing and being used today!
- **800 MHz**
 - Currently the most commonly used Public Safety frequency band
- **900 MHz**
 - Primarily used for private "in-house" radio and campus/casino operations

NECA • BICSI
SUMMIT 2022

Public Safety Repeater Classes

FCC Part 90 Repeater Classes

- Public Safety repeaters are classified in two categories based primarily on the **filtering bandwidth** for the supported channels.
- The AHJ may specifically require the use of a Class A or Class B repeater.

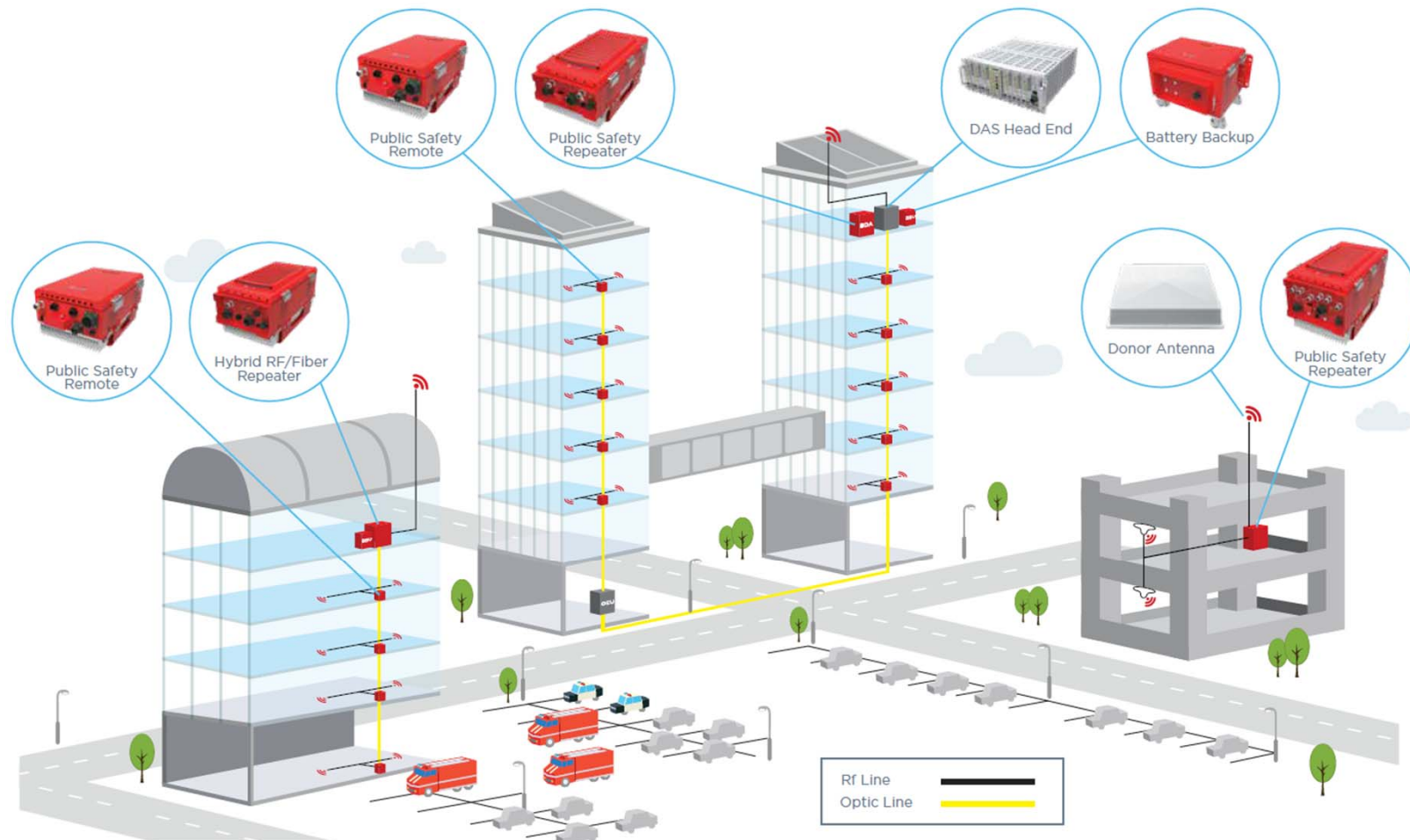
Class A	Class B
Capable of finer filtering to select channels as narrow as 6.25KHz	Allows for the selection of channels as narrow as 250KHz
Typically, capable of supporting 8 or more narrowband channels, no passbands exceeding 75KHz	Typically supports one or two wideband filters with passbands that exceed 75KHz (up to 20MHz) to support multiple channels
Ideal for system that has channels dispersed throughout the band or interleaved with channels that need to be excluded from the system	Ideal for system where all the supported channels are contiguous
Recommended for applications that are sensitive to noise	Can introduce more noise to the system if the supported traffic channels are non-contiguous



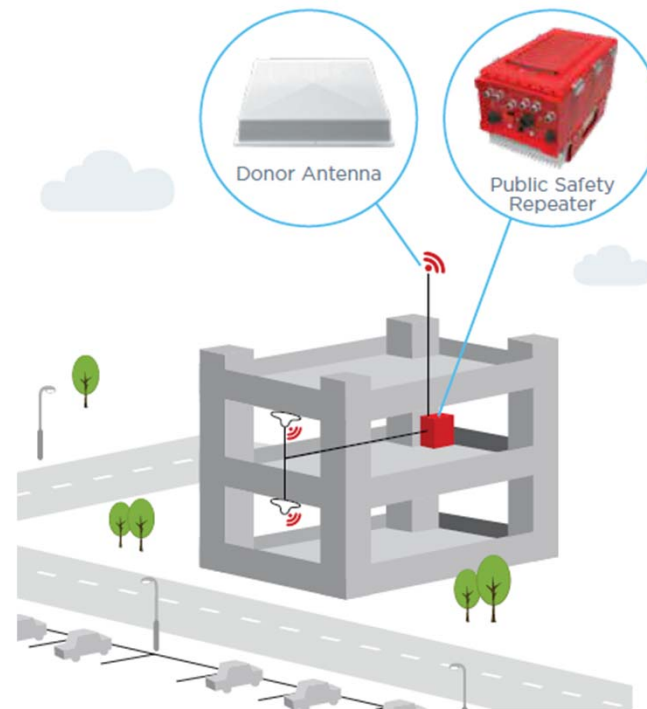
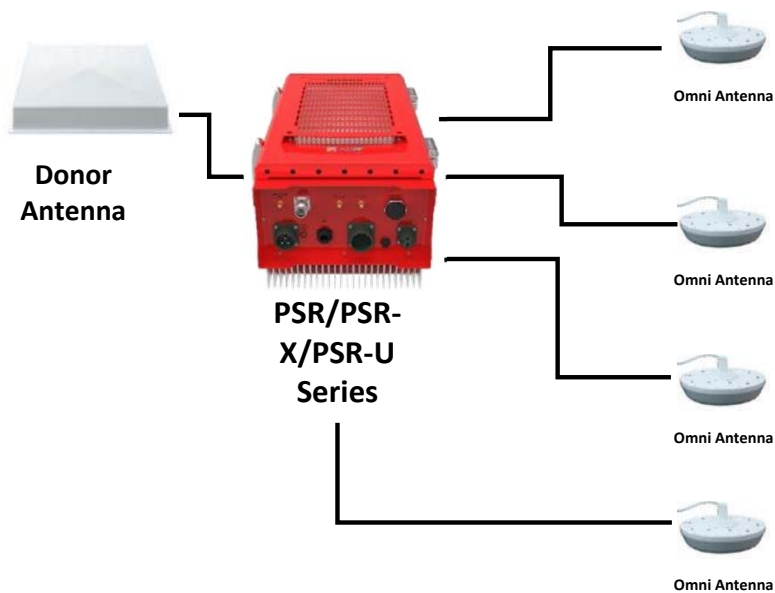
NECA • BICSI
SUMMIT 2022

Public Safety System Architecture

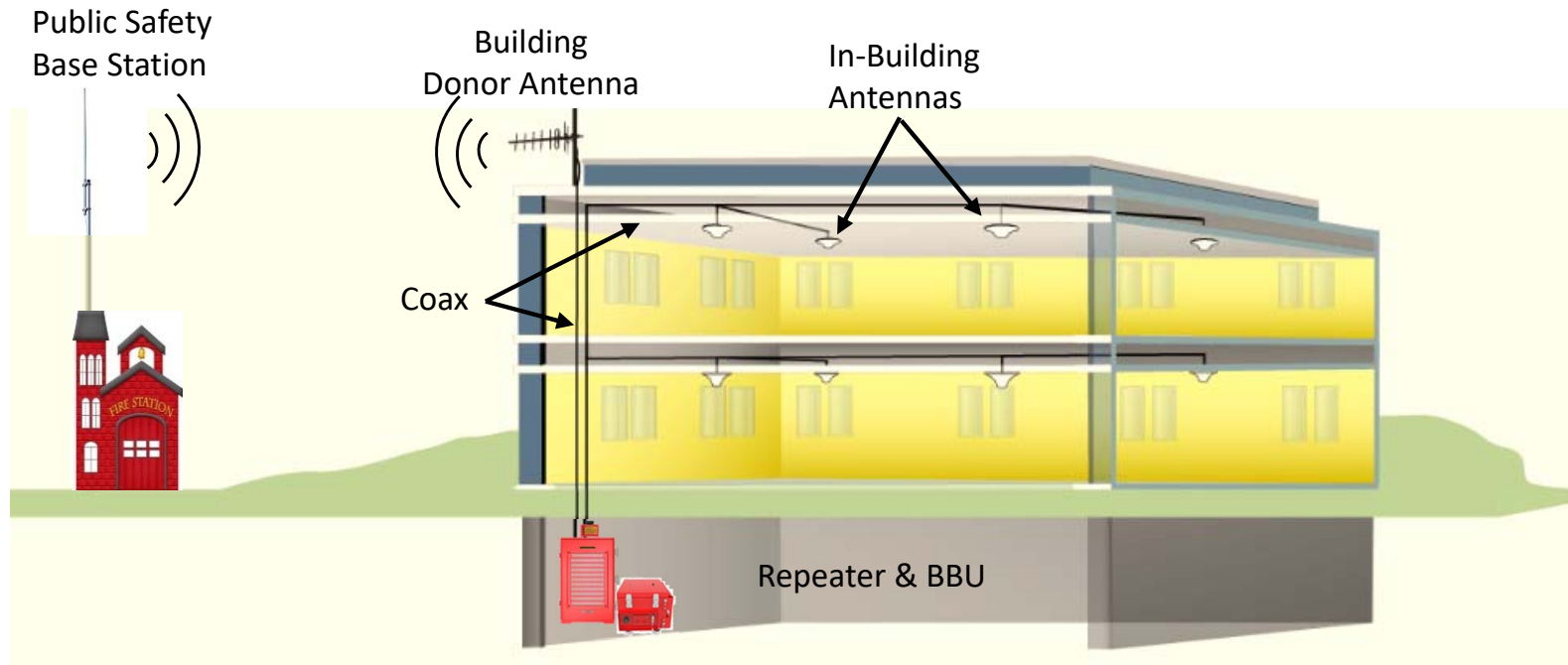
Public Safety Solutions in a Business Campus



Public Safety Solutions – Small Venue/Building - BDA



Passive DAS Overview



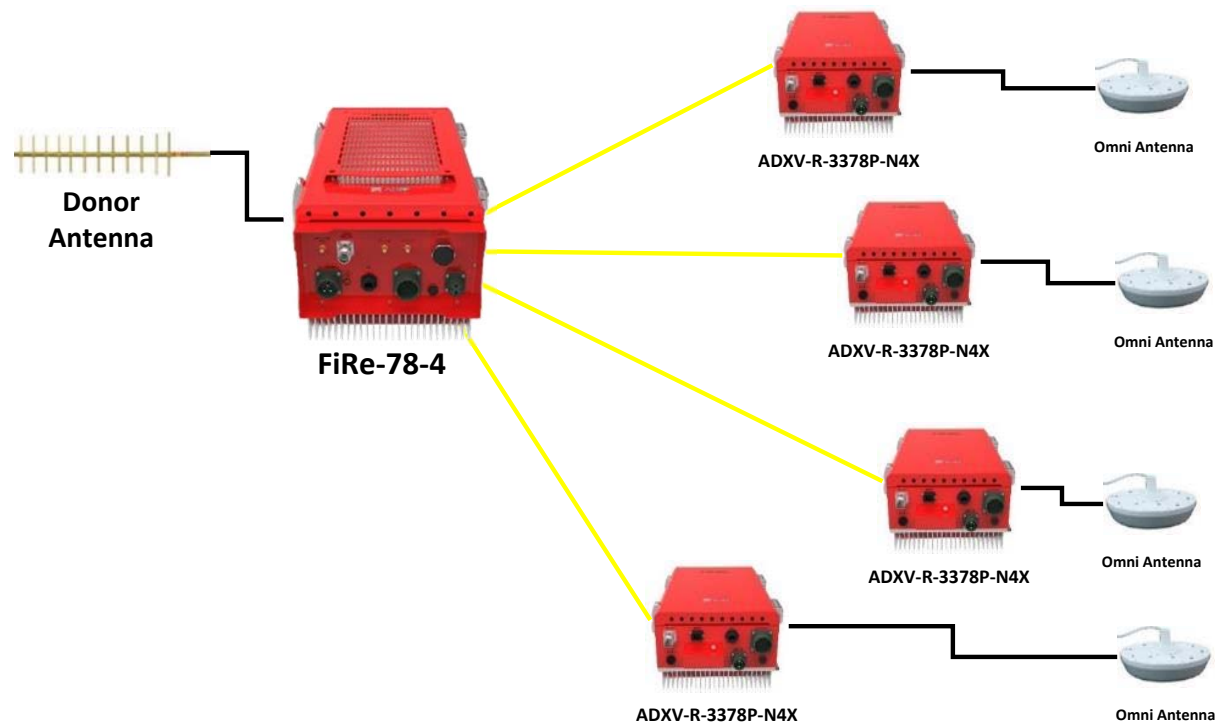
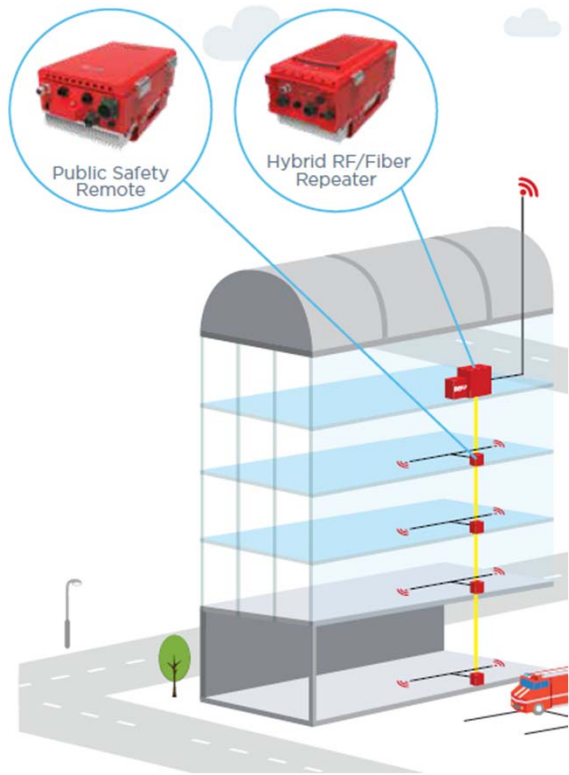
Passive DAS - Coax distributes RF

- Repeater – Is the only active component
- Ideal solution for smaller venues or portions of buildings <+/-150K sq. ft
- Provides for limited growth or expansion capability

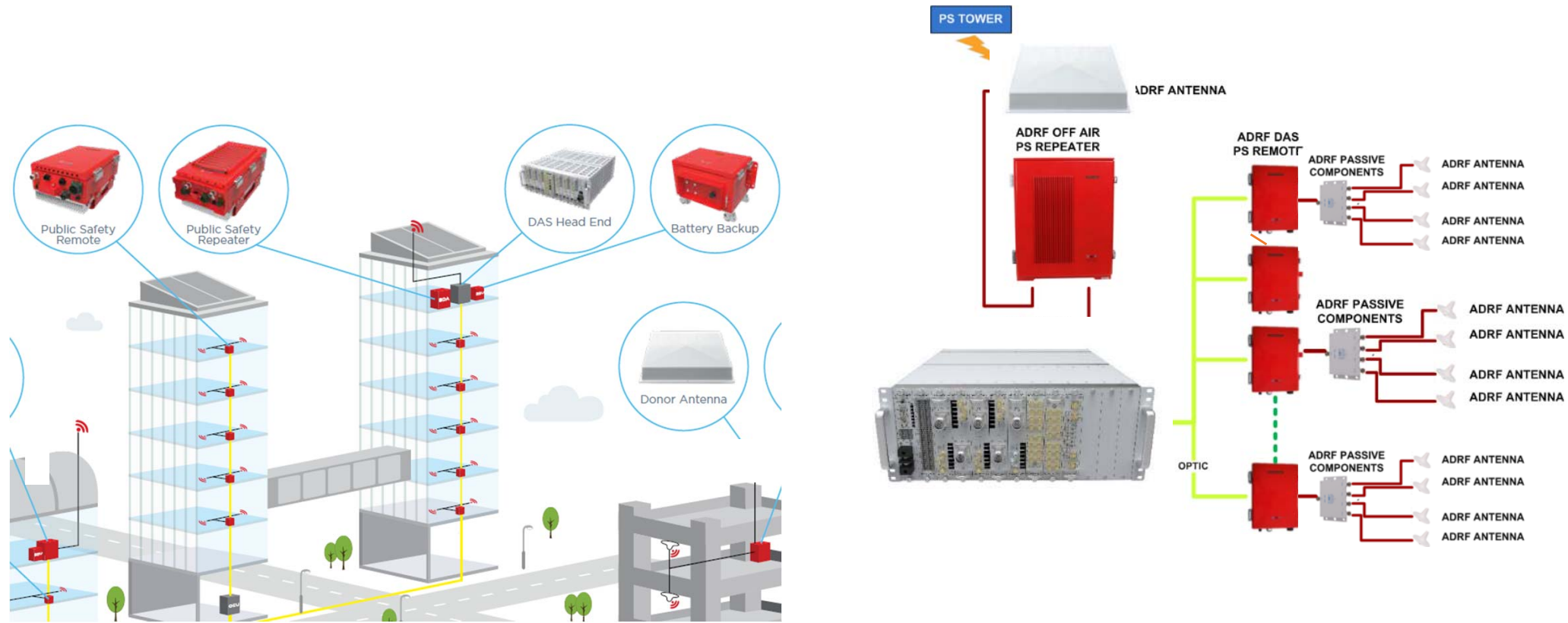
Typical Deployment Passive System



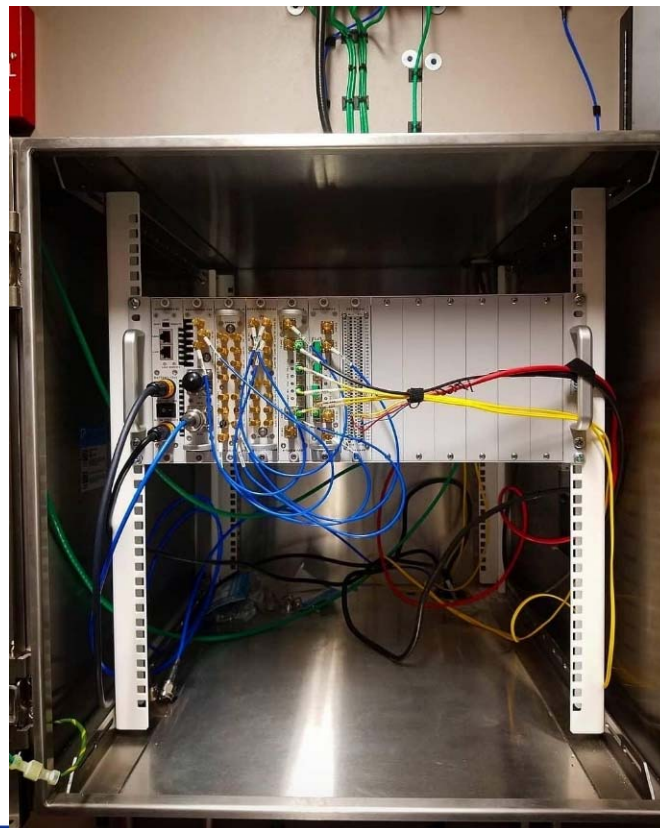
Public Safety Solutions – Medium Sized Venue or Small Campus – Hybrid DAS



Public Safety Solutions – Large Venue, Stadium, Airport, Large Campus – Fiber DAS



Typical Deployment for Active Fiber DAS



Public Safety System - Breaking ground to system acceptance....



Stakeholders

- First Responders / Public Safety Agencies
- FCC & FCC frequency license holder(s)
- OEMs: repeaters, active fiber DAS, passives, antennas, & coaxial cable
- System Integrators: RF testing, design & installation
- Material Distributors: Logistics, coordination, supply
- Building owners (REITs)
- Local AHJ (Authority Having Jurisdiction)
- Specifiers (Architects, Consultants, etc.)
- General Contractors
- Electrical Contractors
- Fire Marshal
- Code Officials / Inspectors
- Wireless Carriers



WHO ARE THE STAKEHOLDERS?

- **Influencers**

- Public Safety Code Agencies: NFPA, IFC, CFC
- Standards Writers: UL
- FCC & Local Radio License Holder
- Wireless Carriers
- Wireless Consortium: Safer Buildings Coalition

- **Adopters & Enforcers**

- Local Code Enforcement: AHJ (Authority Having Jurisdiction), Code Officials, Inspectors
- FCC

- **Users**

- First Responders: Police, Fire, EMS (Homeland Security, FBI & Others)
- Building tenants/owners, Campus Public Safety, Private Security & Others

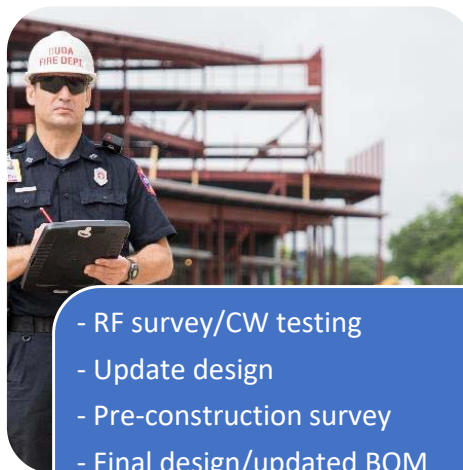
- **Installers (Responsible Parties)**

- Building owners (REITs), facility managers, general/electrical contractors, architects, engineering firms
- OEMs: repeaters, passives, antennas, & coaxial cable
- System Integrators: RF testing, design, installation & annual certification
- Material Distributors: Logistics, coordination, supply

Steps for Success – ERCES PS System Deployment



- Identify AHJ & local requirements
- FCC license holder
- Engage System Integrator(SI)
- Site survey
- Baseline testing
- System definition
- Performance requirements
- Preliminary design-ROM BOM
- Statement of work (SOW)



- RF survey/CW testing
- Update design
- Pre-construction survey
- Final design/updated BOM
- Submittal documents
- Sign-off by customer
- Order equipment based on final design
- Equipment tested at ADRF and shipped



- Installation
- Commissioning
- Grid/Approval testing
- System acceptance
- Sign-off by Fire Marshal
- Certificate of occupancy
- Annual maintenance and health check

Step for success when deploying a public safety system

- Engage the AHJ early to understand their set of requirements for in-building public safety system & this will help prevent delays during the system approval process
 - Each local Authority Having Jurisdiction (AHJ) interprets the NFPA code differently
 - DAS must meet their specific interpretation in order to get approved
- Engage a System Integrator that understands the local codes and understands Rf. The right SI will make your project go smoothly from start to finish.
 - Rf study, design, system selection based on needs/requirements, installation, turn-up, commissioning, testing, approval, C of O
 - LEED certification is great for energy conservation, but impacts coverage within a building
- Delays are most commonly a result of:
 - ERCES does not meet local code requirements or wrong code year
 - DAS Alarming
 - Battery Backup runtime requirements
 - Insufficient RF Coverage at critical areas such as exit passageways and stairwells
- Proper planning upfront & engaging the right partners will save time, money, and headaches!



THANK YOU!

NECA • BICSI
SUMMIT 2022

Dennis J. Burns
Director, Public Safety - ADRF
(201) 755-9500
dburns@adrfttech.com





NECA • BICSI **SUMMIT 2022**

