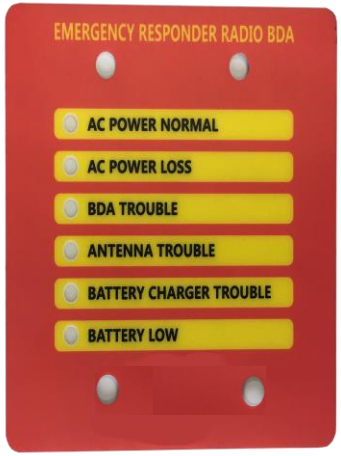

BDA PRESENTATION AND TRAINING FOR BROWARD

November 2018

Presented by David Thompson

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Emergency Responder Communications Enhancement System (ERCES)

In-Building Emergency Responder Radio Coverage Enhancement Systems (IBERRCES)

Bi-Directional Amplifier (BDA) SYSTEMS

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Public Safety Radio

“Reliable Radio Coverage is a Necessity!

Lives Depend on It!”

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The PROBLEM:
In-Building Radio Signal Degradation

Radio signals are attenuated by:

- Concrete, Metal & Other Materials
- Low-E Glass
- Below-Ground Structures
- Other Obstructions
- Radio Frequency Interference

The consequence:

- Poor in-building Fire Fighter radio signal coverage and “dead spots”

- Emergency responders lose communications

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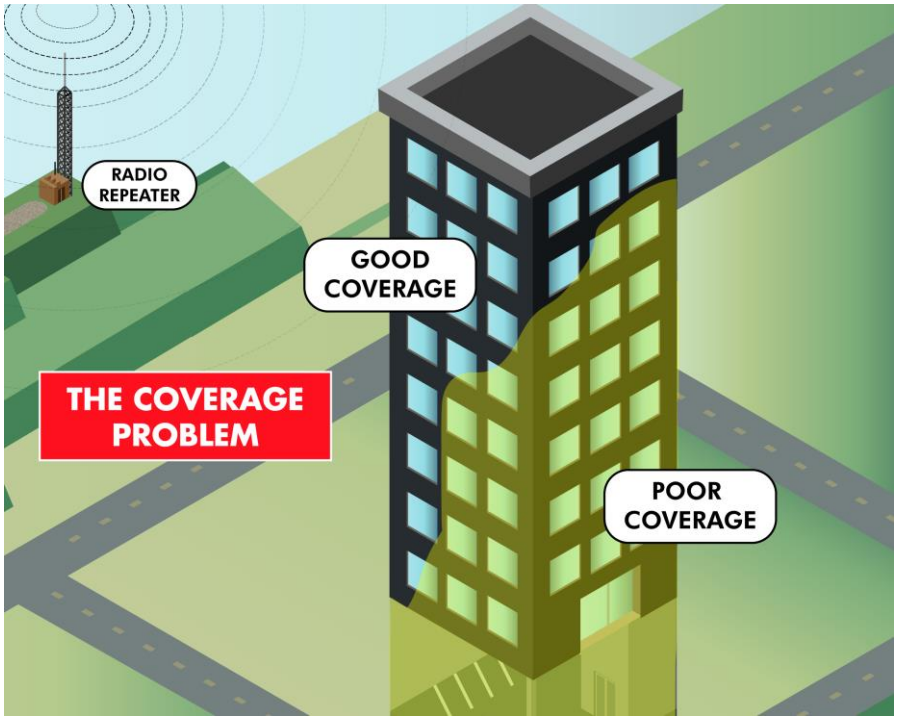
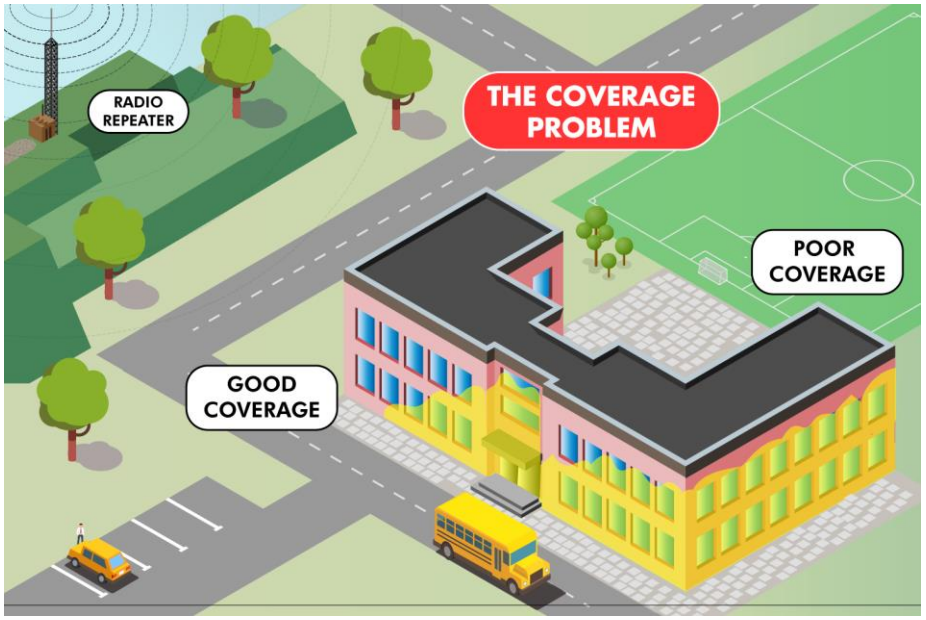
The Coverage Problem





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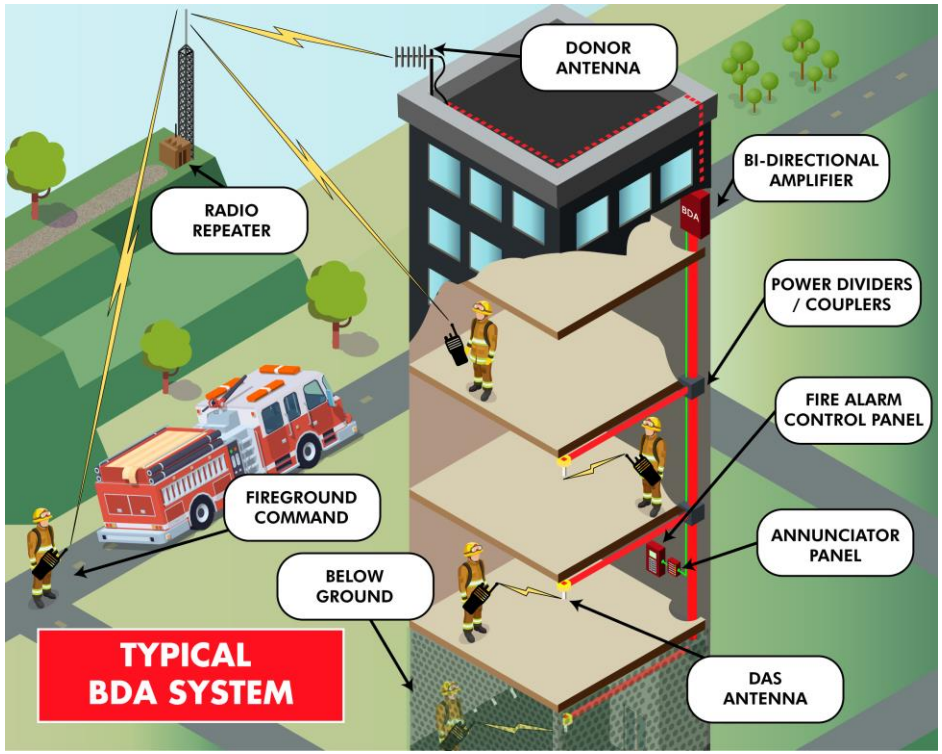
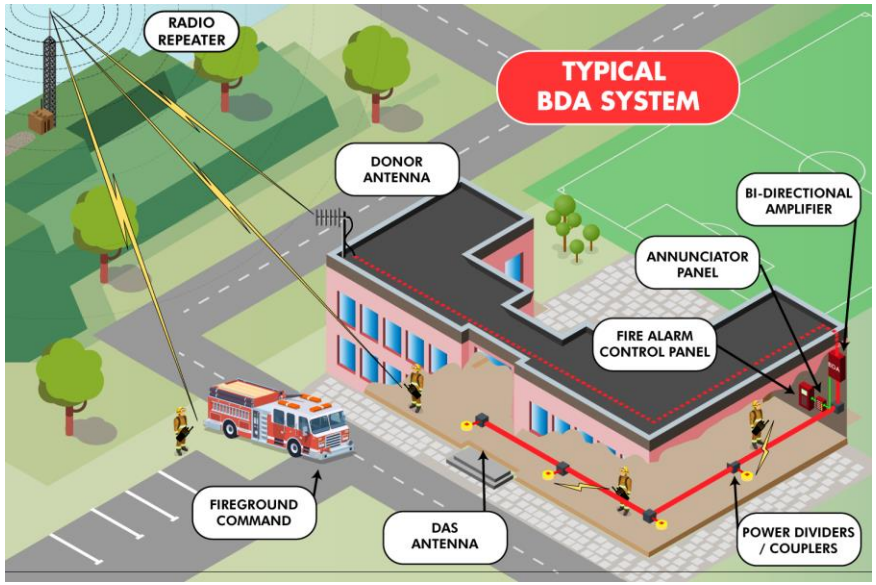
ERRCES / BDA - The Coverage SOLUTION:





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Going Into the UNKNOWN: Will My Radio Work In This Building?

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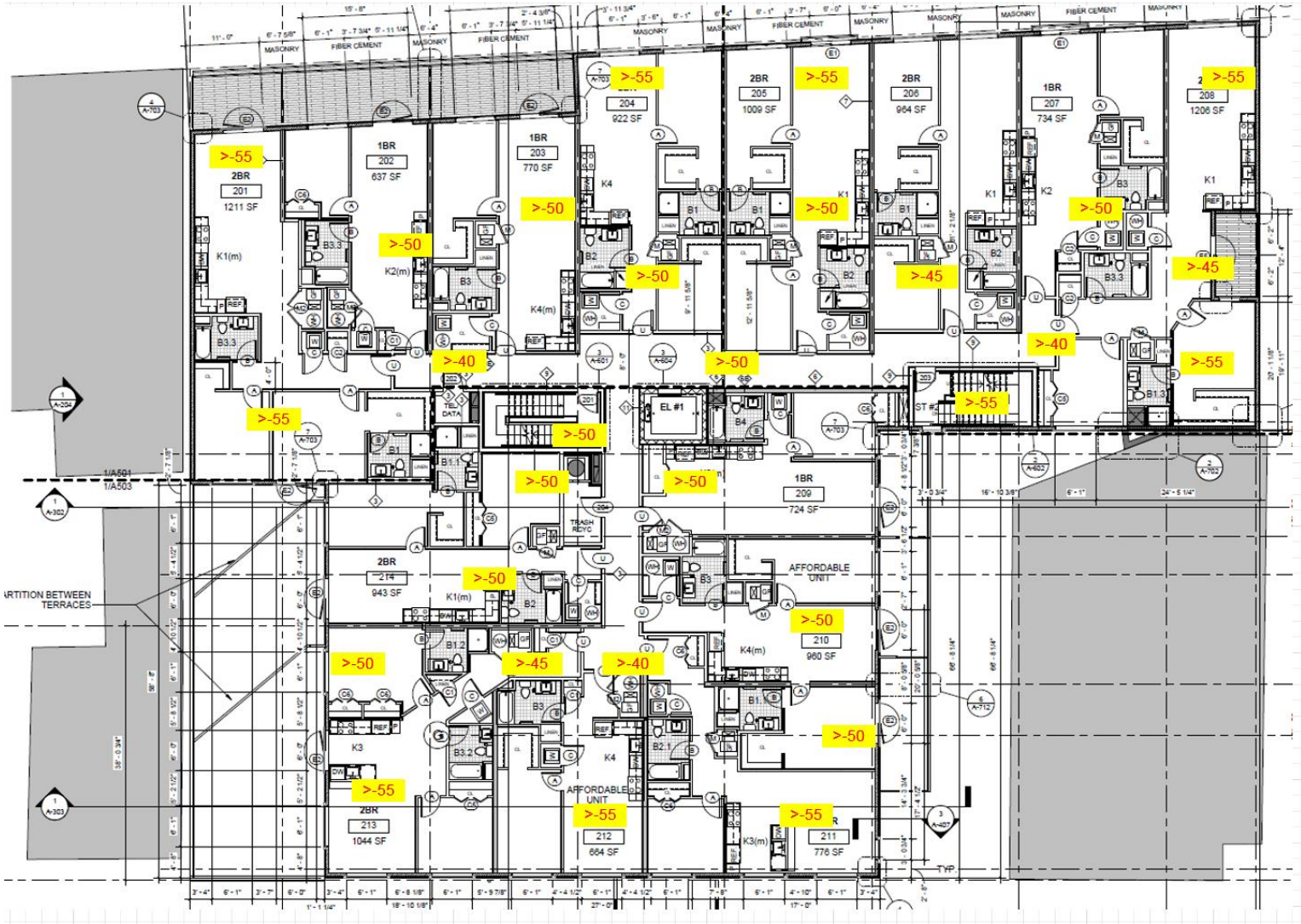
Radio Signal Survey – The “Coverage Map”



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Radio Signal Survey

- Determines if a building has sufficient radio signal coverage or if it needs a signal enhancement (ERRCES) system.
- It is a responsibility of the building owner or construction company to perform survey and to certify signal coverage on a **100% completed** building. Survey report needs to be submitted to the AHJ.
- AHJ Should have signal surveys for all buildings in the jurisdiction.
- Signal enhancement (ERRCES) is required for building with insufficient coverage.
- Final survey / signal coverage certification is done upon building completion.
- Surveys are done by FCC GROL certified technicians. Minimum 20 readings per floor. Test all critical areas. Report submitted to AHJ.

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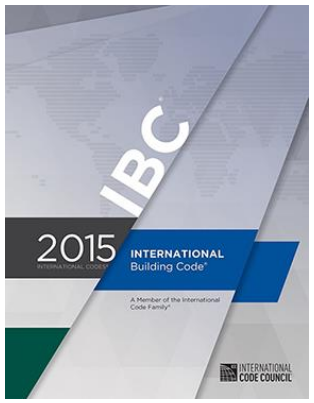
Life Safety Benefits of BDA Systems

Codes & Standards

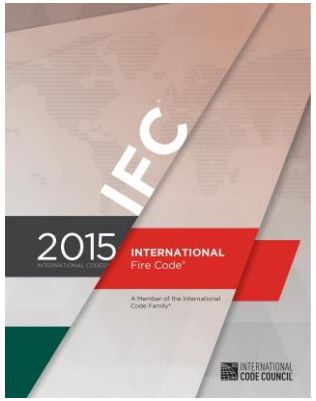
Code-Driven Requirement



IBC 2015 - Section 916

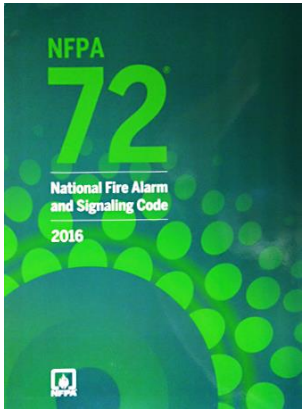
- Refers to IFC section 510 or the state recognized fire code

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 __ states have adopted the 2012 edition of the IFC and __ 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 / 2013 Edition, section 24.5.2
- The 2016 edition of NFPA 72 relocated the requirements to NFPA 1221
- NFPA 1221, Section 9.6 is a Life-Safety Code

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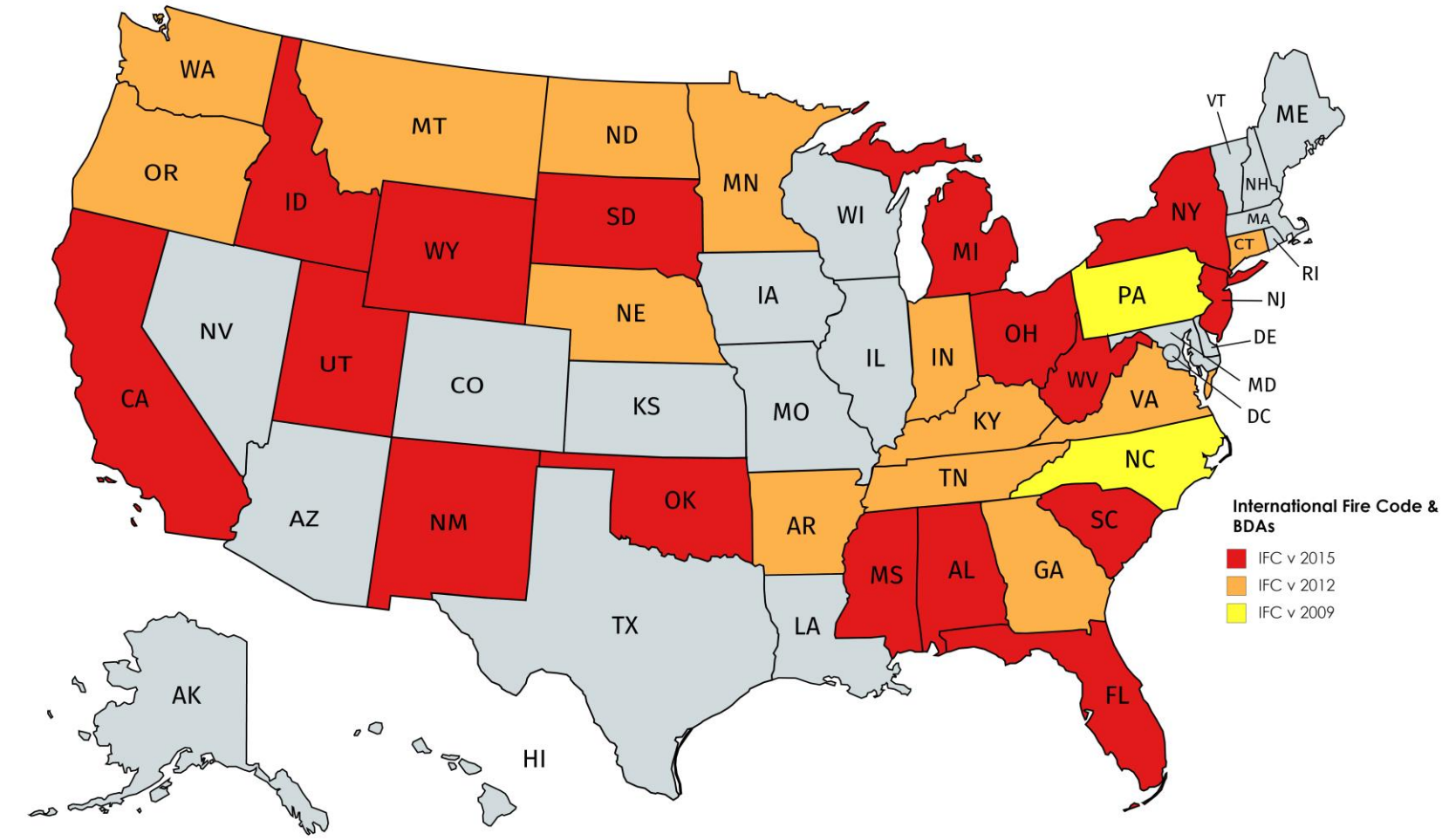
International Fire Code Adoption



ERCES CODE FOR FLORIDA

- Florida currently follows NFPA 101 2015 Edition and NFPA 1 2015 Edition

- NFPA 1 2015 Section 11.10 Requires all new and existing buildings, to have minimum radio signal strength for all fire department communications and shall be maintained at a level determined by the AHJ

- Where required by the AHJ all two-way radio communication enhancement systems shall comply with NFPA 72 and 1221

Florida Fire Prevention Code 633.202

- All existing high-rise buildings are required to have a Radio Frequency Signal Strength Survey by December 31st, 2019

- This provides a 24-month window (until January 1st, 2022) to correct the signal levels for EVERY existing building in the state.

- Existing Apartment and Condominium Buildings must comply by January 1st, 2025

How do you know that the product was Listed for the Intended Purpose?

NFPA 1221 → NFPA 72 Chapter 10.3.1

- “The equipment constructed and installed in conformity with this code shall be listed for the purpose for which it is used.”

IFC 510 / NFPA Coverage Requirements

510.4.1 Radio signal strength.

- The building shall be considered to have acceptable emergency responder radio coverage when signal strength measurements in 95 percent of all areas on each floor of the building meet the signal strength requirements in Sections 510.4.1.1 and 510.4.1.2.

510.4.1.1 Minimum signal strength into the building.

- A minimum signal strength of **-95 dBm** shall be receivable within the building.

510.4.1.2 Minimum signal strength out of the building.

- A minimum signal strength of **-95 dBm** shall be received by the agency's radio system when transmitted from within the building.

NFPA Coverage Requirements

<u>Critical Area Coverage</u> – 99% (NFPA 2013 / 2016) 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**

<u>General Area Coverage</u> – General building areas should have **90%**

NFPA Requirements

Dedicated Monitoring 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
- **INDEPENDENT OF THE FIRE PANEL!**

AHJ CONCERNS ABOUT ERCES

Concerns About ERCES Systems

- **Improper installation** or a failure could lead to **oscillation** (donor antenna signal feeds back into the DAS), creating harmful interference to Public Safety Radio System.
- **Noise on uplink** can potentially add up & cause signal degradation for firefighter radio systems.
- **Failure of A System Component** may go unnoticed without proper monitoring & supervision (required by NFPA 1221), resulting in the system NOT being available when you need it most.
- **“Competency”** of System Designer & Installer
- How do AHJs **specify & ensure compliance**?

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THE SOLUTION

UL 2524 Listed ERCES BDA

Oscillation Suppression

- BDA Detects Oscillation & Reduces Gain in 5dB steps until no further oscillation
- BDA Sends Trouble Signal to Fire Alarm Control Panel
- BDA Indicates Trouble on Remote Annunciator / Monitor
- BDA Continues normal operation with the maximum allowable gain

Noise Suppression

- Most BDAs normally generate a small amount of noise when idle.
- The cumulative effect of all this noise raises the “noise floor” on a frequency.
- Honeywell BDAs operate in “stand-by mode” and do not transmit any noise while idle.

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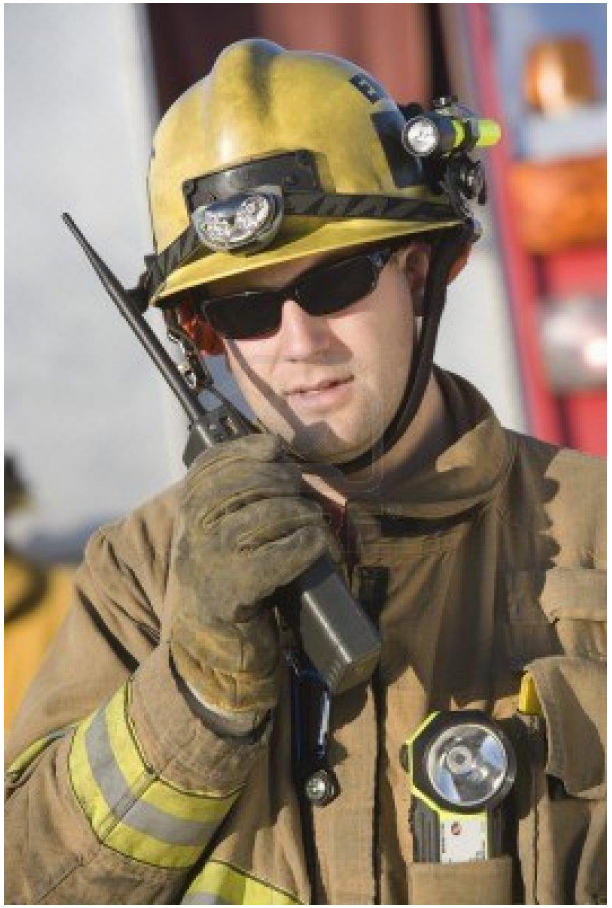
Compliance, Safety and Reliability = UL 2524

- **IFC & NFPA Compliance**
  - **Supervision & Monitoring**
  - **UL-Listed Power Supplies**
  - **Battery Backup (24 hrs @ 20% derated)**
  - **Monitoring of Secondary Power Supply**
  - **Type 4 Enclosure (certified as an assembly)**
  - **Supervised dedicated monitoring panel**
- **Electric Shock & Fire Safety (UL 60950)**
- **Product Reliability (2nd Edition)**
- **FCC Compliance**
- **Oscillation Suppression**



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Elements of a TRUE Life Safety ERCES / BDA System

Each UL2524 Listed BDA is installed by Factory-Certified Life Safety Systems Technicians with F.C.C. G.R.O.L. Licenses as required by IBC/IFC.

Standardized Training, Tools & Equipment, Standardized Design Process (using iBwave software)

Each ERCES system design is either certified or done by the manufacturer

Proficiency ensures that the entire system meets Honeywell's Quality Standards

UL 2524

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Integrated, All Inclusive UL-Listed Solution

- **Honeywell is the *first Fire & Life Safety Co.* to market a UL 2524 Listed, fully integrated BDA solution**
- The first, and the only all-inclusive, turnkey, **code compliant** BDA System on the market
- *Independent Testing & Verification of Performance Assures AHJs, A&Es & Building Owners that Honeywell's BDA Systems* ***Perform the First Time and Every Time,*** *exactly as prescribed in IFC 510.5.3 and NFPA 1221 / 72*
- Pursuing CSFM (Oct '18), UL2524 2nd Edition (Jan '19), FM

UL 2524

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Are In-Building ERCES Regulated?

NEW UL 2524 Product Performance Listing ensures safe, reliable equipment as required by code

- Until recently, there was no certification process for ERCES systems.
- UL has created a product standard by publishing an Outline of Investigation (OOI) in December 21, 2017.
- Honeywell BDA now complies with and is listed to this new UL Standard as of June 11, 2018.

UL 2524

FCC-Certified

- Signal Boosters must be FCC certified (manufacturer product brochures and product labels must include FCC ID number).
- The end-user must ensure that all equipment is FCC-certified.
- *FCC will not approve a BDA for both Cellular & Land Mobile Radio.*

FC

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Do Fire Jurisdictions Require UL

Broward County FL October 29, 2018

On October 19th, 2018, the first edition of ANSI-UL 2524 has been issued to reflect the ANSI approval as a national standard and covers products used for in building 2 way emergency radio communication enhancement system installed in a location to improve wireless communication at that location. BORA Formal Interpretation # 20 states that 6 months after UL issues a standard all BDA systems shall have a listing by a National Registered Testing Laboratory. This requirement is issued by OSHA and is enforced in construction by the National Electrical Code section 110.3B. Therefore, after April 29th, 2019, the authorities having jurisdiction in Broward County will no longer recognize BORA Formal Interpretation #20 and will be instructed to enforce NEC section 110.3B. If the BDA system is installed without a listing label, the only way to receive equipment approval would be by using a third party field evaluation service.

How do AHJs specify & ensure compliance?

Elements of the AHJ ERCES Specification

Technical

- Frequency Coverage
- Radio Site Locations
- Permitting Process
- Testing & Acceptance
- UL Listing, Regulatory Requirements
- It's a Performance-Based Specification, "no need to over-specify"

Administrative

- AHJ Contact Information
- Permitting & Certification Forms
- Submittal Documentation Requirements
- Maintenance Contract Requirements & Certifications
- Applicable Code References
- Installer Qualification Requirements

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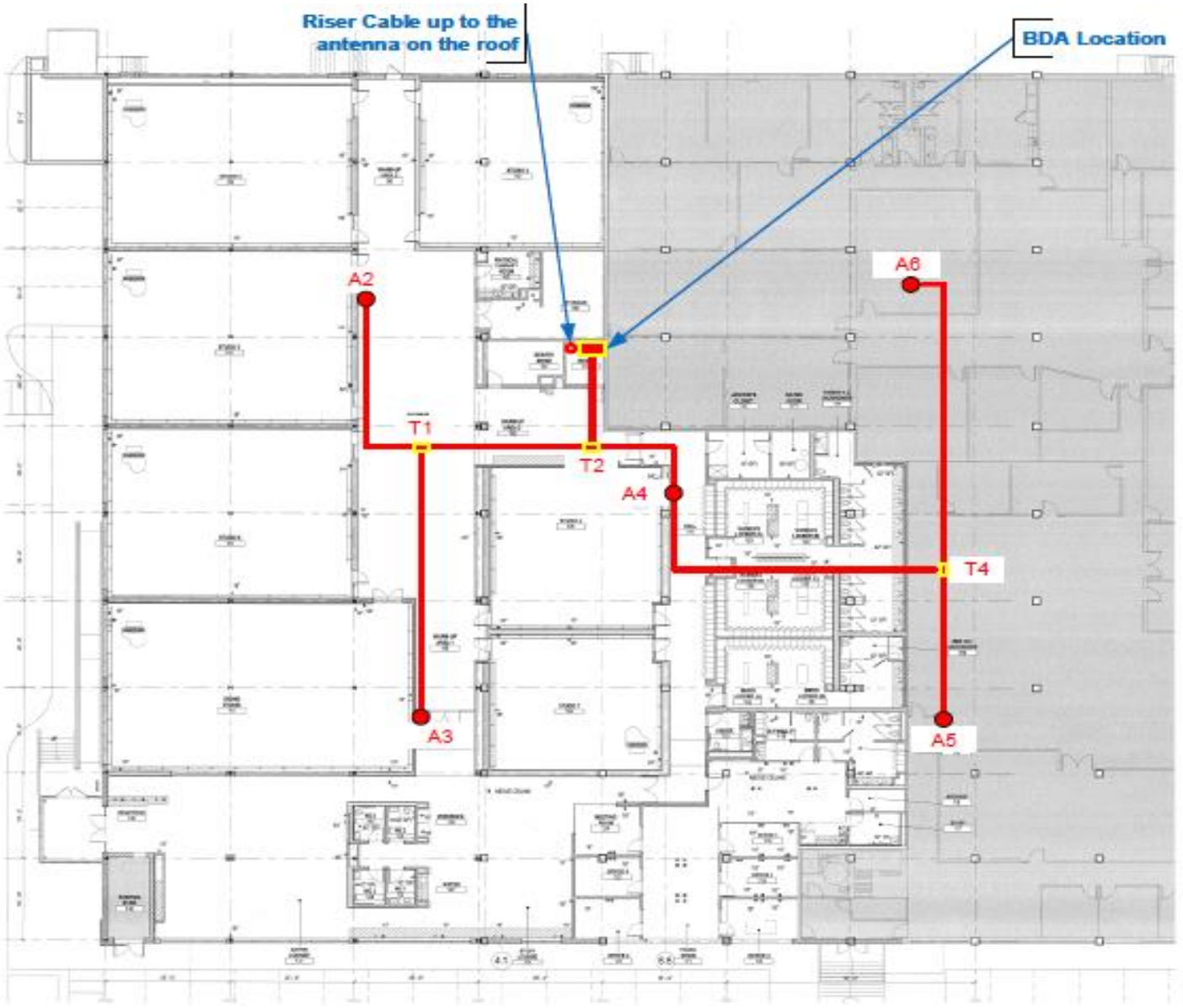
BDA Floor Plan Design



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Typical Signal Survey Report

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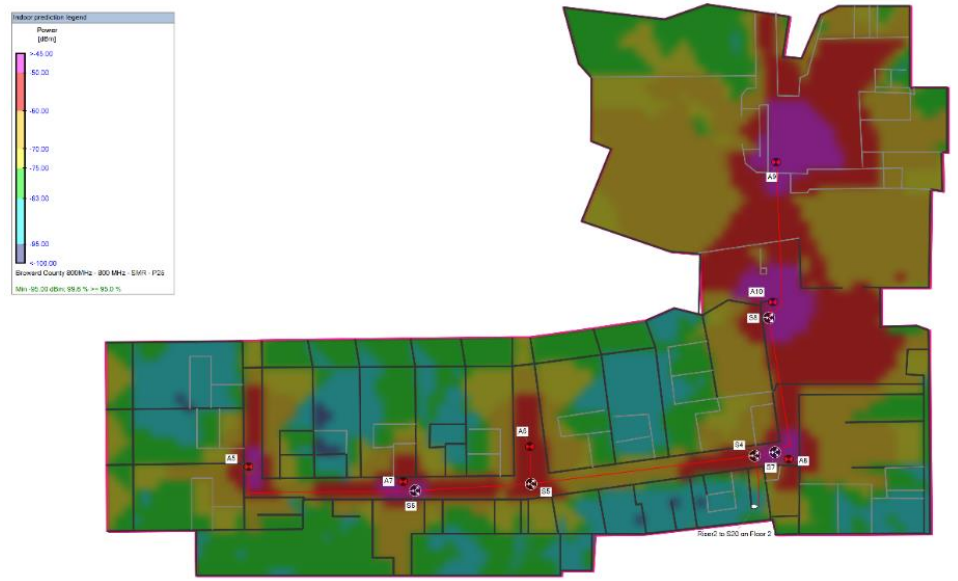
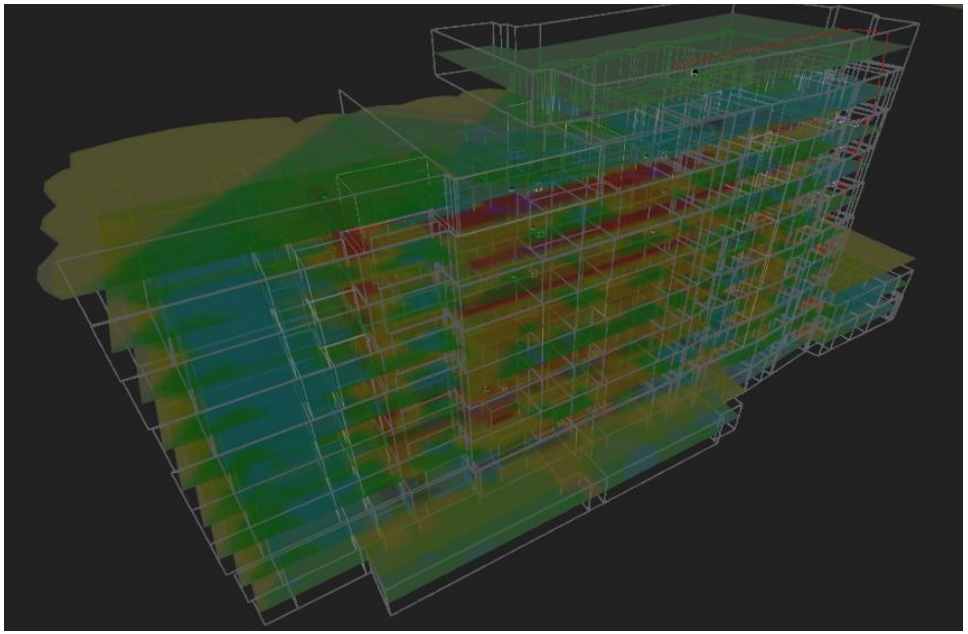
IB-Wave Design

- Benefits of IB-Wave Modeling
  - Signal Prediction for new construction.
  - Design layout for installers.
  - Submittal documentation for AHJ's and A&E's.





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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Signal Booster
Class A vs Class B?

Signal Boosters – Class A or Class B? What is the difference? Which one is better?

FCC classifies signal boosters as either Class A or Class B.

FCC Definitions per 47CFR90.219 rule:
Class A signal booster: “A signal booster designed to retransmit signals on one or more specific channels. A signal booster is deemed to be a Class A signal booster if none of its passbands exceed 75 kHz.”

Class B signal booster: “A signal booster designed to retransmit any signals within a wide frequency band. A signal booster is deemed to be a Class B signal booster if it has a passband that exceeds 75 kHz.”

Note: This classification is different from Class A and Class B fire alarm circuit wiring.

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Signal Boosters – Class A vs Class B

Class A	Class B
Maximum Passband is 75KHz. Intended to amplify no more than one channel at one time	Maximum Passband is more than 75KHz. It can amplify more than one channel at the same time It can either be broadband or band-selective.
Mobile use allowed	Fixed use only
Introduces signal delay (aka “group delay”) of over 50 microseconds resulting in signal distortion and interference in signal overlap areas	Very low to negligible signal delay (usually less than 2 us). Does not introduce signal distortion and interference in signal overlap areas.
Higher power consumption, higher heat dissipation = lower efficiency	Lower power consumption, less heat dissipation = higher efficiency

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Class A and B Signal Boosters – Myth Vs Fact

Myth # 1: Class A signal boosters are better because they only amplify the select channels, thus eliminating unwanted interference to the BDA.

Fact # 1: Using Class B signal boosters ensures that radios will work for all public safety users, regardless of what frequency channels they use within the 700MHz and 800MHz public safety frequency bands. Class A signal boosters have a limited number of channels that can be amplify and it is usually 32 or less.

Myth # 2: Class B signal boosters can oscillate and produce harmful interference, and that is not the case with class A signal boosters

Fact: BDA oscillation can happen with either class A or class B signal boosters equally, there is no difference based on the class of the signal booster. What does makes a difference is the Oscillation Prevention Function of the signal booster.

Myth # 3: Class A signal boosters are less prone to intermodulation interference. Class B signal boosters can produce inter-modulation interference because they allow multiple carriers.

Fact: Intermodulation interference can equally happen with either class A or class B signal boosters, all it takes is two or more RF carriers. What does make a big difference is the quality of the design and the immunity of the LNA (low noise amplifier) stage to high RF signals.

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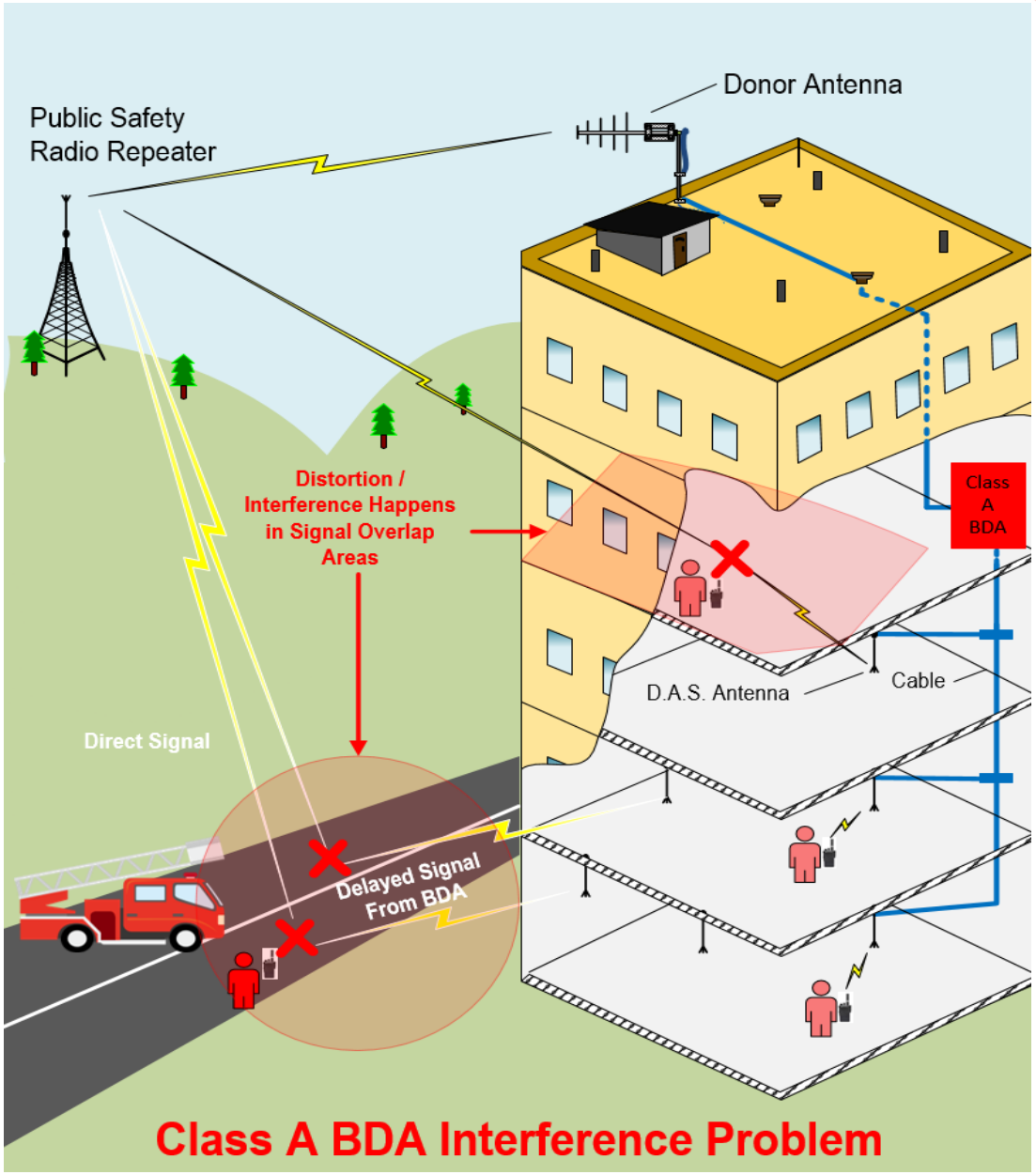
Myth # 4: Class A signal boosters do not create interference

Fact: Probably the least understood, yet the biggest shortcoming of class A signal boosters is the fact that they distort the radio signal by delaying it by more than 50 microseconds, which degrades the signal in the overlap areas and creates harmful interference.



Architect and Engineer Considerations

Did You Know?

- Many design professionals are not aware of the requirements for Emergency Responder Radio Coverage even if required by code

- If ERRS Levels are not referenced on a building submittal or construction documents, the fire official should immediately notify the building official and design professional that the signals levels must be evaluated; and if the existing radio coverage has not been met, then ERRCES must be provided.

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NFPA BDA Pathway Survivability Requirements

9.6.2.1.1* Where a two-way radio communications enhancement system is used in lieu of a two-way in building wired emergency communications system, **it shall have a pathway survivability of Level 1, Level 2, or Level 3.**

9.6.2.1.1.1 The feeder and riser coaxial cables **shall be rated as plenum cables** that match the building's fire rating and pathway survivability.

9.6.2.1.3* Riser coaxial cables shall be rated as riser cables and routed through **a 2-hour–rated enclosure.**

9.6.2.1.4 The connection between the **riser and feeder coaxial cables shall be made within an enclosure matching the building's fire rating and pathway survivability**, and passage of the feeder cable in and out of the enclosure shall be fire-stopped to the building's fire rating and pathway survivability.

9.6.3* Systems shall have **lightning protection** that complies with NFPA 780.

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Design Challenges and Solutions

- It is difficult for design professionals to design and project total costs for BDA when the testing to determine requirements must be done on the substantially completed structure.

- Our Honeywell Distributors doing BDA can use predictive modeling software (iBWave) and floor plans assuming they know the signal strength of the public safety frequency at the building site to determine BDA requirements pre bid or construction.

- A Radio Signal Survey cost and specification should be included in the construction bid requirements in section 28 since this is a life safety system. This will ensure survey cost is covered when construction is substantially completed.

- In most cases it would be cost effective to include an allowance or alternate for a BDA system and possibly make provisions for wiring in Section 28.

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Design Challenges and Solutions

- The building can be prewired assuming that a signal booster will be required or predictive analysis shows it will most likely be needed.

- Our Honeywell Distributors can also assist with specifications for UL listed BDA systems and survey specifications.

- The design professional should reach into the Fire Official with Jurisdiction and ask for local BDA requirements or if they have an AHJ Specification for BDA.

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A&E Design Recommendations

- **Donor Antenna**
  - Show and call out a donor antenna on the roof of the building.
  - Indicate the “Donor antenna shall be pointed towards direction of the public safety city repeater antenna”.

- **BDA System**

  -Indicate location of BDA (2hr enclosure if required per NFPA or building type)

- **Annunciator**

  -Indicate location of Annunciator panel next to FACP.

  -Indicate points being monitored at FACP.

- **Coaxial Cable**
  - Indicate vertical run of coaxial cable
  - Survivability requirements based on NFPA
  - Horizontal runs are predictions
  - Show Conduit pathway for Horizontal feeder cable

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QUESTIONS & ANSWERS?

Thank You for Your Time

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In-Building Emergency Radio Communications

- **Reliable Communications: Going into "the Unknown"**
  - Signal Survey: Removes the uncertainty of in-bldg. Radio Frequency Coverage
  - Public Safety Signal Booster (BDA System, or IBERRCES) fixes RF dead spots
  - IBC, IFC, State & Local Building Codes Specify the Signal Strength Survey
- **How can you be sure that the system works first time & every time? = UL**
  - Having Access to a Code-Compliant System fixes the uncertainty of AHJs
  - Without a Standard, AHJs have not been certain what they've been getting
  - UL2524 Independently assures AHJs that the SYSTEM is compliant
- **How can we assure that UL2524-Listed Systems Function Properly?**
  - Oscillation Prevention & Noise Suppression (Assurance; Make Specs Easy)
  - Where in the Code are Signal Strength Mandates? How to Enforce…
- **How can you ensure this is a sustainable solution to the problem?**
  - Certified Installers of Life Safety Systems with F.C.C. G.R.O.L. Licenses
  - Standardized Training, Tools & Equipment, Standardized Design Process
  - Proficiency ensures that the entire system meets Honeywell's Quality Standards
- **How do you go about specifying the BDA System properly?**
  - Frequencies, Radio Sites, Permitting Process, Testing & Acceptance, Submittals, Signal Booster Registration, **(How to "Make it Happen")**

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Design Challenges

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