


HONEYWELL
BDA / ERCES SYSTEMS
UNDERSTANDING ERCES/BI-DIRECTIONAL AMPLIFIER (BDA) SYSTEMS

JP Plouffe
National Sr. Business Development Manager (BDA)

June 1, 2021

Honeywell

DURING AN EMERGENCY, RELIABLE COMMUNICATION IS CRITICAL FOR ALL FIRST RESPONDERS.

STAYING INFORMED WITH CLEAR RADIO TRANSMISSIONS BETWEEN FIRST RESPONDERS WILL HELP PREVENT FURTHER INJURIES AND SAVE MORE LIVES

AGENDA

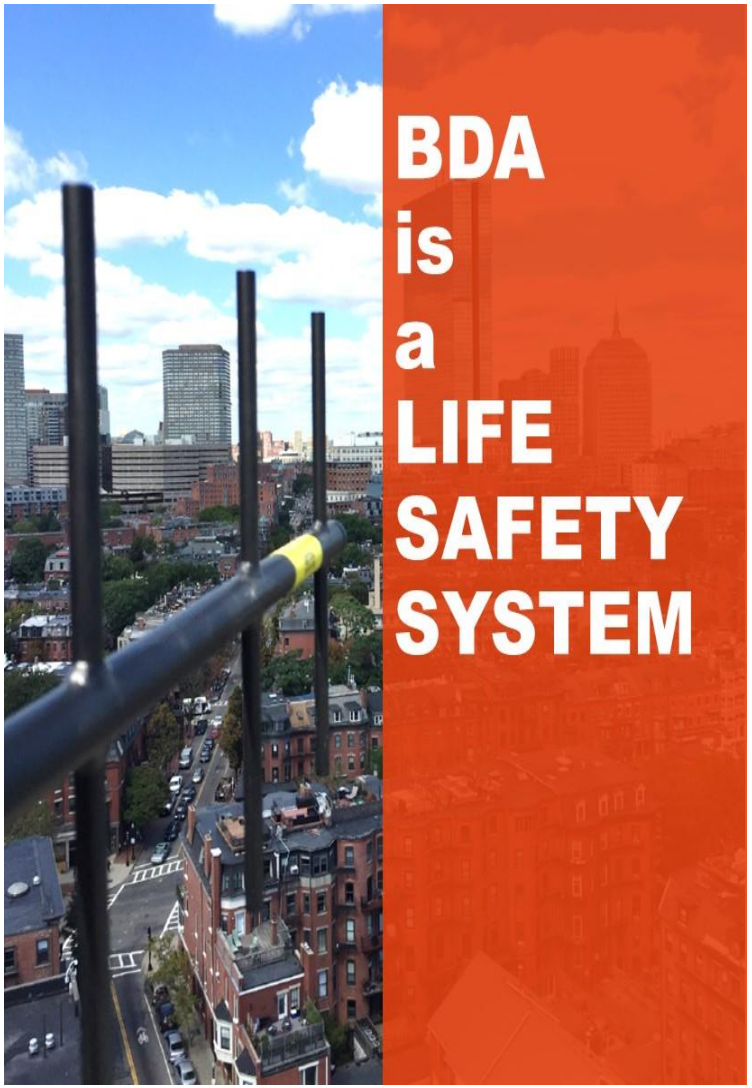
1. What is an ERCES-BDA System?
2. Why Would My Building Need One?
3. How to Determine If My Building Needs a BDA?
4. Site Surveys
5. Codes

Honeywell

WHAT IS AN ERCES-BDA SYSTEM?

A BDA IS A LIFE SAFETY SYSTEM!

- **Code Driven Requirements for all buildings new and existing since 2012!**
- **Local AHJ-Fire Marshal Specifications**
  - AHJ/Jurisdictions have different requirements
- **Typically purchased with Fire Alarm**
  - Installed and tested by qualified, factory certified technicians
  - Inspected by AHJ
- **Supervised by the building's fire alarm system**



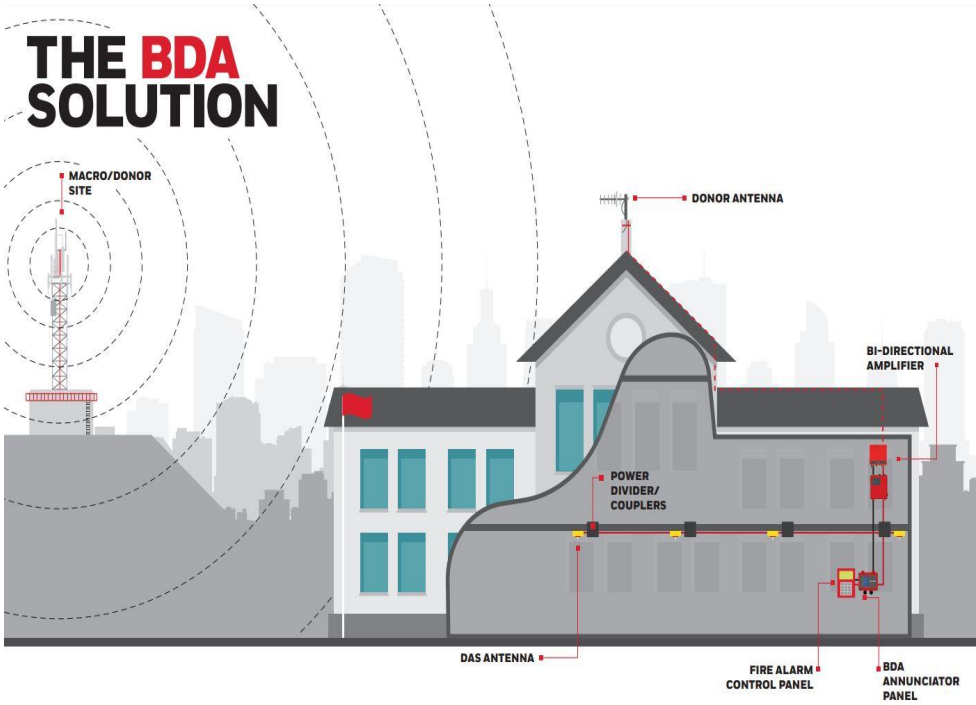
WHAT IS A BDA SYSTEM?

BDA – Bi-Directional Amplification system 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

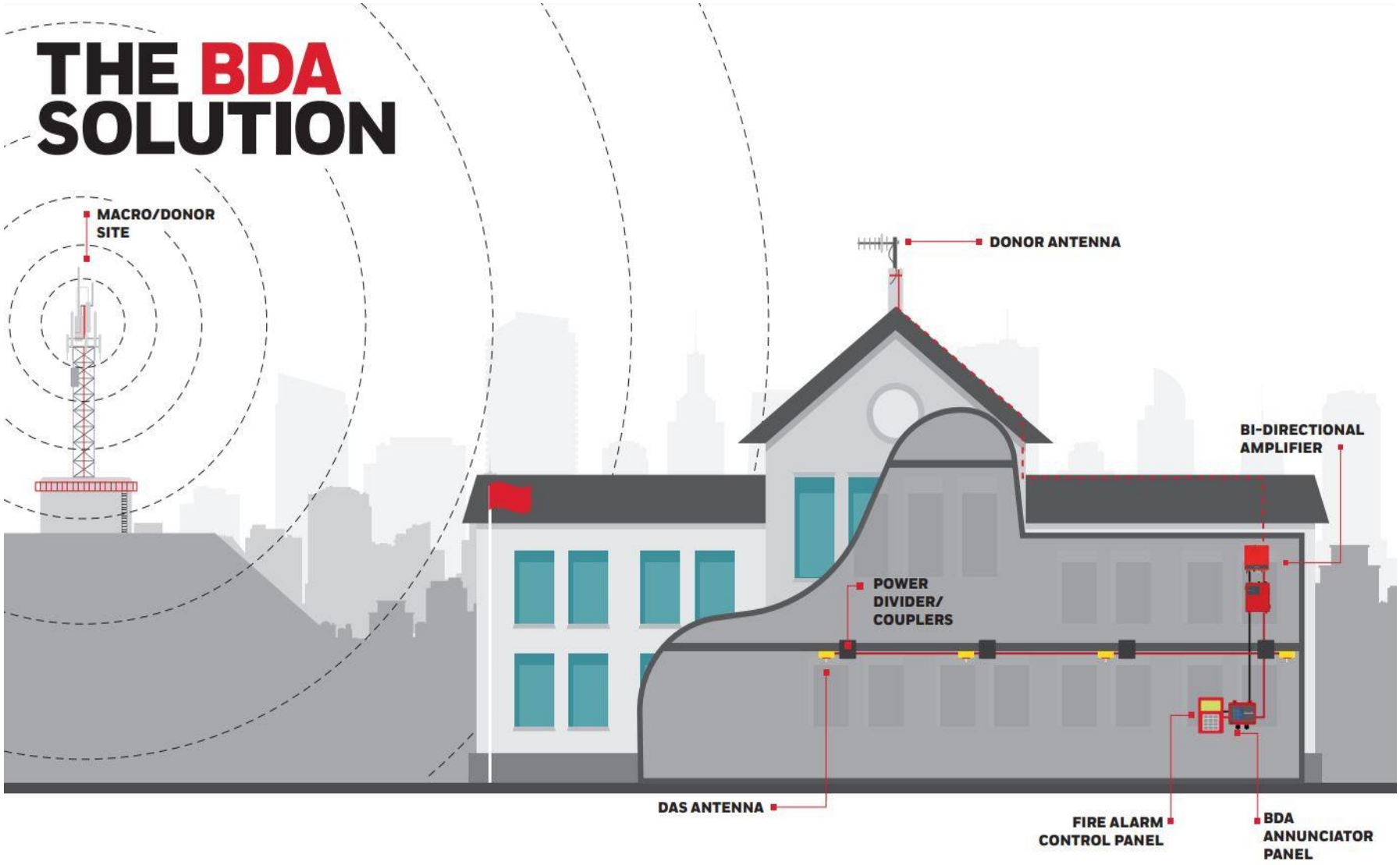
Distributed Antenna System (DAS)

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



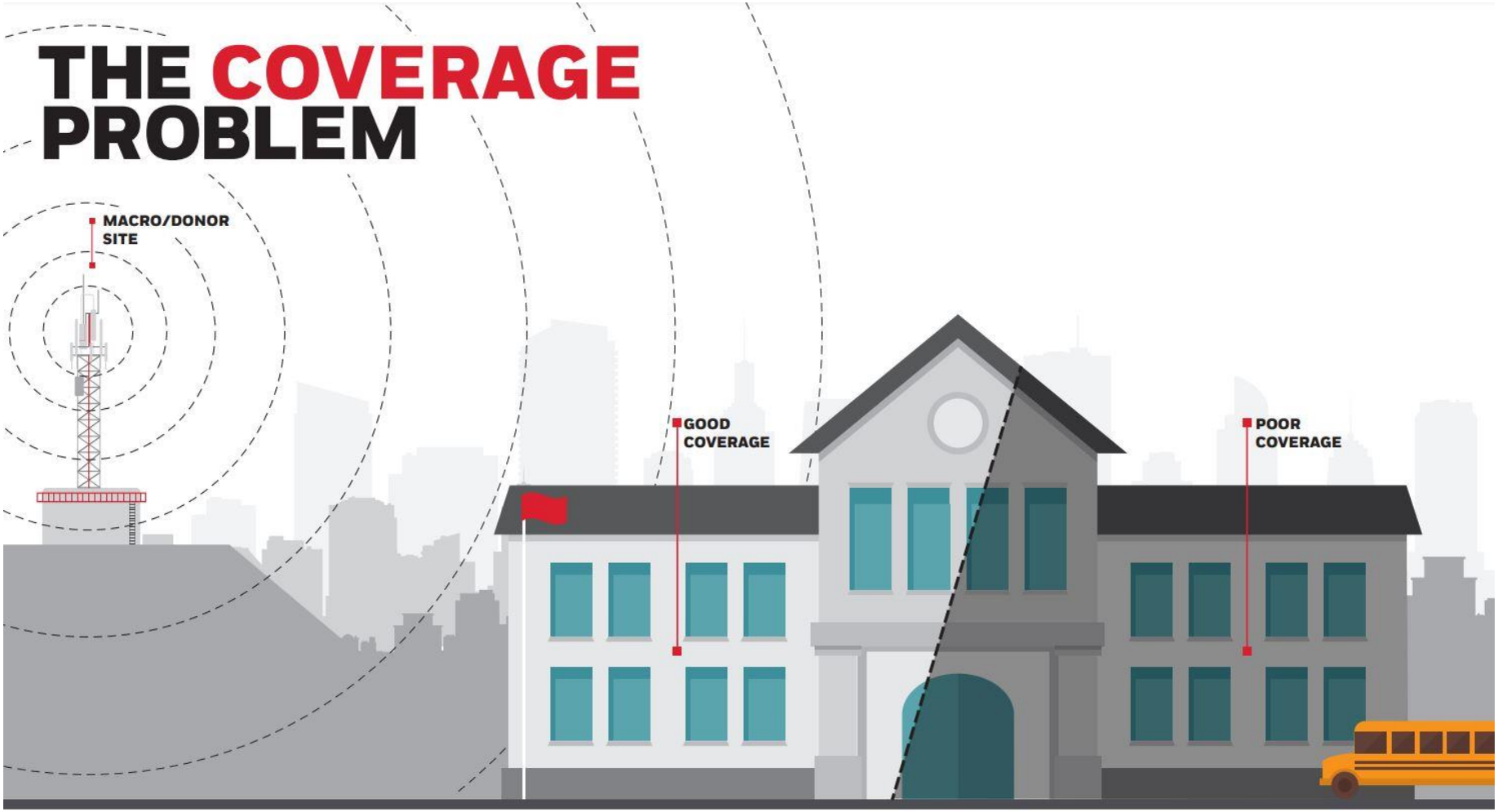
TWO WAY COMMUNICATION IN & OUT OF BUILDINGS

COVERAGE SOLUTION
ERCES / BDA



WHY WOULD MY BUILDING NEED AN ERCES-BDA SYSTEM?

MOST BUILDINGS HAVE COVERAGE PROBLEMS



THE COVERAGE PROBLEM

What causes in-building radio signal degradation & attenuation or what blocks radio signals?

Concrete & Block Walls

Low-E Glass & Window Tint

Forestry & Land Scaping

Metal & Flat Roofing Materials

Storm Shelters Above & Below Ground

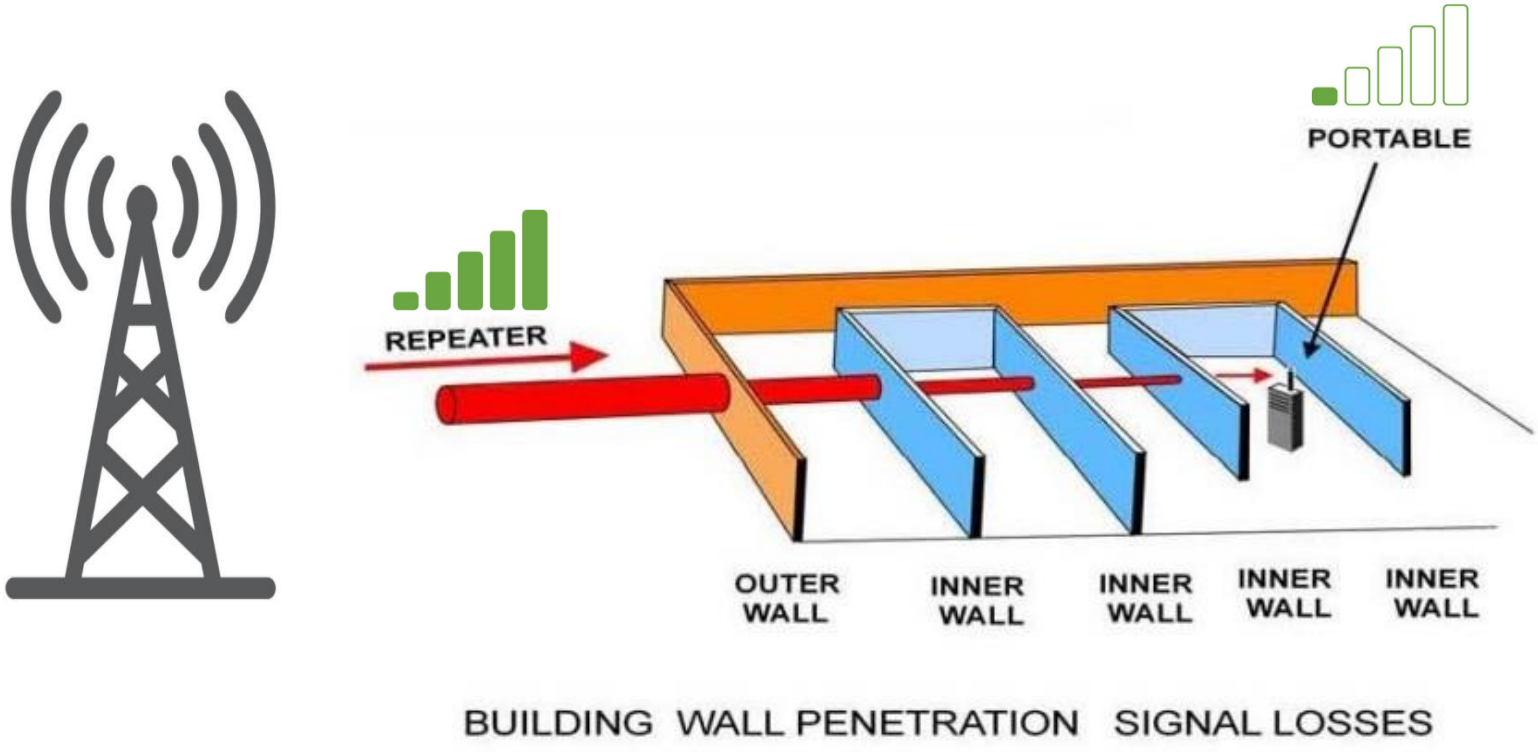
Flat Screen TV's & Monitors

Billboards

The consequence: Poor in-building radio signal coverage and "dead spots". Emergency responders lose communications

THE COVERAGE PROBLEM

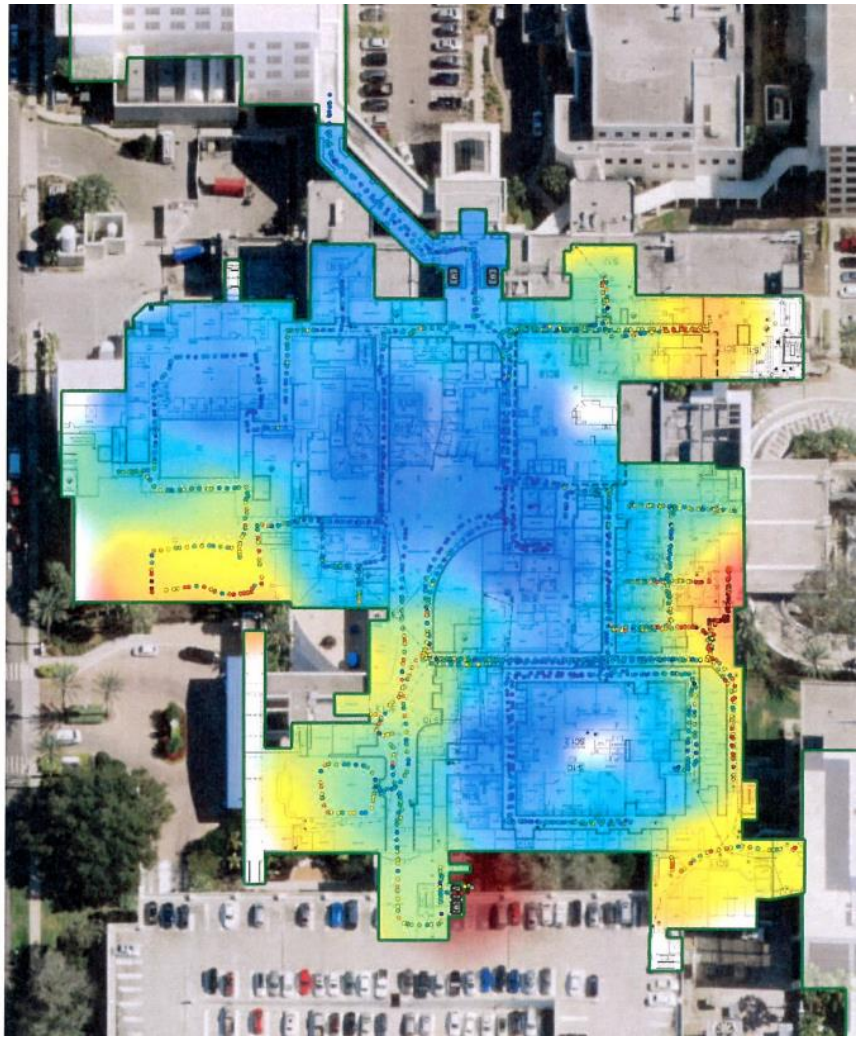
What degraded radio signals (i.e., attenuation) looks like to you!



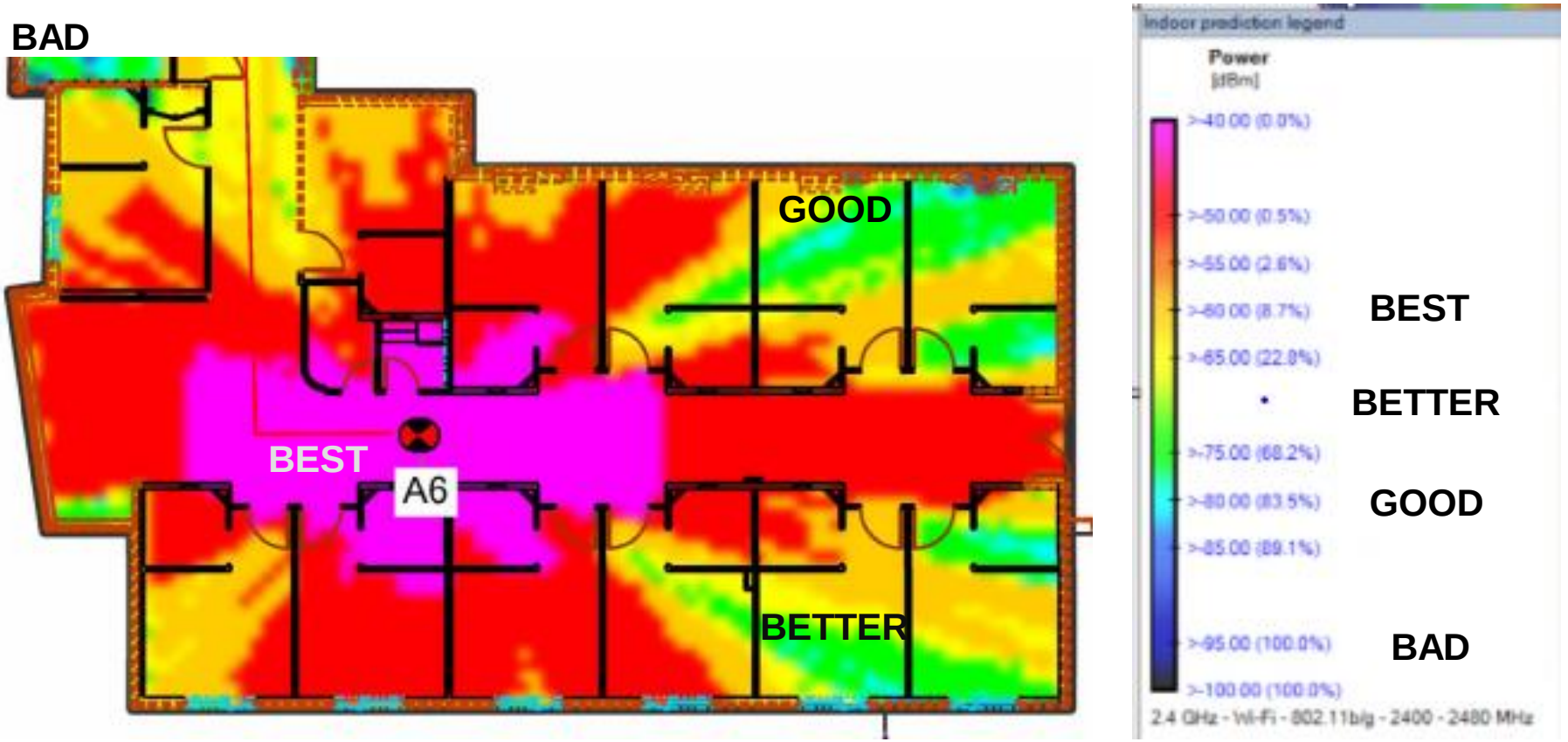
The consequence: Poor in-building radio signal coverage and “dead spots”. Emergency responders lose communications

HOW TO DETERMINE IF YOUR BUILDING NEEDS AN ERCES-BDA SYSTEM?

SAMPLE RF SITE SURVEYS



SAMPLE RF PROPAGATION



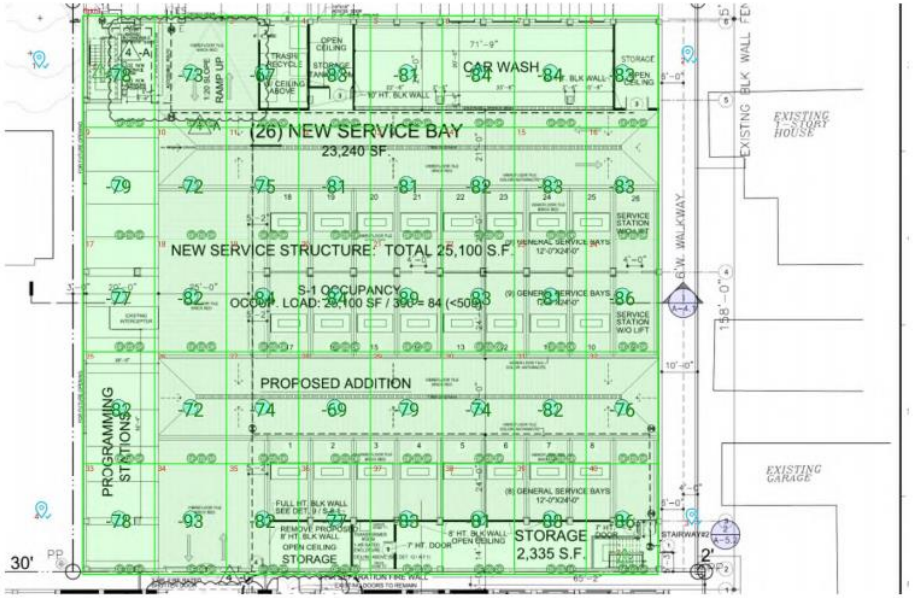
You always want the best signal strength when it comes to Life Safety!!!

SAMPLE RF SITE SURVEYS

Channel: Alhambra PD 1

Result: Pass

Areas Tested:	40	**Area Points Pass Criteria:**	95 %
Critical Points Tested:	2	**Critical Points Pass Criteria:**	99 %
Total Grid Size:		**Frequency (MHz):**	471.13750



Reference Point Report

Reference Point	Power (dBm)	DL S/N (dB)	Selected	Comment
1	-69.17	33.19		
2	-51.55	36.86		
3	-58.40	27.46		
4	-60.74	26.68		Rooftop Average = -59.97 dBm

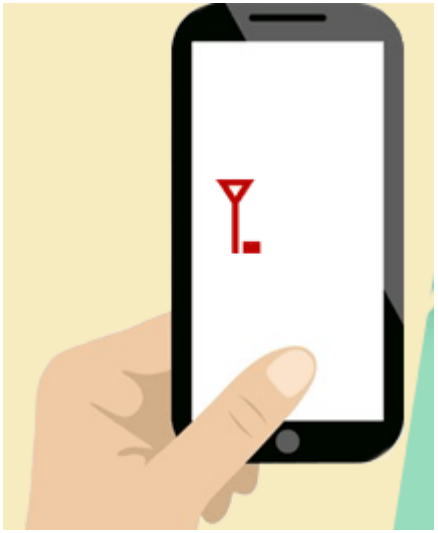
Critical Point Report

Critical Point	DL Power (dBm)	DL S/N (dB)	DL FBER (%)	DL DAQ	UL Power (dBm)	UL S/N (dB)	UL FBER (%)	UL DAQ	Result	DL Loss (dB)	Comment
1	-86.22	35.61	0.00		-88.2				Pass	-124.22	
2	-90.53	25.89	0.00		-92.51				Pass	-128.53	

Area Report

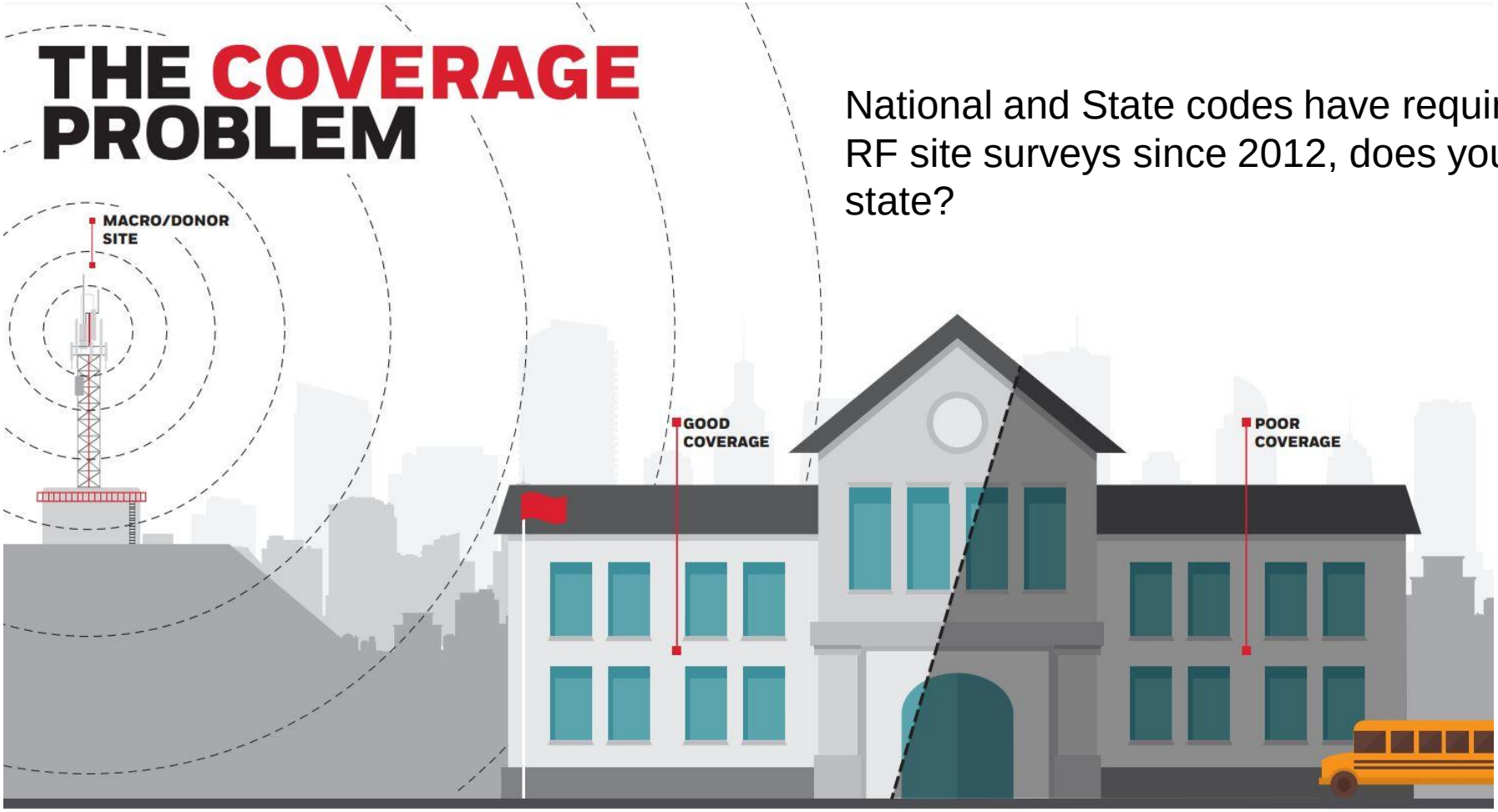
Grid	Area	DL Power (dBm)	DL S/N (dB)	DL FBER (%)	DL DAQ	UL Power (dBm)	UL S/N (dB)	UL FBER (%)	UL DAQ	Result	DL Loss (dB)	Comment
1	1	-77.86	33.05	0.00		-79.84				Pass	-115.86	
1	2	-72.89	33.37	0.00		-74.87				Pass	-110.89	
1	3	-66.81	36.12	0.00		-68.79				Pass	-104.81	
1	4	-82.71	35.43	0.00		-84.69				Pass	-120.71	
1	5	-80.55	35.47	0.00		-82.53				Pass	-118.55	
1	6	-83.14	31.84	0.00		-85.12				Pass	-121.14	
1	7	-83.48	35.91	0.00		-85.46				Pass	-121.48	
1	8	-82.17	33.72	0.00		-84.15				Pass	-120.17	
1	9	-78.18	36.45	0.00		-80.16				Pass	-116.18	
1	10	-71.77	33.87	0.00		-73.75				Pass	-109.77	
1	11	-74.21	29.39	0.00		-76.19				Pass	-112.21	
1	12	-80.46	36.24	0.00		-82.44				Pass	-118.46	
1	13	-80.07	36.67	0.00		-82.05				Pass	-118.07	
1	14	-81.95	34.31	0.00		-83.93				Pass	-119.95	
1	15	-82.97	32.31	0.00		-84.95				Pass	-120.97	
1	16	-82.72	32.11	0.00		-84.7				Pass	-120.72	
1	17	-76.01	34.39	0.00		-77.99				Pass	-114.01	
1	18	-81.94	30.20	0.00		-83.92				Pass	-119.94	
1	19	-83.33	35.41	0.00		-85.31				Pass	-121.33	
1	20	-83.97	24.99	0.00		-85.95				Pass	-121.97	
1	21	-88.36	25.64	0.22		-90.34				Pass	-126.36	
1	22	-82.42	27.04	0.00		-84.4				Pass	-120.42	
1	23	-80.16	36.64	0.00		-82.14				Pass	-118.16	
1	24	-85.23	35.62	0.00		-87.21				Pass	-123.23	
1	25	-81.88	34.43	0.00		-83.86				Pass	-119.88	
1	26	-71.55	35.75	0.00		-73.53				Pass	-109.55	
1	27	-73.39	35.22	0.00		-75.37				Pass	-111.39	
1	28	-68.02	36.31	0.00		-70				Pass	-106.02	

RF ATTENUATION & DEGRADATION CAUSE DEAD ZONES IN BUILDINGS



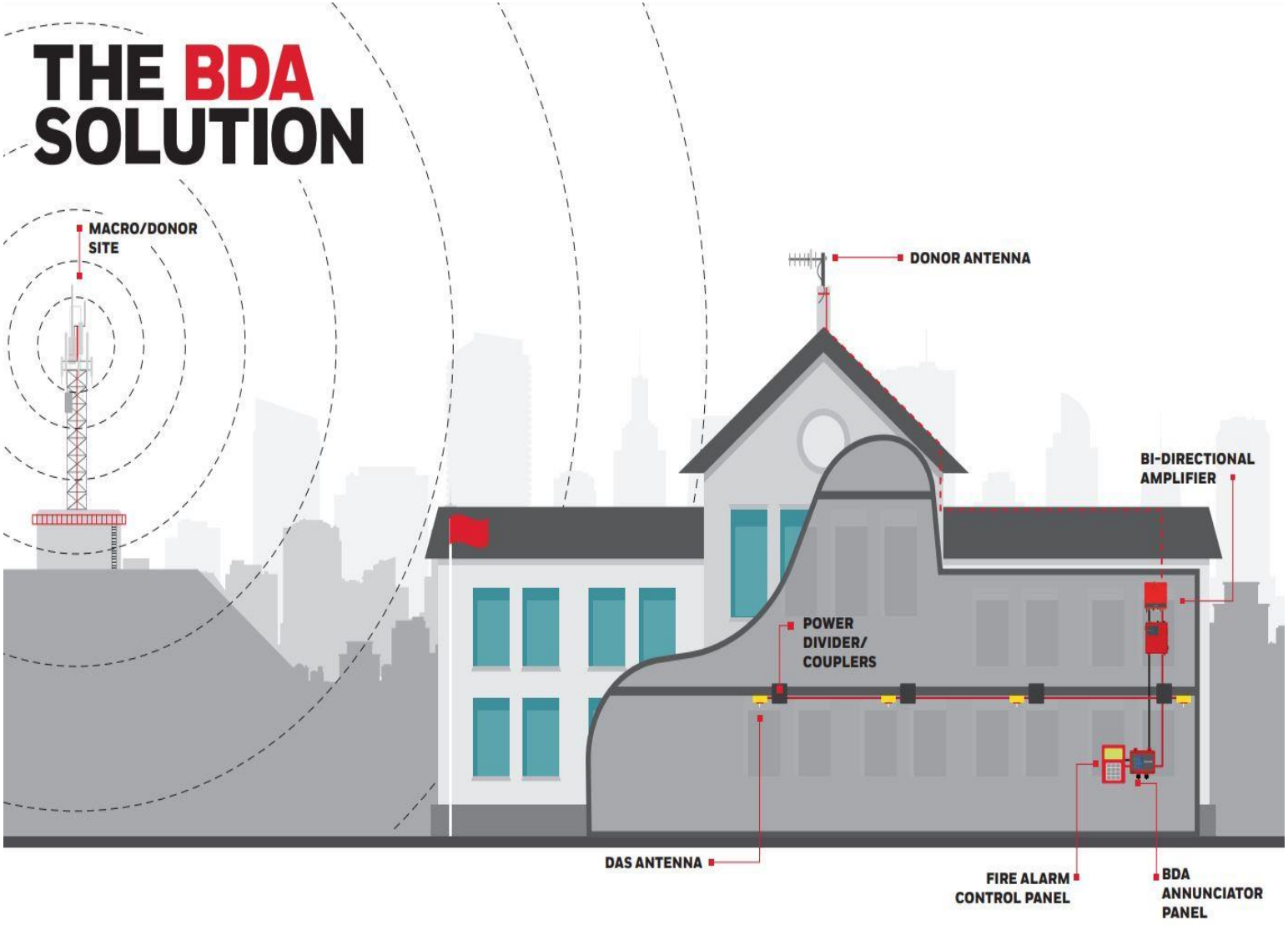
=

RF SITE SURVEYS IDENTIFY THE COVERAGE PROBLEMS IN YOUR BUILDINGS!



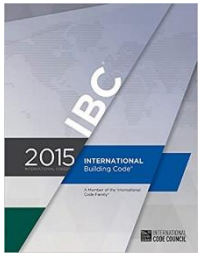
National and State codes have required RF site surveys since 2012, does your state?

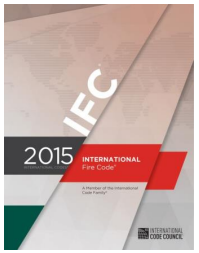
COVERAGE SOLUTION
ERCES / BDA



CODE REQUIREMENTS

CODE-DRIVEN REQUIREMENT



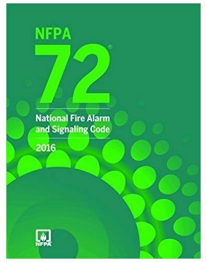


IBC 2015-18 - Section 916, NFPA 1 Section 11.10

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

IFC 2015-18 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.
- 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
- 2016 & 2019 Editions of NFPA 1221, Emergency Service Communications Systems, Section 9.6

Code Adoption

- At present 35 states (including D.C.) are requiring BDA Systems.
- There are 34 States that have adopted IFC; 4 more IBC; 9 more NFPA 1/101.

FUTURE CODE REQUIRES UL 2524

2021 IFC, IBC, and NFPA 1 will all require BDA Systems to comply with UL 2524 & listed by an OSHA-accredited Nationally Recognized Testing Laboratory (NRTL)

F48-18
IFC: 510.4, 80

Proponent: Michael O'Brian, Chair, representing FCAC (FCAC@iccsafe.org)

2018 International Fire Code

Revise as follows:

510.4 Technical requirements. Equipment required to provide emergency responder radio coverage shall be listed in accordance with UL 2524. Systems, components and equipment required to provide the emergency responder radio coverage system shall comply with Sections 510.4.1 through 510.4.2.8.

Add new standard(s) follows:

UL

Underwriters Laboratories LLC
333 Pfingsten Road
Northbrook IL 60062

UL 2524 -2018:

Outline of Investigation for In-building 2-Way Emergency Radio Communication Enhancement Systems

Reason:
This is one of 10 proposals being submitted as a package relating to technical changes proposed for Section 510. While the Fire Code Committee will consider each proposal independently, the intent is for approval of all proposals in this package which have been submitted as a correlated set of companion code change proposals.

This proposal adds a requirement to test and list equipment installed to enhance emergency responder radio coverage in buildings to ensure fire and shock safety and compliance with the performance requirements specified in IFC Section 510 and NFPA 1221.

This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire safety and hazardous materials in new and existing buildings and facilities and the protection of life and property in wildland urban interface areas. In 2017 the Fire-CAC has held 3 open meetings. In addition, there were numerous conference calls, Regional Work Group and Task Group meetings for the current code development cycle, which included members of the committees as well as any interested parties, to discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/codes-tech-support/cs/fire-code-action-committee-fcac/

Cost Impact
The code change proposal will increase the cost of construction .

The requirement to test and list equipment will add to the cost for required equipment installed in new or existing buildings. The cost to test and certify safe equipment should not add more than 1/2% to the total cost of this equipment.

Internal ID: 377

F48-18

Committee Action: **Approved as Submitted**

Committee Reason: This proposal was approved as it will eliminate or reduce the need to have a professional engineer to review all designs and provides an appropriate listing for such equipment. (Vote 13-1)

Assembly Motion: **NONE**

NFPA 1225 – next version of NFPA requirements for BDA Systems currently in development also requires UL 2524 (in current draft, final approvals pending)

NFPA 1-2018 BUILDING REQUIREMENTS

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.

IFC 2018 BUILDING REQUIREMENTS

IFC Rule 510.1 Emergency responder radio coverage in new buildings.

New 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, measured at the exterior of the building.

Current NFPA and IFC Codes

Conditions	NFPA 1221 Section 9.6 – 2016 edition	IFC 510 – 2018 edition
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)

IFC 2018 BUILDING REQUIREMENTS

510.2 Emergency responder radio coverage in *EXISTING BUILDINGS*.

Existing buildings shall be provided with *approved* radio coverage for emergency responders as required in Chapter 11.

Chapter 11: 1103.2 Emergency responder radio coverage in existing buildings.

Existing buildings other than Group R-3, that do not have approved radio coverage for emergency responders in the building based on existing coverage levels of the public safety communication systems, shall be equipped with such coverage according to one of the following:

- Whenever an existing wired communication system cannot be repaired or is being replaced, or where not approved in accordance with Section 510.1, Exception 1.
- Within a time frame established by the adopting authority.

Exception: Where it is determined by the fire code official that the radio coverage system is not needed.

IFC CHPT.-510 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 1221-2016 COVERAGE REQUIREMENTS

9.6.8* Signal Strength.

9.6.8.1* Inbound. A minimum inbound signal strength sufficient to provide usable voice communications, as specified by the AHJ, shall be provided throughout the coverage area. The inbound signal level shall be sufficient to provide a minimum of DAQ 3.0 for either analog or digital signals.

9.6.8.2 Outbound. A minimum outbound strength sufficient to provide usable voice communications, as specified by the AHJ, shall be provided throughout the coverage area. The outbound signal level shall be sufficient to provide a minimum of DAQ 3.0 for either analog or digital signals.

NFPA COVERAGE REQUIREMENTS

Critical Area Coverage – 99% (NFPA 1221 9.6.7.4) coverage required in Critical areas: **This list is doesn't cover all Critical areas, AHJ approval needed.**

- Emergency Command Center(s)
- Fire Pump Room(s)
- Exit Stairs
- Exit Passageways
- Elevator Lobbies
- Standpipe Cabinets
- Sprinkler Sectional
- Valve Locations

Non-Critical Area Coverage – Non-Critical 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

NFPA 1221

(2) The communications link between the dedicated monitoring panel and the two-way radio communications enhancement system must be monitored for integrity.

9.6.14 Technical Criteria. The AHJ shall maintain a document of technical information specific to its requirements that shall contain, as a minimum, the following:

(1) Frequencies required
(2) Location and effective radiated power (ERP) of radio sites used by the public safety radio enhancement system
(3) Maximum propagation delay (in microseconds)
(4) List of specifically approved system components
(5) Other supporting technical information necessary to direct system design

Chapter 10 Computer-Aided Dispatching (CAD) Systems

10.1 General.

10.1.1* Computer-aided dispatching (CAD) systems, when required by the AHJ, shall conform to the items outlined in this chapter.

10.1.2* Where a CAD system is used for emergency dispatch service operations, and an enhanced 9-1-1 emergency number telephone system is in use, the CAD system shall contain all hardware and software components necessary for interface with the 9-1-1 system.

10.4 Alarm Data Exchange.

10.4.1 The CAD system shall have the capability to allow alarm data exchange between the CAD system and other CAD systems.

10.4.1.1* Alarm data exchange between two PSAPs shall comply with the elements contained in 10.4.1.2 through 10.4.1.7.

10.4.1.2 Alarm data elements for alarm processing shall contain the following items from the sending CAD system:

(1) Street address or intersection of event
(2) Latitude/longitude of event
(3) Reporting party name
(4) Reporting party address
(5) Reporting party callback number
(6) Event type
(7) Any remarks entered to that point

10.4.1.3 The new alarm information shall display as a pending event in the receiving CAD system.

10.4.1.4 The receiving CAD system shall automatically send a confirmation message to the sending CAD system that it received the call.

10.4.1.5 It shall be up to the AHJ to decide whether or not to use or display this information.

ERCES / BDA System Codes & Standards

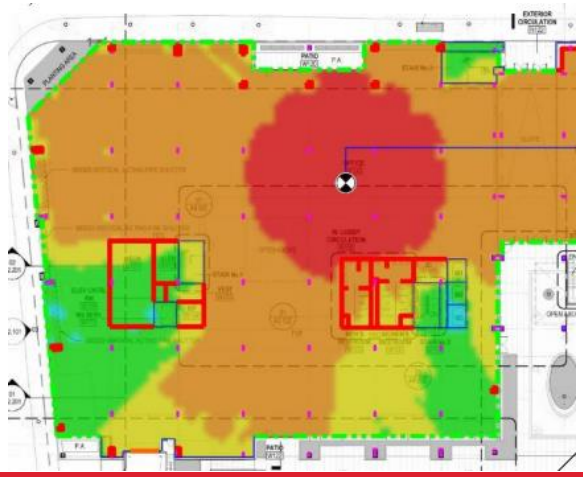
Code Requirements	NFPA*		IFC	
	NFPA 72 - 2013	NFPA 1221 - 2016	IFC 510 - 2015	IFC 510 - 2018
In-Building Solution Required	**Section 24.5.2**	**Section 9.6**	**Section 510.1**	**Section 510.1**
Level 1, Level 2 or Level 3 Pathway Survivability	2 Hour for Riser Coaxial Cable Section 24.3.6.8.1	2-Hour for Riser Coaxial Cable Section 9.6.2.1.1	Not Addressed in Section 510. Referenced in 24.3.6.8.1 of NFPA 72-2013	Yes, Section 510.4.2. Reference to NFPA 1221
Plenum Rated Coaxial Cable Required	Yes, Riser & Feeder Coaxial Cable Section 24.3.6.8.1.1	Yes, Riser & Feeder Coaxial Cable Section 9.6.2.1.1.1	Not Addressed in Section 510. Referenced in 24.3.6.8.1.1 of NFPA 72-2013	Yes, Section 510.4.2. Reference to NFPA 1221
Lightning Protection Required	Not addressed in Section 24.5.2	Yes, In accordance with NFPA 780 Section 9.6.3	Not Specifically Addressed in Section 510	Yes, Section 510.4.2 Per NFPA 780 as Referenced in NFPA 1221
Isolation of Donor Antenna Required	Yes, 15 dB Section 24.5.2.3.3	Yes, 20 dB Section 9.6.9	Not Specifically Addressed in Section 510	Yes, 20 dB - Section 510.4.2.4 (4)
Secondary Power Source	12 Hours Section 24.5.2.5.5.2	12 Hours Section 9.6.12.2	24 Hours - Section 510.4.2.3	12 Hours - Section 510.4.2.3 or 2-Hours Battery w/ Emergency Generator
Signal Strength & Area Coverage Required	-95 dBm - Section 24.5.2.3 90% General - Section 24.5.2.2.2 99% Critical - Section 24.5.2.2.1	DAQ 3.0 - Section 9.6.8 90% General - Section 9.6.7.5 99% Critical - Section 9.6.7.4	-95 dBm - Section 510.4.1 95% General - Section 510.4.1 99% Critical - Not Specifically Addressed in Section 510	DAQ 3.0 - Section 510.4.1.1 95% General - Section 510.4.1 99% Critical - Section 510.4.2 Reference to NFPA 1221
Monitoring By Fire Alarm Required	Yes - Section 24.5.2.6	Yes - Section 9.6.13	Yes - Section 24.5.2.6 NFPA 72 -2013	Yes - Section 9.6.13 NFPA 1221-2016
Cabinets for Equipment & Battery Backup Required	Yes, NEMA 4/NEMA 4X -Section 24.5.2.5.2	Yes, NEMA 4/NEMA 4X - Section 9.6.11.2	Yes, NEMA 4 - Section 510.4.2.4 (1) & (2)	Yes, NEMA 4/NEMA 3R - Section 510.4.2.4 (1) & (2)
Monitor Antenna Malfunction Required	Yes, Donor Antenna - Section 24.5.2.6(2)(a)	Yes, Donor Antenna - Section 9.6.13.1(2)(a)	Yes, Section 24.5.2.6(2)(a) NFPA 72-2013	Yes, Donor Antenna - Section 510.4.2.5
System Acceptance/Testing	Section 24.5.2.1.2	Section 9.6.4, 11.3.9 & 11.3.9.1	Section 510.5.3	Section 510.5.3

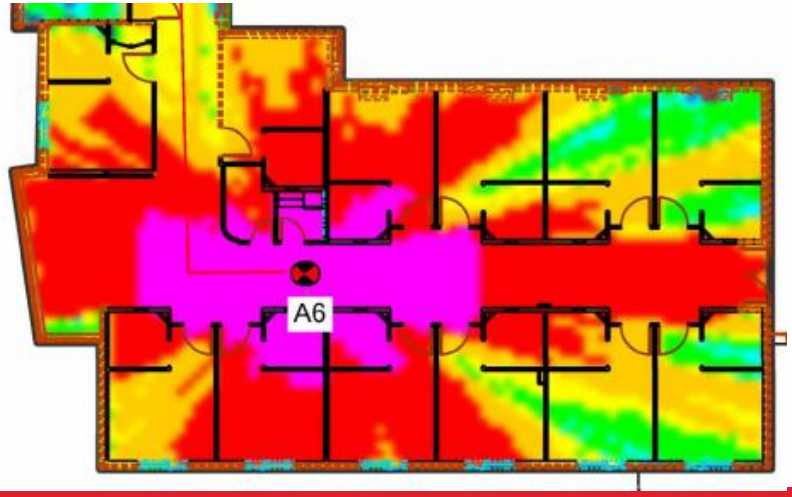
***NFPA 1 Section 11.10: In all new and existing buildings, minimum radio signal strength for fire department communications shall be maintained at a level determined by the AHJ. Where required by the AHJ, two-way radio communication enhancement systems shall comply with NFPA 1221.**

Always Verify *EXACT* AHJ BDA System Requirements for *Each Jurisdiction*!

RADIO SIGNAL PROPAGATION

- **“Propagation” is the transmission of radio signals.**
- **When Radio signals encounter a physical obstruction, the signal is attenuated to a measurable extent, and some of the signal is reflected away from the desired area.**
- **Weakened (attenuated) radio signals reduce the range in which a radio can both transmit and receive.**





RF GLOSSARY OF TERMS

- **Signal Booster –** Also called a BDA (Bi Directional Amplifier) or Repeater.
- **Signal attenuation –** Degradation of the signal as it passes through an obstacle.
- **Noise Floor** - Noise that's generated by transmitting boosters or other equipment
- **DAS –** Distributed Antenna System that distributes the signal thought a structure**.**
- **Macro Site –** The radio System infrastructure that the mobile and portable unit depend on for wide area coverage.
- **Uplink –** The Signal path from the mobile or portable to the Macro.
- **Downlink –** The signal path from the Macro site to the mobile and portable.
- **Base Station –** Also referred to as a Macro or Donor site, is the radio communications infrastructure shat support wide area radio coverage.
- **Donor Site –** The site used to obtain a signal source.

RF GLOSSARY OF TERMS

- **RF -** Radio Frequency
- **DAS –** Distributed Antenna System
- **BDA –** Bi Directional Amplifier also called a Signal Booster
- **RSSI –** Receive Signal Strength Indicator
- **dBm –** Abbreviation for 1 milliwatt of RF power
- **ATP –** Acceptance Test Procedure
- **DAQ –** Delivered Audio Quality
- **BER –** Bit Error Rate
- **MTBF –** Mean Time Between Failure
- **FirstNet –** 700LTE d Block – National Interoperability Standard
- **P25 –** Industry Standard for Digital Public Safety Radio Communications
- **SNIR –** Signal to Noise ratio

RADIO SIGNAL SITE SURVEY

- **Determines if a building has sufficient radio signal coverage or if it needs a signal enhancement (ERCES) system.**
- **It is the 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 their jurisdiction.**
- **Signal enhancement system (ERCES) is required for buildings 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.**

CODE-REQUIRED INBOUND AND OUTBOUND SIGNAL STRENGTH

IFC 2015

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.

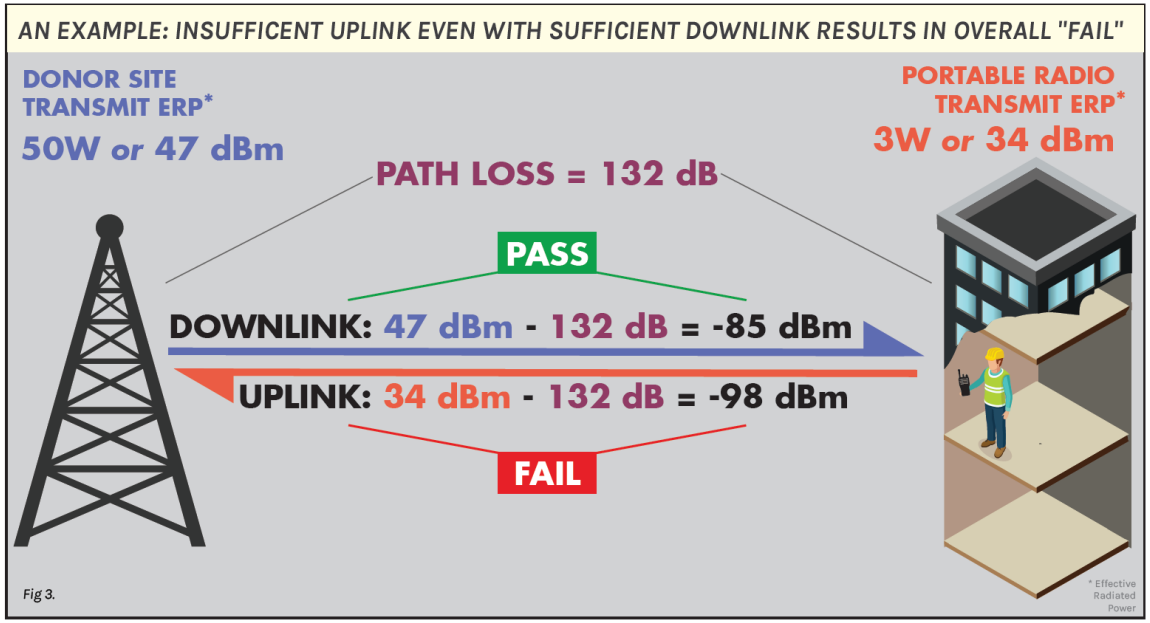
A minimum signal strength of -95 dBm shall be received by the agency's radio system when transmitted from within the building.

CODE-REQUIRED INBOUND AND OUTBOUND SIGNAL STRENGTH

Q: If signal strength readings are not performed at the donor site, *how can you ensure a minimum outbound signal strength of -95 dBm?*

A: Calculate outbound signal strength based on the inbound signal strength.

1. Determine the *signal strength difference* between the *donor site ERP* (effective radiated power) and the *portable radio's ERP,* typically 34 dBm
2. Then subtract the *signal strength difference* from our *in-building signal strength* reading to determine the *outbound signal strength*



-85 dBm is the inbound signal strength and *13 dB is the signal strength difference* (47 dBm – 34 dBm = 13 dB).
We can calculate the **outbound signal strength as -98 dBm** (-85 dBm - 13 dB = -98 dBm).
Although the minimum inbound signal strength is met**, the site survey will fail** since the outbound signal strength is below the required -95 dBm minimum.

DAQ-3 VS -95 DOWNLINK & -95 UPLINK

DAQ is used to test audio quality, the challenge is the translation of DAQ to dBms, which is not a part of NFPA or IFC codes.

DAQ LEVEL	dBm LEVEL	DEFINITION
1	**-115 to -122dBm**	Unusable. Speech present but not understandable.
2	**-110 to -115dBm**	Speech understandable w/slight effort. Requires occasional repetition due to noise or distortion.
3	**-110dBm**	Speech understandable w/slight effort. Requires occasional repetition due to noise or distortion
3.4	**-100 to -105dBm**	Speech understandable without repetition. Some noise or distortion present.
4	**-95 to -100dBm**	Speech easily understandable. Little noise or distortion.
4.5	**-90 to -95dBm**	Speech easily understandable. Rare noise or distortion.
5	**Higher than -90dBm**	Perfect. No Distortion or noise discernible.

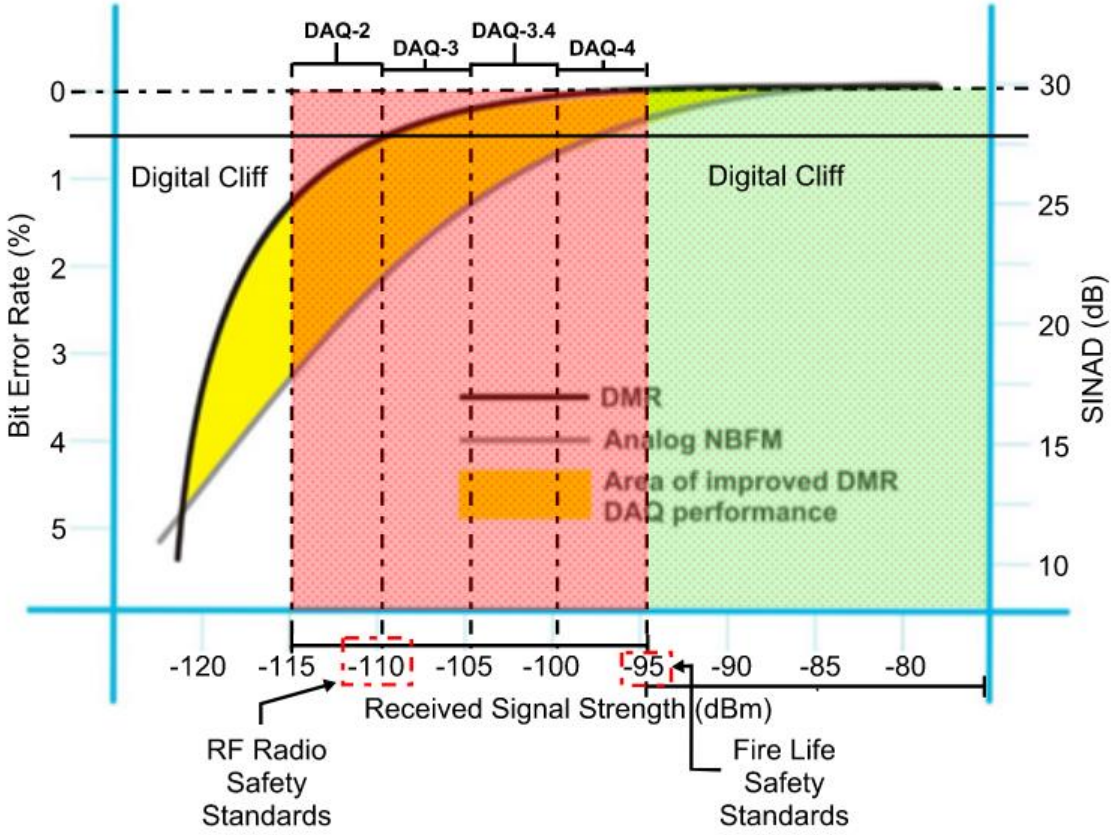
Attenuation will result in a lower DAQ level. What Attenuation factors should you be aware of?

1. Building Occupancy Load - *Transit*
2. Furnishings – *Transit*
3. Building Construction – *Static*
4. Building Occupancy Type – *Organic*
5. Weather – Seasons – *Organic*
6. Humidity – *Organic*
7. Forestry & Land Scaping - *Organic*

DAQ-3 VS -95 DBM RSSI

DAQ-3 VS -95dBm RSSI

The diagram below shows the relation between DAQ-3 and the dBm RSSI level to achieve it and the rapid lose of audio quality known as the “CLIFF”.



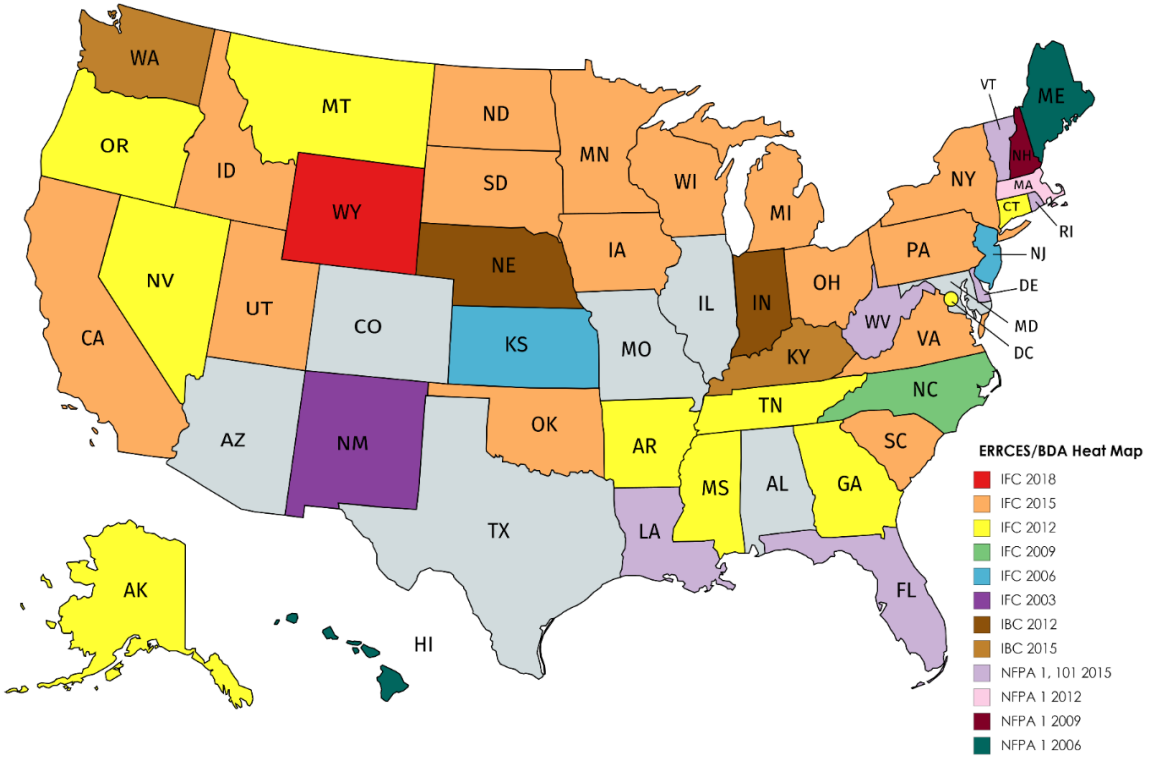
DAQ	dBm	Definition
1	-115 to -122dBm	Unusable. Speech present but not understandable.
2	-110 to -115dBm	Speech understandable w/slight effort. Requires occasional repetition due to noise or distortion.
3	-110dBm	Speech understandable w/slight effort. Requires occasional repetition due to noise or distortion
3.4	-100 to -105dBm	Speech understandable without repetition. Some noise or distortion present.
4	-95 to -100dBm	Speech easily understandable. Little noise or distortion.
4.5	-90 to -95dBm	Speech easily understandable. Rare noise or distortion.
5	Higher than -90dBm	Perfect. No Distortion or noise discernible.

POLL QUESTION

(2 of 3)
DO YOU CURRENTLY HAVE AN ERCES SPECIFICATION AVAILABLE?
YES OR NO

STATE WIDE CODE ENFORCEMENT - APPENDIX

REQUIRED BY CODE IN MOST STATES



Enforcement is Growing as AHJs Learn about Life-Saving Benefits of BDAs

STATE WIDE CODE ENFORCEMENT

State	BDA Required	IFC, NFPA 1, NFPA 101 Adoption	Link to Code or Bulletin	Edition Number	NFPA 72 Adoption	NFPA 72 Edition Number	Notes
Alabama	**Yes (possibly). ICC website references adoption of IFC but unconfirmed if section 510 is amended/deleted.**	International Fire Code (IFC) NFPA 1 - Fire Code NFPA 101 - Life Safety Code	http://bc.alabama.gov/buildingcode.htm	2009 - IFC 2012 - NFPA	2013 Edition Adopted by Reference	2013	
Alaska	**Yes, confirmed**	International Fire Code (IFC)	https://dps.alaska.gov/getmedia/5b0d3e53-e7b8-432c-a870-6c66b009a284/13-AAC-50-55b;.aspx	2012	2010 Edition by Reference	2010	
Arizona	No. Enforcement by jurisdiction	There is no state wide fire or building code. Codes are adopted by jurisdiction	https://www.dfbls.az.gov/userfiles/files/ofm/Amendments%20to%202012%20IFC.pdf	Codes adopted by Jurisdiction	Adopted by Jurisdiction	Adopted by Jurisdiction	
Arkansas	**Yes, confirmed**	International Fire Code (IFC)	https://up.codes/viewer/arkansas/ifc-2012/chapter/5/fire-service-features#5	2012	2010 Edition by Reference	2010	Arkansas currently uses the 2007 AR Fire Prevention Code based on the 2012 IFC
California	**Yes, confirmed**	**International Fire Code (IFC)**	2016 CFC	**2015**	2013 Edition by Reference	NFPA 72 - 2016	The 2016 California Fire (CFC) is based on the 2015 IFC and section 510 has been deleted.

State	BDA Required	IFC, NFPA 1, NFPA 101 Adoption	Link to Code or Bulletin	Edition Number	NFPA 72 Adoption	NFPA 72 Edition Number	Notes
Colorado	No. Enforcement by jurisdiction	There is no state wide fire or building code. Codes are adopted by jurisdiction		Codes adopted by Jurisdiction	Adopted by Jurisdiction		Codes are adopted first at the local level in Colorado under "home rule" with state agencies adopting building and safety codes which apply to projects under state purview.
Connecticut	No, section 510 deleted from the 2016 CT Fire Code	International Fire Code (IFC)	2016 CFSC	2012	2010 Edition Adopted by Reference	2010	The 2016 Connecticut Fire Safety Code CFSC is based on the 2012 IFC and section 510 has been deleted. The State Fire Marshal is in the process of creating the 2018 (CFSC) which is based on the 2015 edition of the IFC and will be effective in October of 2018. Section 510 of the 2018 CFSC has not been deleted or amended.
Delaware	Yes, confirmed	NFPA 1 - Fire Code NFPA 101 - Life Safety Code	In-Building Communications Regulation	2015	2013 Edition by Reference	NFPA 72 - 2013	All newly constructed buildings of 25,000 square feet or more are required to have approved radio coverage to prevent "dead zone" areas
District of Columbia	Yes, confirmed	International Fire Code (IFC)	https://codes.iccsafe.org/content/chapter/9220/	2012	2010 Edition by Reference	NFPA 72 - 2010	
Florida	**Yes, by Law**	**NFPA 1 - Fire Code** **NFPA 101 - Life Safety Code**	**File available**	**2015**	2013 Edition Adopted by Reference	2013	In March of 2016 HB 535 was signed into law. The language for in-building radio requirements for existing high rise begin on line 1319 of the attached bill.

State	BDA Required	IFC, NFPA 1, NFPA 101 Adoption	Link to Code or Bulletin	Edition Number	NFPA 72 Adoption	NFPA 72 Edition Number	Notes
Georgia	**Yes, confirmed**	**International Fire Code (IFC)**	File available	**2012**	2010 Adopted by Reference	2010	Georgia has a state-wide fire code that is based on the 2012 edition of the IFC. The BDA requirements have not been removed (see the attached state amendments to the 2012 IFC).
Hawaii	**Neither of these references show ERRCES to be deleted or amended**	NFPA 1 - 2006; IBC-2012	Hawaii Fire Code - http://labor.hawaii.gov/wp-content/uploads/2013/02/State-Fire-Code-1-1-10-w-signatures.pdf Hawaii Building Code - https://ags.hawaii.gov/wp-content/uploads/2012/09/buildingcode-20170918.pdf	2006	2010 Adopted by Reference	NFPA 72 - 2010	Hawaii has had difficulty in adopting current codes because their State Building Code Council has not received funding from the State to move forward with many of their code adoption goals.
Idaho	Yes (possibly). ICC website references adoption of IFC but unconfirmed if section 510 is amended/deleted.	International Fire Code (IFC)	https://doi.idaho.gov/sfm/Prevention/Statutes	2015	2013 Edition Adopted by Reference	NFPA 72 - 2013	
Illinois	No. Enforcement by jurisdiction	There is no state wide Fire Code. Codes are adopted by jurisdiction.		Codes adopted by Jurisdiction	Adopted by Jurisdiction	Adopted by Jurisdiction	
Indiana	No. Enforcement by jurisdiction	IBC IFC 2012 with Amendments see link	http://www.in.gov/legislative/iac/20140827-IR-675130341FRA.xml.pdf		2010 Edition by Reference	2010	
Iowa	**Yes (possibly). ICC website references adoption of IFC but unconfirmed if section 510 is amended/deleted.**	International Fire Code (IFC)		2015	2013 Edition Adopted by Reference	NFPA 72 - 2013	

State	BDA Required	IFC, NFPA 1, NFPA 101 Adoption	Link to Code or Bulletin	Edition Number	NFPA 72 Adoption	NFPA 72 Edition Number	Notes
Kansas	No. The state has adopted by reference the 2006 edition of the IFC	International Fire Code (IFC)		2006	Adopted by Reference	2007	The 2006 edition of the IFC has no requirement for the installation of BDA systems.
Kentucky	No. Section 916 of the Building Code is deleted	International Building Code (IBC)	Kentucky Buidling Code	2015	2010 Edition by Reference	2010	**Kentucky, with amendments, has adopted the 2012 edition of the IFC and is utilized for new construction projects.**
Louisiana	No	NFPA 101 - Life Safety Code		2015	2010 Edition by Reference	2010	NFPA 101 only permits BDA systems to be used in lieu of wired firefighter telephone systems in high-rise buildings.
Maine	**Possibly. Section 916 of the IBC was not amended or deleted**	NFPA 1	Adopted Codes in Maine Maine Building Code - https://www.maine.gov/dacd/meocd/bbcs/index.html	2006	2007 Edition	2007	
Maryland	Enforcement by jurisdiction	There is no state wide Fire Code. Codes are adopted by jurisdiction.		Codes adopted by Jurisdiction	Adopted by Jurisdiction	Adopted by Jurisdiction	
Massachusetts	**Yes, confirmed.**	**NFPA 1**	State Amendments to NFPA 1	**2012**	2010 Edition Adopted by Reference	2010	
Michigan	Yes. 2015 IBC and 2015 IFC no amendments		https://www.michigan.gov/lara/0,4601,7-154-89334_10575_17550-234789--,00.html	**7/7/1905**	Adopted by Jurisdiction	Adopted by Jurisdiction	The ICC website claims the state has not adopted the IFC . The NFPA Code Finder website only references the IFGC. So it “appears” there is no state-wide fire code.

State	BDA Required	IFC, NFPA 1, NFPA 101 Adoption	Link to Code or Bulletin	Edition Number	NFPA 72 Adoption	NFPA 72 Edition Number	Notes
Minnesota	**Yes, confirmed.**	International Fire Code (IFC)	State Fire Code	2015	2010 Edition Adopted by Reference	2010	The 2015 Minnesota Fire Code (MFC) is based on the 2012 IFC and section 510 relating to BDA systems has been deleted from the MFC
Mississippi	**yes but only STATE buildings**	International Fire Code (IFC)	https://www.mid.ms.gov/legal/regulations/FM20101reg.pdf	2012	2013 Edition Adopted by Reference	2013	The MFPC only applies to state owned buildings, places of assembly, buildings over 75' in height, correctional facilities, and private fraternity and sorority houses. Jurisdictions may adopt local fire codes not less stringent than the MFPC, as determined by the Fire Marshal.
Missouri	No. Enforcement by jurisdiction	There is no state wide Fire Code. Codes are adopted by jurisdiction.		Codes adopted by Jurisdiction	Adopted by Jurisdiction	Adopted by Jurisdiction	There is no state-wide fire code. Most jurisdictions are on a recent edition of the IFC, but it's all locally adopted. The only exception would be state-licensed facilities such as day care and nursing homes and with a requirement to follow NFPA 72. Any BDA requirements is left up to the local AHJ to require.

State	BDA Required	IFC, NFPA 1, NFPA 101 Adoption	Link to Code or Bulletin	Edition Number	NFPA 72 Adoption	NFPA 72 Edition Number	Notes
Montana	**Yes, confirmed**	International Fire Code (IFC) International Building Code (IBC)	Adoption of IFC/IBC	2012	2010 Edition Adopted by Reference	NFPA 72 - 2010	23.12.601(4) The building code adopted by the Building Codes Bureau of the Department of Labor and Industry controls design and construction in Montana. If there is any conflict between the construction standards in the IFC and construction standards set forth in the building code, the provisions of the building code control.
Nebraska	**Yes (possibly). ICC website references adoption of the IFC but unconfirmed if section 510 is amended/deleted.**	International Building Code (IBC)		2012	2010 Edition Adopted by Reference	NFPA 72 - 2010	
Nevada	**Yes, confirmed**	**International Fire Code (IFC)**	**File available**	**2012**	2010 Edition Adopted by Reference	NFPA 72 - 2010	The current Fire Code made no changes to section 510 of the IFC. However, attached are the BDA amendments for Southern Nevada which are different than the State Fire Code.
New Hampshire	**Yes, confirmed**	NFPA 1	State Fire Code http://www.gencourt.state.nh.us/rules/state_agencies/saf-c6000.html	2009	2010 Edition Adopted by Reference	NFPA 72 - 2010	Saf-C 6008.02 Exceptions to Fire Prevention Code. Section 11.10 has not been deleted or amended.

State	BDA Required	IFC, NFPA 1, NFPA 101 Adoption	Link to Code or Bulletin	Edition Number	NFPA 72 Adoption	NFPA 72 Edition Number	Notes
New Jersey	**Yes for new construction only, confirmed**	**International Fire Code (IFC)**	2015 NJBC	2006			Section 916 of the2015 New Jersey Building Code (NJFC) section 510 of the IFC requires BDA systems in new construction. BDA is not required in existing buildings because N.J.A.C. 5:70-4 does not require it?
New York	**Yes, confirmed**	**International Fire Code (IFC)**	2016 NYSFC	**2015**	2013 Edition Adopted by Reference	NFPA 72 - 2013	The 2016 New York State Fire Code (NYSFC) is based on the 2015 IFC and section 510 has been deleted.
New Mexico	No. The state has adopted by reference the 2003 edition of the IFC	International Fire Code (IFC)	http://www.nmprc.state.nm.us/state-firemarshal/docs/2006SFMOPlansReviewGuidelines.pdf	2003	Adopted by Jurisdiction	Adopted by Jurisdiction	New Mexico is behind with Fire Code adoption, they are on the 2003 IFC which has no requirement for the installation of BDA systems.
North Carolina	**Yes, confirmed**	International Fire Code (IFC)	2018 Fire Prevention Code	2009	2013 Edition Adopted by Reference	2013	North Carolina is adopting the 2015 IFC and the only change to the attached amendments is deleting section 510.2 relating to existing buildings (page 72). The effective date of the next edition of the NCFPC is 1/1/19.
North Dakota	**Yes (possibly). ICC website references adoption of the IFC but unconfirmed if section 510 is amended/deleted.**	International Fire Code (IFC)		2015	2010 Edition Adopted by Reference	2010	

State	BDA Required	IFC, NFPA 1, NFPA 101 Adoption	Link to Code or Bulletin	Edition Number	NFPA 72 Adoption	NFPA 72 Edition Number	Notes
Ohio	**Yes, confirmed**	**International Fire Code (IFC)**	File available	**2015**	2016 Edition	2016	The Ohio Fire Code (OFC) is based on the 2015 edition of the IFC. Attached is a SFM bulletin relating to BDA systems. The requirements relating to existing do not apply retroactively to already existing buildings unless the building or system is altered.
Oklahoma	**Yes, confirmed**	International Fire Code (IFC)	Oklahoma Fire Code	2015	2013 Edition Adopted by Reference	2013	The Oklahoma Fire Code is based on the 2015 IFC and section 510 has not been deleted or amended.
Oregon	Yes, confirmed	International Fire Code (IFC)	File available	2012	2010 Edition Adopted by Reference	NFPA 72-2010	Oregon Building Codes Division (BCD) published a proposed Rule (see attached) that requires BDA systems to be installed in buildings with below grade levels, more than 5 stories and more than 50K square feet as well as exempting BDA systems under certain criteria and requires survivability requirements.

State	BDA Required	IFC, NFPA 1, NFPA 101 Adoption	Link to Code or Bulletin	Edition Number	NFPA 72 Adoption	NFPA 72 Edition Number	Notes
Pennsylvania	**Yes, confirmed**	**International Fire Code (IFC)**	File available	2015	2007 Edition Adopted by Reference	2007	The Uniform Construction Code Review and Advisory Council announced the adoption of the of the 2015 edition of the International Fire Code (IFC). The attached document claims there were no state amendments to the IFC.
Rhode Island	**Yes, confirmed**	NFPA 1	Rhode Island Fire Code	2015	2010 Edition Adopted by Reference	2010	Chapter 11 of the 2012 edition of NFPA 1 has been adopted without amendments. Section 11.10 of NFPA 1 requires all new and existing buildings to have minimum radio signal strength for fire department communications shall be maintained at a level determined by the AHJ.
South Carolina	Yes, confirmed.	International Fire Code (IFC)	South Carolina Fire Code https://codes.iccsafe.org/content/chapter/7162/	2015	2013 Edition Adopted by Reference	2013	The South Carolina Fire Code is based on the 2015 IFC and section 510 has not been deleted or amended.

State	BDA Required	IFC, NFPA 1, NFPA 101 Adoption	Link to Code or Bulletin	Edition Number	NFPA 72 Adoption	NFPA 72 Edition Number	Notes
South Dakota	**Yes (possibly). ICC website references adoption of the IFC but unconfirmed if section 510 is amended/deleted.**	International Fire Code (IFC)		2015	2013 Edition Adopted by Reference	2013	The only state authority is the State Fire Marshal and is authorized to update the codes through the state rule-making process. The state authorizes counties and local governments to adopt model building codes, with the restriction that they adopt the IBC. Jurisdictions are permitted to amend the State Codes to conform to local needs.
Tennessee	Yes, confirmed.	International Fire Code (IFC)	Tennessee Fire Code	2012	2010 Edition Adopted by Reference	2010	The Tennessee Fire Code is based on the 2012 IFC and section 510 has not been deleted or amended.
Texas	No. Enforcement by jurisdiction	There is no state wide Fire Code. Codes are adopted by jurisdiction.		Codes adopted by Jurisdiction	Adopted by Jurisdiction	Adopted by Jurisdiction	There is no statewide adoption of the I-Codes or NFPA standards. The State Fire Marshal (SFM) has jurisdiction over conducting fire safety "inspections" of state buildings, daycare and elder-care centers, foster homes, hospitals, hotels and motels, university and college buildings, and other buildings upon request or complaint.

State	BDA Required	IFC, NFPA 1, NFPA 101 Adoption	Link to Code or Bulletin	Edition Number	NFPA 72 Adoption	NFPA 72 Edition Number	Notes
Utah	**Yes (possibly). ICC website references adoption of the IFC but unconfirmed if section 510 is amended/deleted.**	International Fire Code (IFC)		2015	2013 Edition Adopted by Reference	NFPA 72-2013	
Vermont	**Yes, confirmed**	NFPA 1/101	Vermont Fire & Building Safety Code	2015	2013 Edition Adopted by Reference	NFPA 72-2013	Chapter 11 of the 2015 edition of NFPA 1 has been adopted without amendments. Section 11.10 of NFPA 1 requires all new and existing buildings to have minimum radio signal strength for fire department communications shall be maintained at a level determined by the AHJ.
Virginia	**Yes, confirmed.**	**International Fire Code (IFC)**	2015 SFPC	**2015**	2013 Edition Adopted by Reference	2013	The final regulations for the 2015 Virginia Statewide Fire Prevention Code (SFPC) have been published in the Virginia Register and section 510 requires increased amplification of the emergency communication system where required by the AHJ. The 2015 SFPC is based on the 2015 IFC and is effective on 10/16/18.
Washington	**Yes, confirmed**	**International Building Code (IBC)**	Washington State Building Code	**2015**	2013 Edition Adopted by Reference	NFPA 72-2013	The Washington Building Code (WBC) is comprised of the 2015 edition of the IFC. Section 916 of the IBC has been deleted from the Washington Building Code. Therefore, BDA systems are not required. Also, Chief Rogers claims the Spokane FD is not enforcing the BDA requirement because they have no issues with poor radio coverage in buildings.

State	BDA Required	IFC, NFPA 1, NFPA 101 Adoption	Link to Code or Bulletin	Edition Number	NFPA 72 Adoption	NFPA 72 Edition Number	Notes
West Virginia	**No**	NFPA 1, NFPA 101 and International Building Code	Fire and Building Code	2015	Adopted by Reference	2013	The West Virginia Fire Commission has adopted statewide the 2015 edition of the IBC and section 4.I .j .1. of Title 87 (Fire Commission Legislative Rule) omits the reference to International Fire Code and substitutes with NFPA 101 Life Safety Code 2015 edition. NFPA 101 only permits BDA systems to be used in lieu of wired firefighter telephone systems in high-rise buildings
Wisconsin	**Yes, confirmed**	**International Fire Code (IFC)**	File available	**2015**	Adopted by Reference	2007	BDA systems should be required for new construction soon after the Department of Safety and Professional Services (DSPS) announced the adoption the 2015 edition of the IBC. The attached document has no reference that section 916 of the IBC nor section 510 of the IFC have been removed.
Wyoming	**Yes (possibly). ICC website references adoption of the IFC but unconfirmed if section 510 is amended/deleted.**	International Fire Code (IFC)	Wyoming Fire Code	2018	Adopted by Reference		