

EMERGENCY RESPONDER RADIO COVERAGE (ERRC)

BDA Systems

2018

NOTIFIER®
by Honeywell



DURING AN EMERGENCY, RELIABLE COMMUNICATION IS CRITICAL.

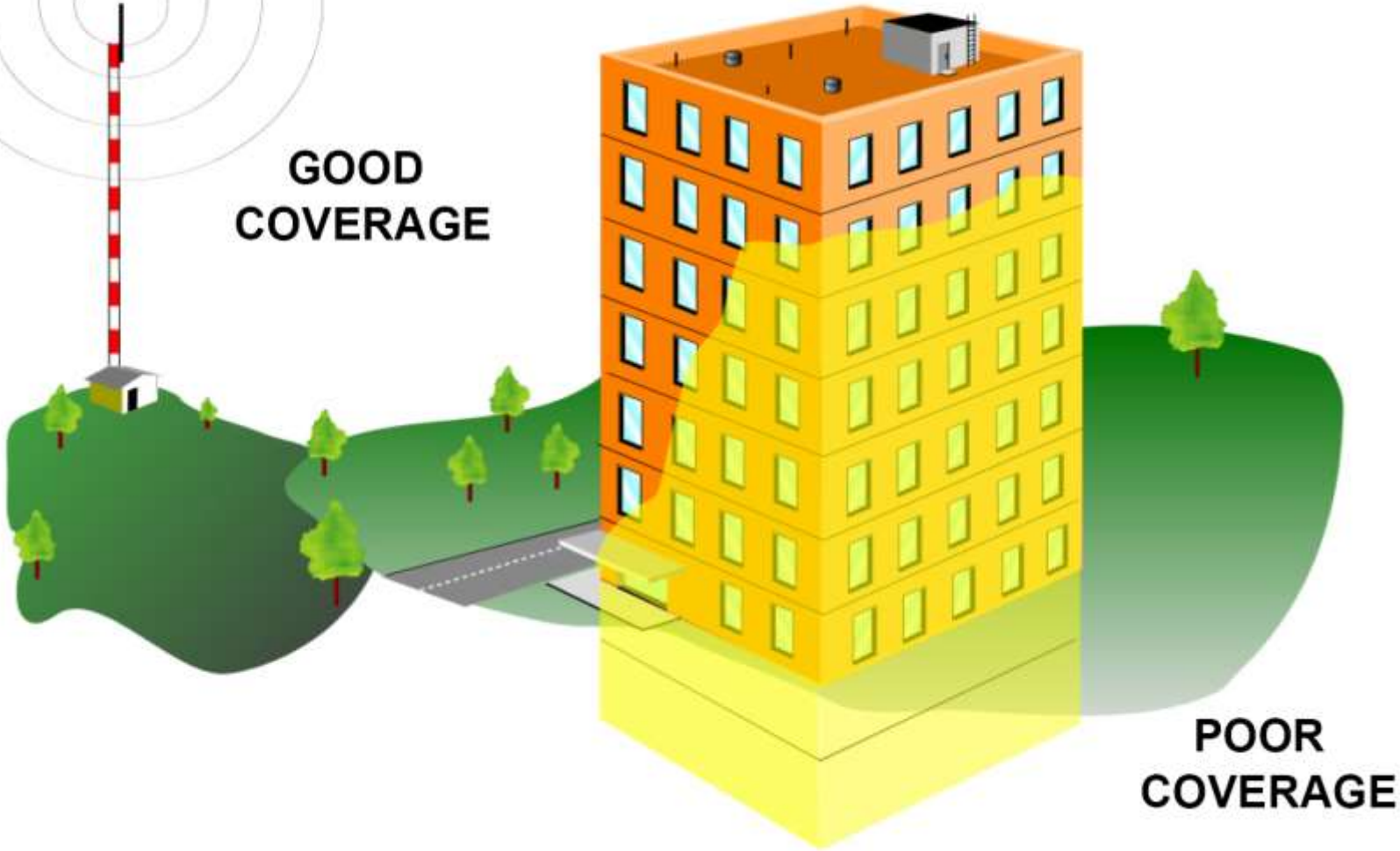
Staying informed with clear radio transmissions between first responders will **help prevent further injuries and save more lives**

The Coverage Problem

In-building radio signal degradation

Radio signals are attenuated by:

- Concrete, Metal and other building materials
- Low-E Glass
- Below-Ground Structures
- Other obstructions
- RF Interference



The consequence:

Poor in-building radio signal coverage and “dead spots”.
Emergency responders lose communications

Company Internal

What is a BDA System?

BDA – Bi-Directional Amplification system is used to enhance in-building radio frequency signal coverage

- Radio Frequency (RF) Amplifier that amplifies/boosts
  - Signals in 2 directions
- Also known as a signal booster
- Can also be UDA
  - Uni-Directional Amplifier
    - Signals in 1 direction

Distributed Antenna System (DAS)

- An active device (BDA/Signal Booster) and an antenna distribution
  - Provides coverage where it needs to be within a structure

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BDA is a LIFE SAFETY SYSTEM

- Supervised by building's fire alarm system
- Typically purchased with Fire Alarm
  - Installed and tested by qualified, factory certified technicians
  - Inspected by AHJ
- Code Driven Requirement
- AHJ Specifications
  - AHJ/Jurisdictions have different frequency requirements

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Basics:
Two Way Radio & BDAs

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The Two Modes of Two-Way Radio Communications:

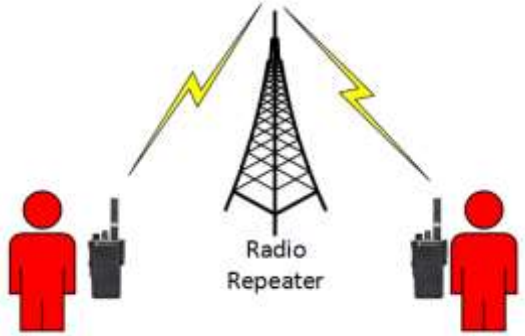
DIRECT RADIO TO RADIO

- AKA, “Simplex” Radio Communications where radios “talk” directly and there is no need for a central radio site.



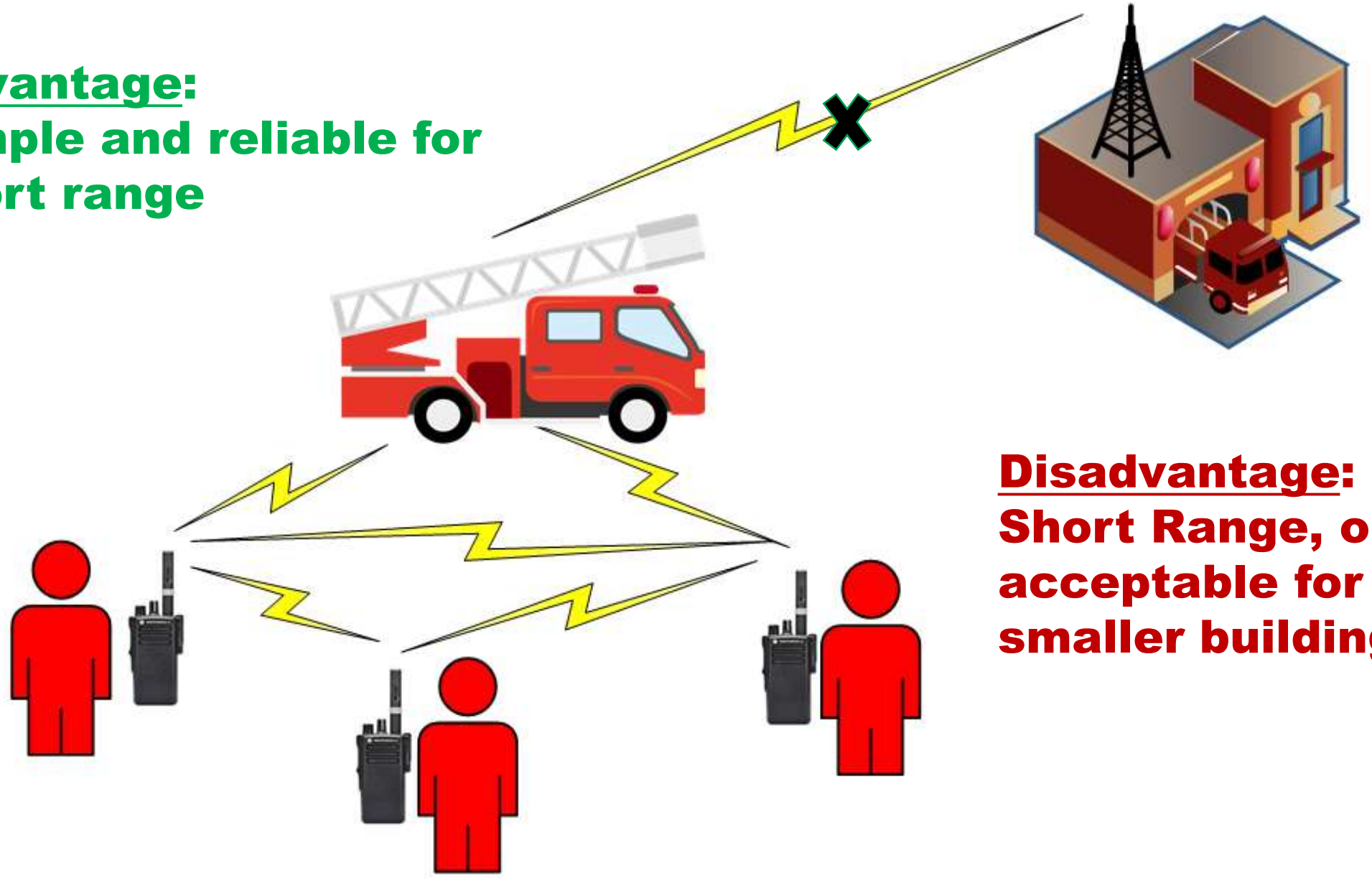
REPEATED

- AKA, “duplex” frequency systems where all communications go through the repeater site. All transmissions are received and rebroadcasted with higher power by the repeater.



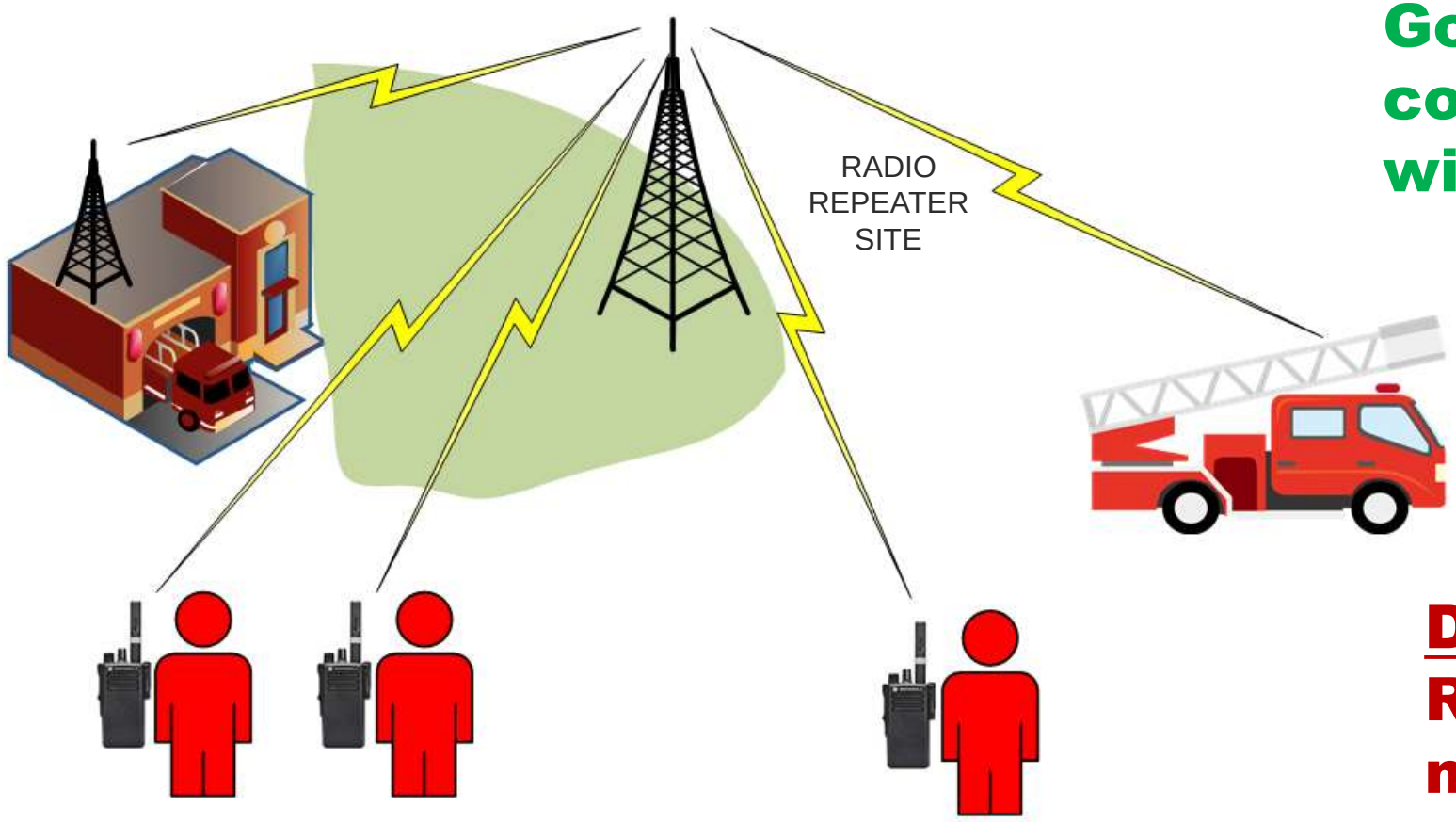
Direct – “Simplex” Radio Communications

Advantage:
Simple and reliable for short range



Disadvantage:
Short Range, only acceptable for smaller buildings

Repeated, “Duplex” Frequency Systems



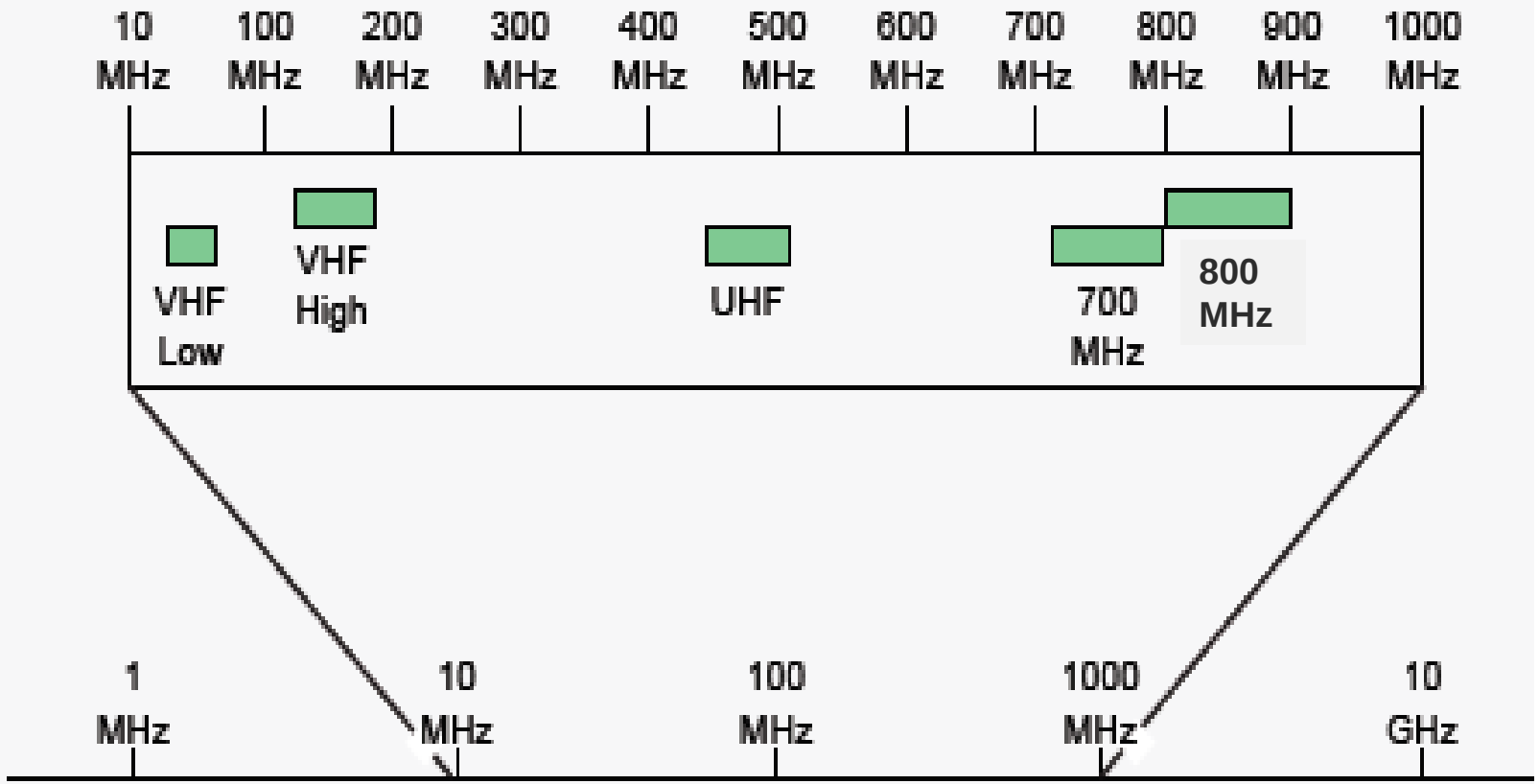
Advantage:
Good radio signal coverage over a wide area.

Disadvantage:
Radio signals must reach repeater site to work.

Radio Frequency

Operates on a specific radio frequency/radio channel - Within a specific band

Figure 2.1. The Electromagnetic Spectrum



VHF Band = 150-174MHz

UHF Band = 450-520MHz
Comprised of 10MHz-wide Sub-Bands

700MHz

800 MHz

Bi-Directional Amplifiers (BDAs) Frequencies / Models

- **What types of radio system(s) does your jurisdiction use?**

	TYPICAL USE CASE
• **37%** VHF High Band 150-174 MHz	Public Safety Communications
• **17%** UHF Band 450-470 MHz	Public Safety Communications
• **4%** UHF T-Band (470-512 MHz)	Formerly TV; rebanded now to Public Safety Comm.
• **4%** 700 Broadband (758-769/788…)	Public Safety **Data** Communications: **FIRST NET**
• **13%** 700 NarrowBand (768-775/798…)	Public Safety **Voice** Comm: 2-way radio only
• **6%** NPSPAC Band (806-809/851…)	Natl Public Safety Planning Advisory Committee
• **49%** 800 MHz Band (809-815 MHz/854…)	Public Safety **Voice** Communications 99% time
• 2% 4.9 GHz Band (4940 – 4990 MHz)	former public safety, now LANs & hotspots
• 1% 5.9 GHz Band (5850-5925 MHz)	

How important are BDAs to Public Safety?

Source: IAFC Survey 2017

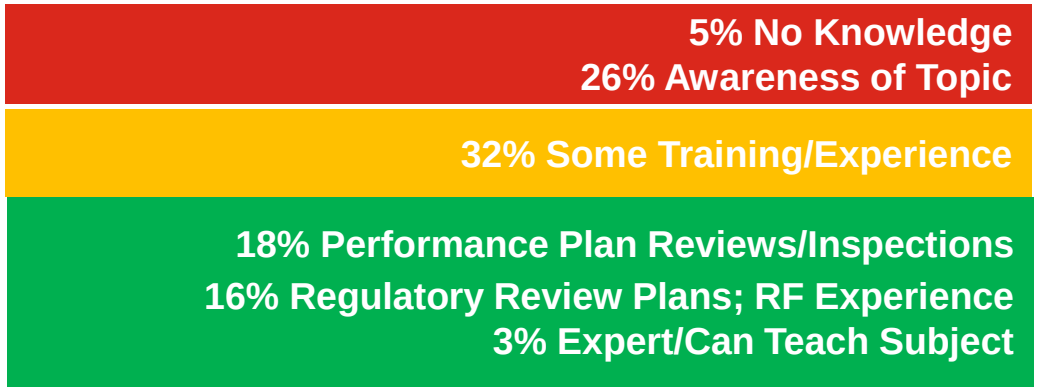
% of Buildings with Poor Radio Frequency Coverage



Do you have a method to track these buildings?

Yes 38%, No 62%

Level of Expertise with BDA/ERRCS Systems



Have You Experienced a Communications Failure within a building during an emergency incident?

56%

- Last 6 months 31%
- Last Year 16%
- Last 2 Years 9%

How Important is Reliable In-Building Communication Coverage of PS LRM during emergencies?

94%

Critical 79%
Frequently Important 15%

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Code Requirements

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Fire Code Terminology – Commonly Used

- **Emergency Radio Communication Enhancement Systems - ERCES**
- In-Building Emergency Responder Radio Systems - IBERRS
- In-building public safety radio signal booster - IBPSRSB
- In-building radio system -IBRS
- In building emergency communication radio enhancement systems – IBECRES
- **In-building emergency responder radio enhancement system – IBERRES**
- In-Building Public Safety Communication Systems - IBPSCS

- **Auxiliary Radio Communication | ARC System (in New York City & Long Island)**

- **Public safety signal booster – PSSB**
- Public safety in-building communications systems - PSIBCS
- Public safety bi directional amplifier –PSBDA
- Public safety radio enhancement system – PSRES

- **Emergency radio coverage system - ERCS**
- Emergency Communications Radio System – ECRS
- **Emergency responder radio coverage systems – ERRCS**

- Signal booster system – SBS
- Distributed antenna system –DAS
- 2-way radio communication enhancement systems – RCES

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It
Is now...

FIRE
CODE

Code Development

- In-Building Life Safety Concerns:
  - Protect Public
  - Protect First Responders/Emergency Personnel
- Standardization and Consistency for In-Building Public Safety Systems
- Enforce “Public Safety” grade qualifiers for the
  - Installation
  - Installer

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Code Driven Requirement

IFC SECTION 510 EMERGENCY RESPONDER RADIO COVERAGE

- First appeared in the appendix of the 2009 IFC, the provision was moved to the body of the code in 2012
- At present 12 states have adopted the 2012 edition of the IFC and 12 states have adopted the 2015 edition of the IFC
- Section 1103.2 specifies the requirements for emergency responder radio coverage in existing buildings

NFPA 72 NATIONAL FIRE ALARM AND SIGNALING CODE

- 2010 Edition, section 24.5.2
- The 2016 edition of NFPA 72 relocated the requirements to NFPA 1221
- NFPA 1221, Section 9.6

IBC 2015 -SECTION 916

- Refers to IFC section 510 or the state recognized fire code

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IFC Building Requirements

IFC Rule

- All newly constructed buildings, shall have approved radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building.

Current NFPA and IFC Codes

Conditions	NFPA 1221 Section 9.6 – 2016 edition	IFC 510 – 2015 edition (2018 ed. avail. Oct 2017)
Antenna Malfunction	Applicable – System & BDA	Not specifically – AHJ may require
Signal Booster Failure	Yes	Yes
Low Battery 70%	Yes	Not specifically – AHJ may require
Loss of Normal A.C.	Yes	Yes
Failure of Battery Charger	Yes	Not specifically – AHJ may require
Backup Duration	12 Hours	24 Hours* (12 hours 2018 IFC)
Signal Coverage	>=95 dBm (DAQ3.0 2016 edition) / 90% / 99%	>=95 dBm (DAQ3.0) / 95%
Monitoring / Maintenance	Yes	Yes
Battery Backup Cabinets	NEMA4	NEMA4 (NEMA3R 2018 IFC)

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NFPA Coverage Requirements



- Critical Area Coverage – 99% (NFPA 1221 9.6.7.4) coverage required in Critical areas:
  - Emergency Command Center(s)
  - Fire Pump Room(s)
  - Exit Stairs
  - Exit Passageways
  - Elevator Lobbies
  - Standpipe Cabinets
  - Sprinkler Sectional
  - Valve Locations

- General Area Coverage – General building areas should have (90% NFPA 1221 9.6.7.5) and (95% “all floors of the building,” IFC 510.5.3, DRAFT 2018 edition) coverage

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NFPA Requirements

Signal Booster Components

- Boosters should have FCC certification prior to installations.

Analog and digital communications

- All signal boosters shall be compatible with both analog and digital communications simultaneously at the time of installation

Component Enclosures

- All signal booster and components shall be contained in NEMA-4 or 4X type enclosure(s)

Donor Antenna Isolation

- Isolation shall be maintained between the donor antenna and all inside antennae. A signal generator is recommended to test for Isolation.

Dedicated Monitoring / Annunciator Panel

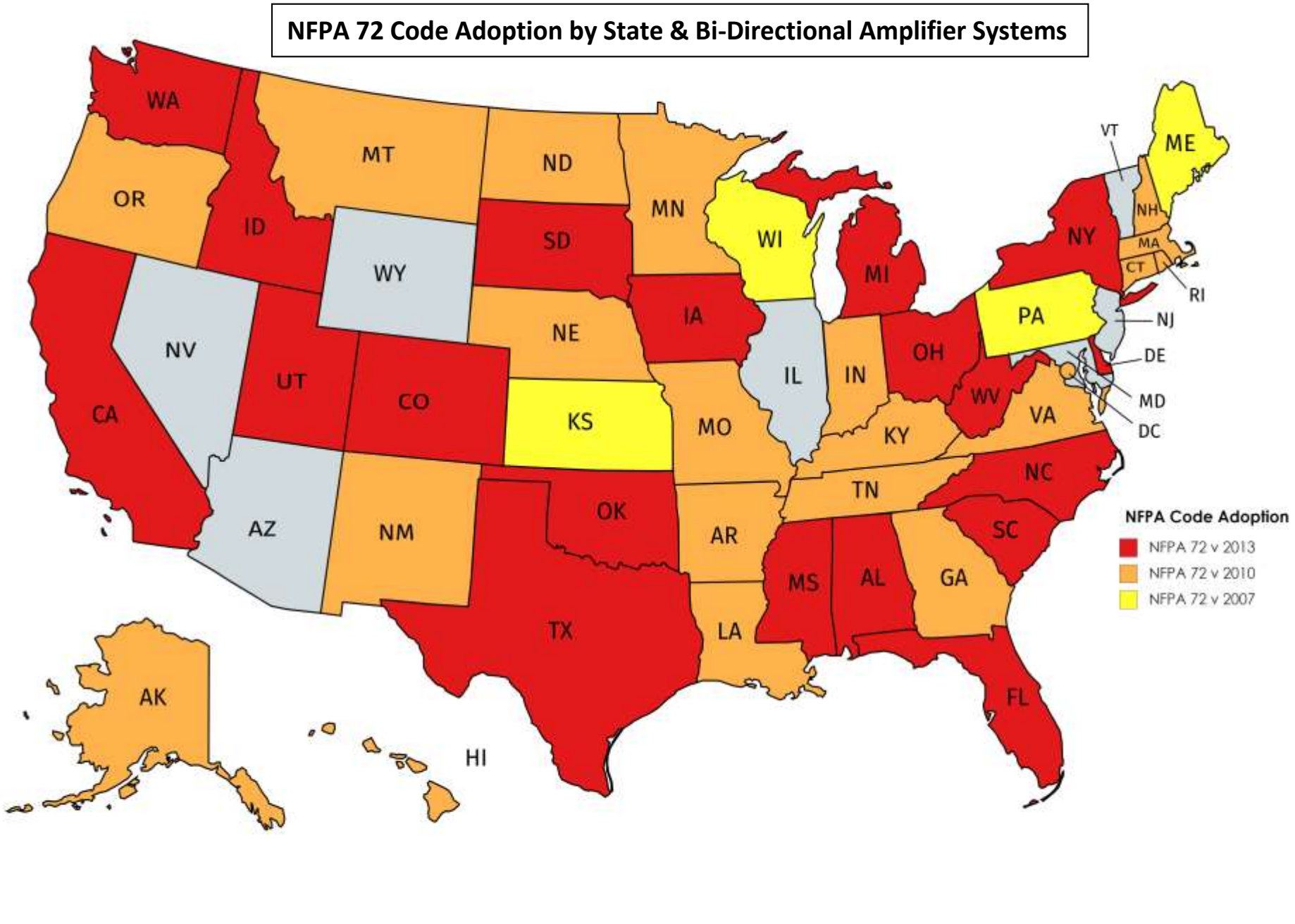
A dedicated monitoring panel shall be provided within the emergency command center to annunciate the status of any signal booster(s). The monitoring panel shall provide visual and labeled indication of the following for each signal booster:

- Normal AC power
- Signal booster trouble
- Loss of normal AC power
- Failure of battery charger
- Low-battery capacity
- Antenna failure

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Is BDA Enforceable?

Depends on whether it is required by Building Code or by AHJ OR by city ordinance



RESPONSIBILITY



- As required by the building code
- As requested and specified by the AHJ

- Property Owners are Responsible for:
  - Maintenance
  - Surveys
  - Upgrades



UL-2524

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What is the UL2524 Product Standard?

- “The UL 2524 Creates a Product Performance Standard that allows manufacturers to design and list BDA systems to”

- “UL2524 Assures AHJs, A&Es, Building Owners & Occupants that Honeywell’s BDA Systems Perform the First Time and Every Time—exactly as prescribed in IFC 510.5.3 and NFPA 1221.”

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Brand New Product Standard for ERCES/BDA Systems

- Covers products used for 2-way ERCES/BDA systems installed in a location to improve wireless communication at that location.
- Current UL ensures 100% compliance to:
  - basic installation & operation safety (UL60950),
  - the installation specifications prescribed in NFPA 1221 2016 section 9.6, and
  - performance to the standards defined in IFC 510.5.3 2018, including section 1103.2 for existing buildings

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BDA System Components

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BDA System Components – 1 of 5



- Donor Antenna
  - Installed on the Roof of the building
  - Pointing to the public safety radio
  - repeater site
  - High gain, high directivity
  - Does not need line of sight



- Coaxial Cable
  - Typically Plenum Rated, ½” diameter
  - Low insertion loss is required
  - We now use red cable
  - Some AHJs have special labeling requirements

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BDA System Components – 2 of 5

- Signal Splitters and Couplers
  - Used for signal distribution
  - Come in different coupling values



- RF Connectors
  - Installed using specialized tool
  - Easily done by a trained technician



- DAS Antennas
  - Fiberglass “stick” antennas have the best performance
  - Other antennas, such as low-profile are available
  - Various mounting options are available



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BDA System Components – 3 of 5

- Battery Backup
  - All RSI signal boosters come with a fully integrated
  - battery charger and battery diagnostics functions.
  - OEM Battery backup enclosure is provided
  - with the BDA
  - Easy to install, designed to fit below the BDA



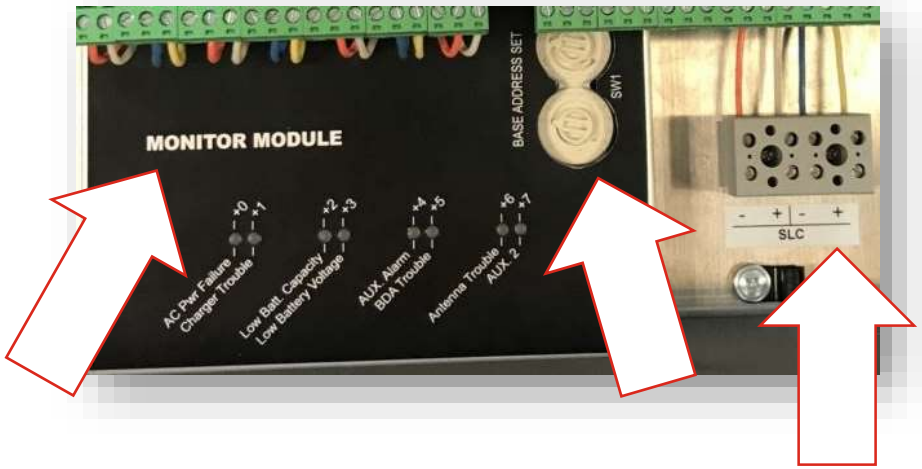
- Annunciator Panel
  - Dedicated monitoring panel is required
  - Specified in NFPA-72 and 1221
  - Independent from fire alarm system
  - Powered by the BDA power supply and battery
  - OEM panel included with the BDA
  - Easy installation on a standard 2-gang electrical box



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BDA System Components – 4 of 5

- Fire Alarm Panel Connection
  - BDAs must be monitored by the building's Fire Alarm System
  - Supervisory signals normally include:
    - Donor antenna malfunction
    - BDA Failure
    - Low Battery Capacity
    - Loss of normal AC Power
    - Failure of a Battery Charger



  - Addressable Monitoring Module is now available as an option for simple connection to NOTIFIER

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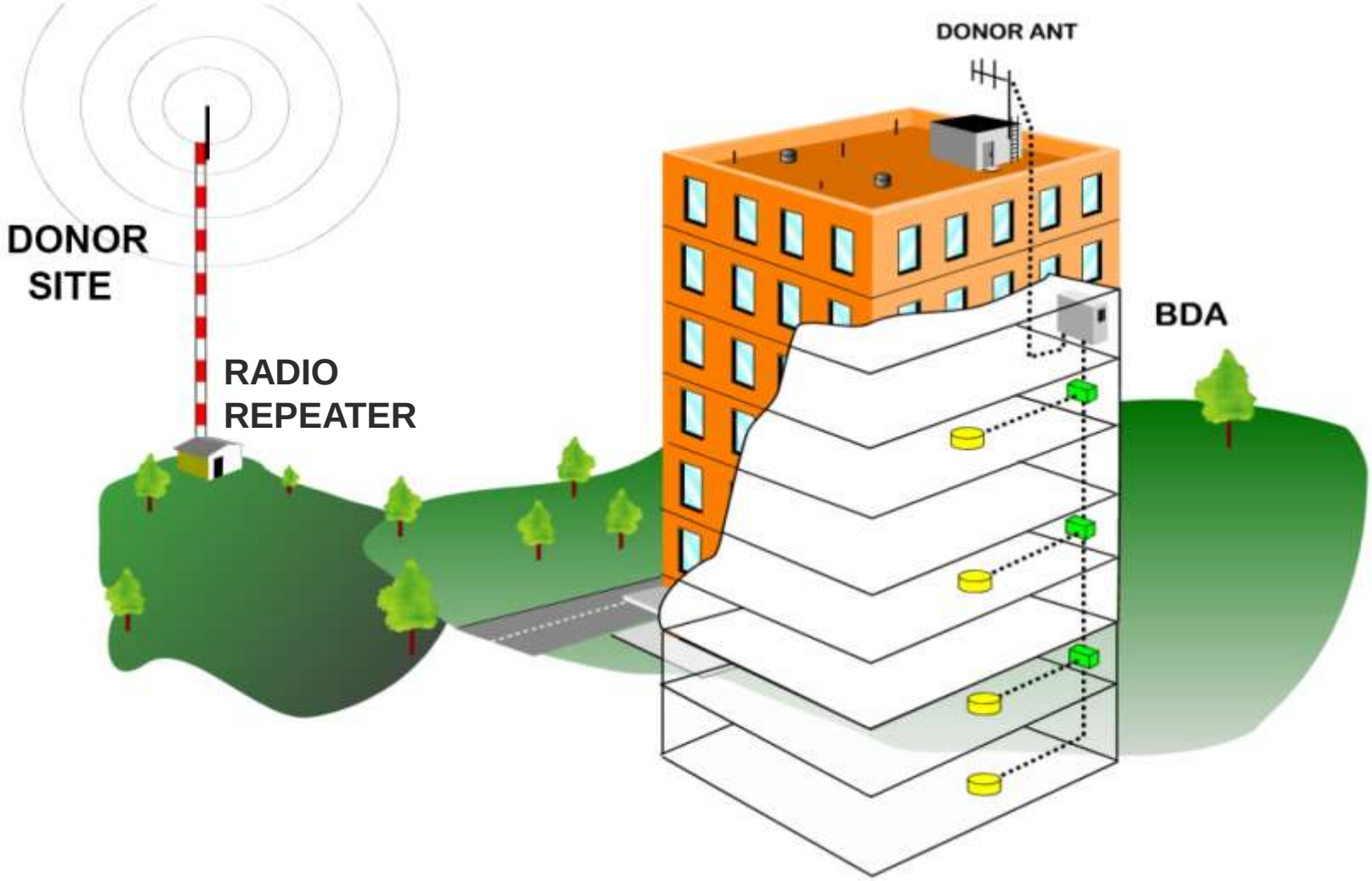
BDA System Components – 5 of 5



- BDA (Signal Booster)
  - Must meet requirements of the local AHJ.
  - Each jurisdiction is different:
    - Frequencies / channels required?
      - VHF, UHF, 700 or 800MHz, or multi-band?
    - Fire only or Fire, Police, EMS, Regional?
    - Bandwidth?
    - Monitoring Requirements?
    - Annunciator Location?
    - Labeling Requirements?
    - Any other requirements?
  - AHJs in larger jurisdictions usually have well-written specs, but for many this is still a new requirement and there is no written spec.
  - RSI Project Managers can assist AHJs with technical specifications.

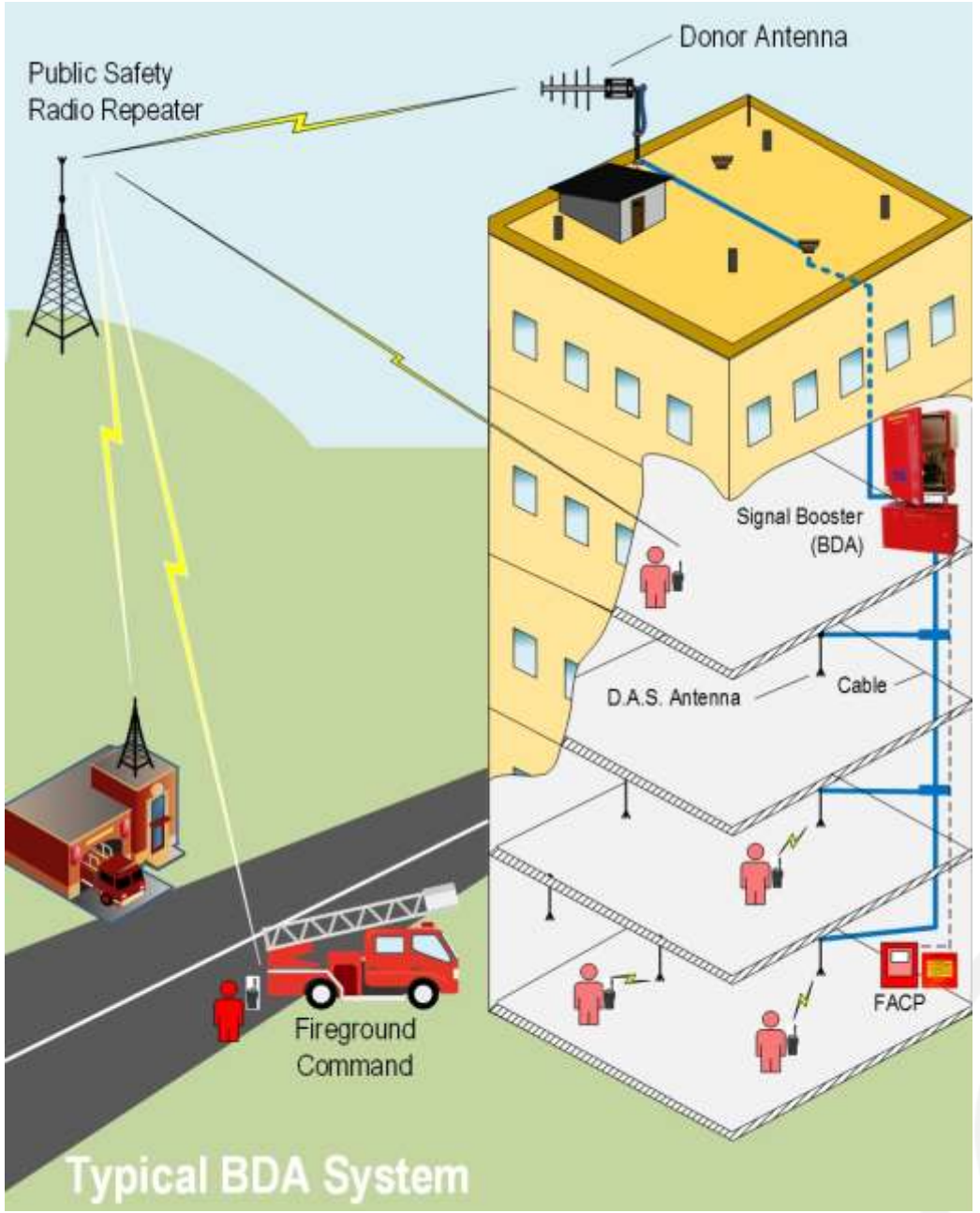
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BDA Systems Provide Reliable In-Building Coverage:



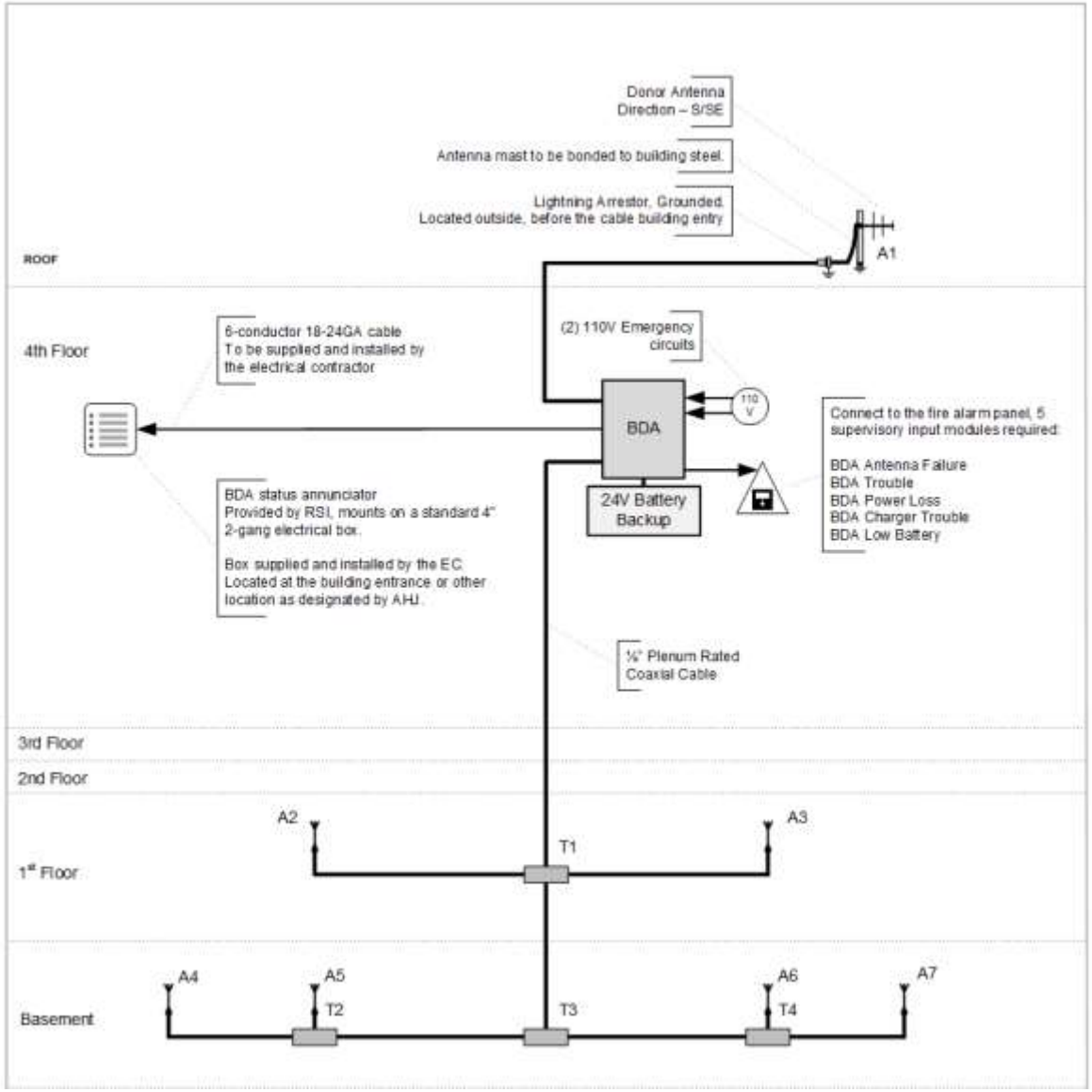
Company Internal

Typical BDA System with Fireground Command



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Riser Diagram of a Typical BDA System



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Deployment

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Typical Deployment Process

VERIFY LOCAL REQUIREMENTS

Review AHJ requirements

- Not all have a BDA written specification
- Freqeuencies that need to be covered?
- Fire Only? Or Fire & Police? Other?
- Repeater locations?
- Backup sites?
- Additional requirements?

SIGNAL SURVEY

Once the building is substantially complete, a qualified and FCC licensed vendor will perform the signal survey to check the current radio signal levels inside the building.

MEASURE SIGNALS

Vendor will measure the incoming signal levels by monitoring the AHJ radio repeater talk-out frequency. Vendor shall notify AHJ and get approval for the testing.

DOCUMENT LEVELS

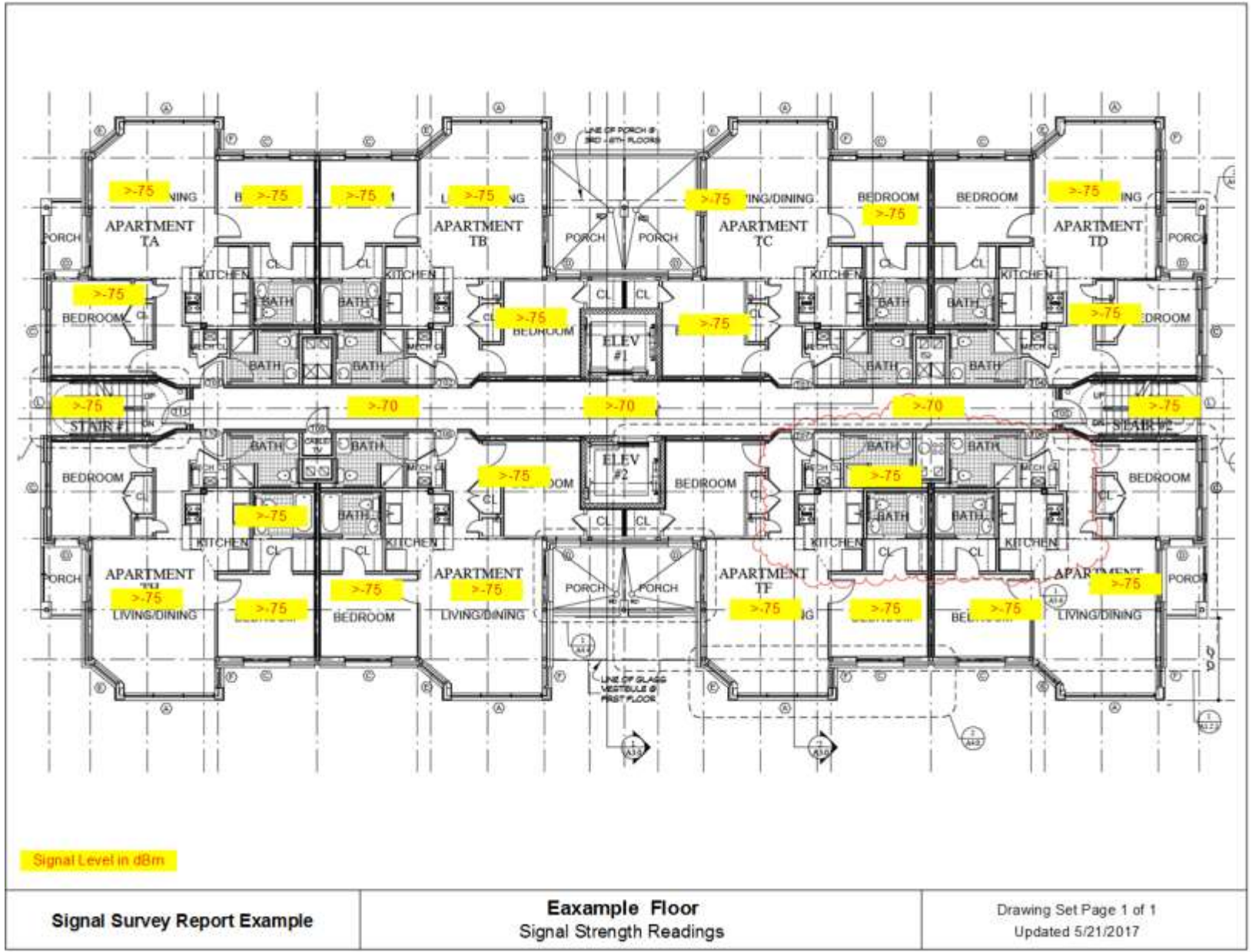
Signal readings are documented/noted on print floor plan and forwarded to the system design engineer

BDA REQUIRED?

If the measurements show that the levels are below the required minimum, then a signal amplification system (BDA system) shall be required.

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Typical Signal Survey Report



Typical Deployment Process (Continued)

- **DESIGN** documents are submitted to the electrical engineer and/or architect and then to the AHJ for review and approval.
- **PERMIT** for installation of a BDA system is obtained by the BDA vendor, as required by the AHJ.
- **INSTALL**: Licensed Electrical contractor installs cable, connects power and makes connections to the fire alarm system. BDA vendor installs the antennas, terminations and other RF components.
- **TEST:** BDA vendor commissions, tests and documents the system in accordance with NFPA specifications.
- **FINAL REPORT** is submitted to the AHJ along with a request for inspection.
- **INSPECT**: AHJ inspects the system and does several radio checks from different parts of the building and all critical areas.
- **COMPLIANCE** AHJ signs off on the system and provides a compliance certificate.

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FCC Certification and Registration Requirements

- Signal Boosters must be FCC certified (manufacturer product brochures and product labels must include FCC ID number)
- BDAs are FCC certified to operate on the licensee's frequencies
- FCC Requires frequency licensees (FD, PD, municipality, etc.) to register all signal boosters that operate on their frequencies
- Registration is free and FCC has a simple on-line registration tool: https://signalboosters.fcc.gov/signal-boosters
- Registration needs to be done by the AHJ (frequency licensee) because it requires the licensee FRN (federal registration) number and FCC password.
- BDA vendor can assist if needed

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Company Internal



Installer Requirements

- Meet one or more and AHJ accepted: (Based on State/Local Agencies supporting Code Licensure Regulations
  - Registered, Licensed, or Certified by AHJ/State
  - Nationally recognized certification organization
  - Brand/System Specific Factory Trained and Certified Fire Alarm and Emergency Communication System Installers

- Requirement Verification
  - Qualification/Certifications by AJH
    - FCC GROL License
    - PS Project References
    - Product Certifications

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NOTIFIER Solution

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Complete Solution

PRODUCT

NOTIFIER offers all the components required for Emergency Radio Communication Enhancement Systems

- Signal Boosters / Bi-Directional Amplifiers (BDA) with in-built NOTIFIER Fire Alarm Panel Monitor Module
- Batteries and Battery Enclosure
- Donor Antennas
- Distributed Antenna System (DAS) Antennas
- Coaxial Cable, Connectors and Lighting Arrestors
- Power Dividers and Hybrid Couplers

SERVICE

NOTIFIER Independent Engineered Systems Distributors offer all the services required for your life safety system

- Design
- Install
- Test & Inspect
- Factory trained and certified by RSI

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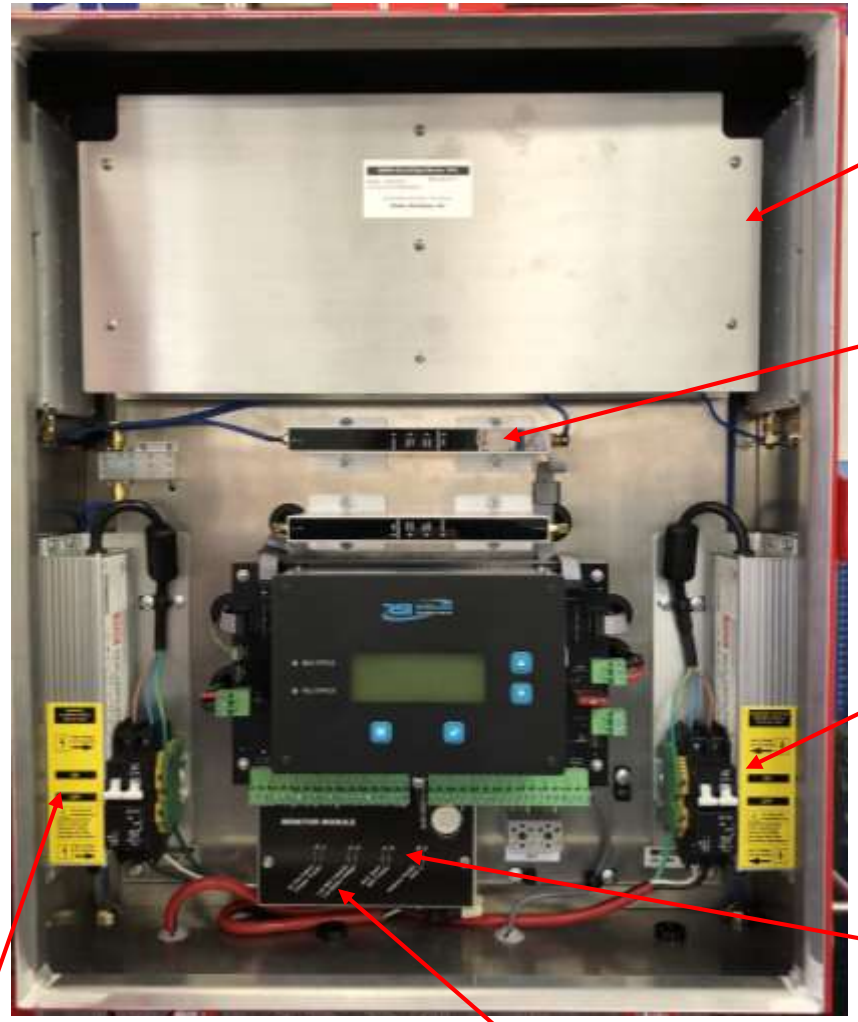
Integrated, All Inclusive Solution



- **UL2524 1st Edition for In-building 2-Way Emergency Radio Communication Enhancement Systems listing**
- **NFPA 72 2010 Edition, NFPA 1221 2016 Edition and IFC 2018 compliant**

- Single portfolio to meet any application across US supporting all public safety frequency bands
- Various models available for UHF, VHF,700MHz FirstNet, 800 MHz and multi-band
- Integrated dual power supply and battery charger with intelligent battery monitoring
- NEMA 4 Type Approved Equipment Enclosure and NEMA 3R Type Approved Battery Enclosure
- Supports higher system gain for efficient link budgeting





NEMA 4-Certified / UL-Listed Enclosure Assembly

RF Resiliency

UL Listed Built In Battery Charger
for on-board Battery Backup Unit

NFPA 1221
“Supervision of Annunciator LEDs”

UL-Listed Power Supply

Built In Monitor Module

Company Internal

Ease of Use

- Integrates directly to NOTIFIER Fire Alarm Panel for BDA monitoring
- Compact size and weight saves premium space in a 2-hour rated room
- LED indication for signal level and LCD display for alarms improves service diagnostics
- Field tuning or programming not required, simplifying setup
- Supervised SD card onboard for alarm logging provides audit and troubleshooting support
- Modular design for easier troubleshooting and field component replacement

Lower Total Life Cycle Cost

- Built-In NOTIFIER addressable monitor module eliminates additional wiring costs
- Single BDA to cover multiple sub-bands with a wider bandpass
- RF resiliency and oscillation prevention for improved reliability
- Lower power consumption for long term reliability and lower cost
- BDA Testing & Inspection can be incorporated into annual fire alarm testing

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LEADER IN LIFE SAFETY TECHNOLOGY

- Trusted Leader in Life Safety Solutions
- Delivering Innovative Life Safety Products for over 60 years
- Commitment to our solutions and partnerships

OVER 400 INDEPENDENT GLOBAL BUSINESS PARTNERS (ESDS)

- Trusted Provider of Life Safety Solutions
- Established network of Architects, Engineers, AHJs, End Users
- Design, Install, and Service total life safety solutions for any application
- Knowledge, Expertise, and Service that exceed expectations

Providing World-Class Products and Support

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SUMMARY

SITUATION

- Emergency Responders -Firefighters, EMS and Law Enforcement Officers rely on two-way radios for communications in every day operations

PROBLEM

- Radio signals in-building are weakened by structures such as concrete, windows, metal, underground, etc
- Emergency responders lack in-building radio coverage

SOLUTION

- Enhance in-building radio frequency signal coverage with NOTIFIER's bi-directional amplifier (signal booster) and distributed antenna system

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Who is Radio Solutions, Inc. – RSI?



RSI™ Radio Solutions, Inc.

- Engineering, deploying and servicing BDA systems for almost 20 years
- Founded in 1998 as a two-way radio communications provider and authorized dealer for Motorola, Tait, Harris, Telex and others.
- Specializing in public safety radio communications systems
- Honeywell Fire Safety's Partner and 'Supplier of Choice' for Bi-Directional Amplifiers

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Company Internal

Thank you!

For over 60 years, NOTIFIER has been a leader in the fire alarm industry

By selecting NOTIFIER, be confident that you will not only receive the very best in fire alarm and emergency communication systems, but also the knowledge, expertise, and service from NOTIFIER distributors that will exceed your expectations.

NOTIFIER®
by Honeywell