

IFC 510 and How It Affects Your Building



Presentation Overview

- ▶ Introduction to IFC 510
- ▶ Coverage Testing (Site Survey)
- ▶ Design a System
- ▶ Installation
- ▶ Commissioning
- ▶ Annual Testing
- ▶ Conclusion and Questions



Introduction to IFC 510

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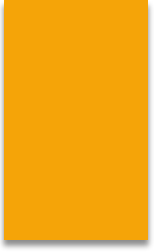
How Did We Get Here?

- ▶ Effective January 7th 2018 City of Austin adopted the 2015 edition of the International Fire Code (IFC) with local amendments

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Section 510 Emergency Responder Radio Coverage (ERRC)

- ▶ Used and Equivalent terms:
 - ▶ Emergency Responder Radio Coverage Systems (ERRCS)
 - ▶ Distributed Antenna System (DAS)
 - ▶ Emergency Radio Coverage System (ERCS)
 - ▶ In-Building RF Enhancement Systems for Public Safety
- ▶ This first entered into the IFC code back in 2009
- ▶ 2016 NFPA 1221 and 2016 NFPA 72 also related to ERRC systems



510.1 Emergency responder radio coverage in buildings. All buildings shall have approved radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communications system of the jurisdiction at the exterior of the building. This section shall not require improvement of the existing public safety communication system.

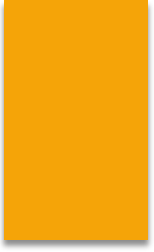
Exceptions:

1. Where approved by the building official and the fire chief, a wired communication system in accordance with Section 907.2.13.2 shall be permitted to be installed or maintained in lieu of an approved radio coverage system in buildings where a floor for human occupancy is located not more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.
2. Where it is determined by the fire code official that the radio coverage system is not needed.

510.1.1 Time Frame for New Building Installations. The adequacy of radio coverage for buildings permitted after adoption of this code shall be determined following completion of construction and issuance of the Certificate of Occupancy. If supplemental equipment such as bi-directional amplifiers are necessary to assure radio coverage, the design and installation of the supplementary radio transmission equipment shall be completed within two years of original occupancy.

510.1.2 Time Frame for Existing Buildings. If it is discovered that radio coverage is not adequate within buildings permitted prior to the adoption of this code, the design and installation of necessary supplementary radio transmission equipment shall be completed within three years of the discovery of the deficiency.

Austin's IFC 510 Amendments



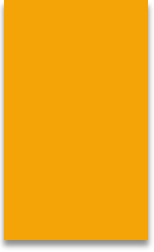
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510.1 Emergency responder radio coverage in buildings



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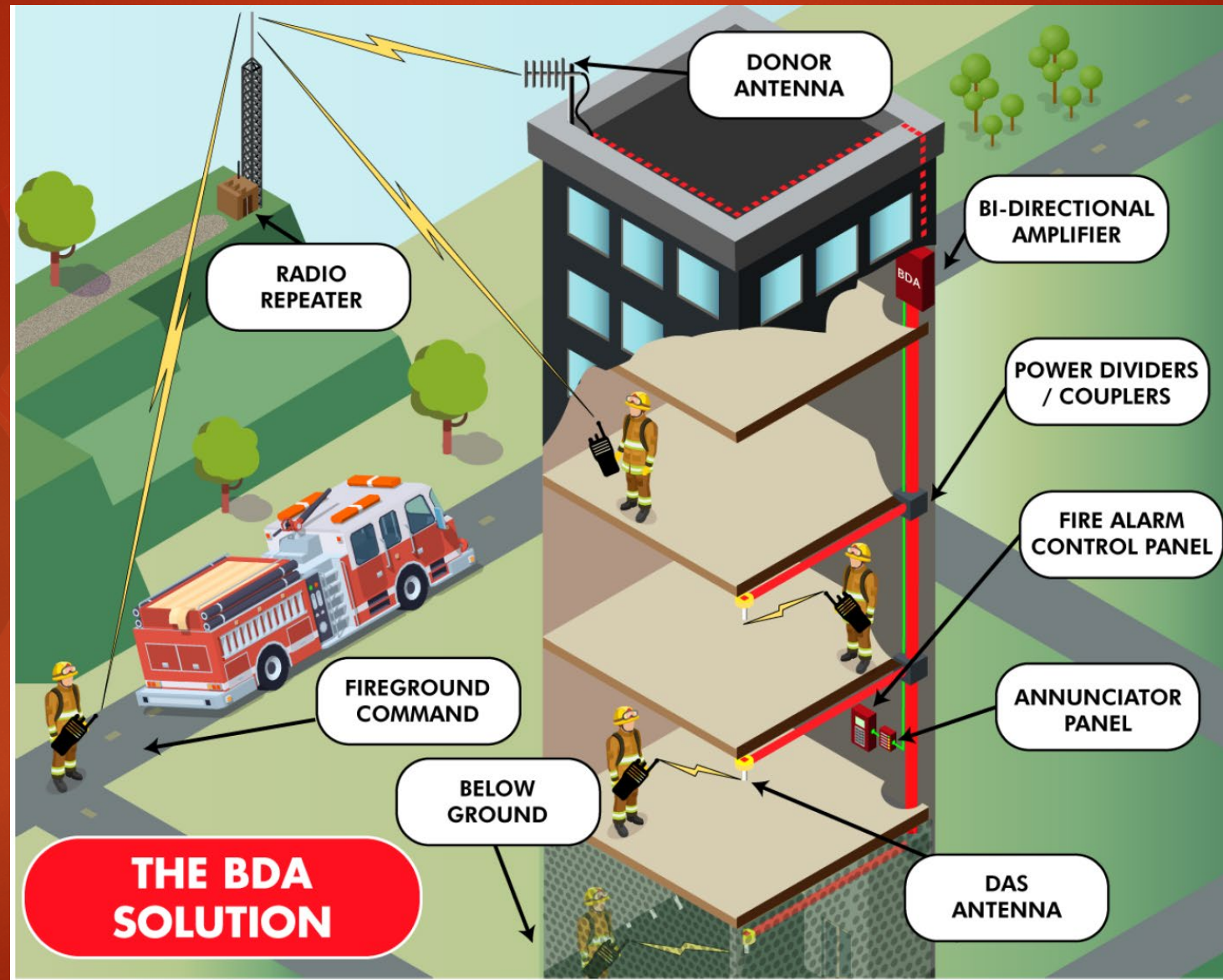
510.1.1 Time Frame for New Building Installations

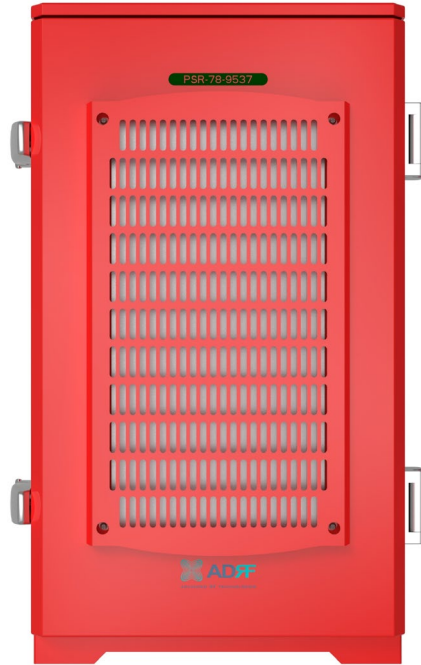


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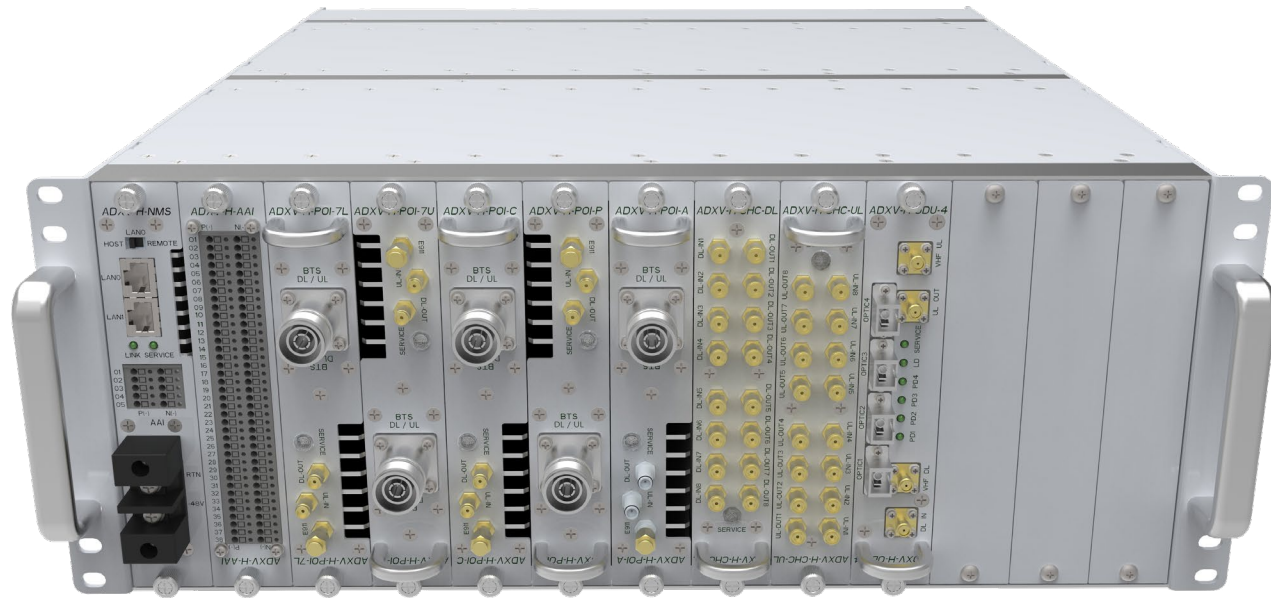
510.1.2 Time Frame for Existing Buildings

Typical System Overview





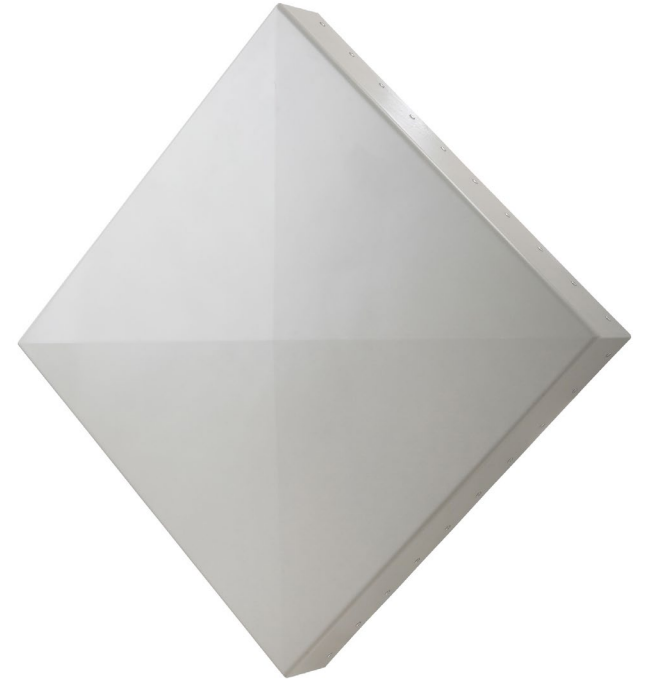
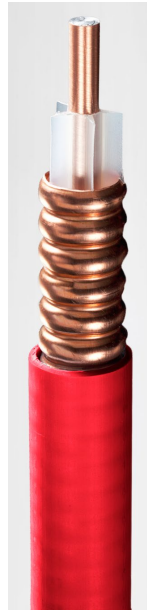
Typical Passive DAS Components



Typical Active DAS Components

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Other Typical Components





Coverage Testing (Site Survey)

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What Triggers a Site Survey

1. Fire marshal conducting a sequence test
2. Buildings being proactive and testing building

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What is Adequate Coverage?

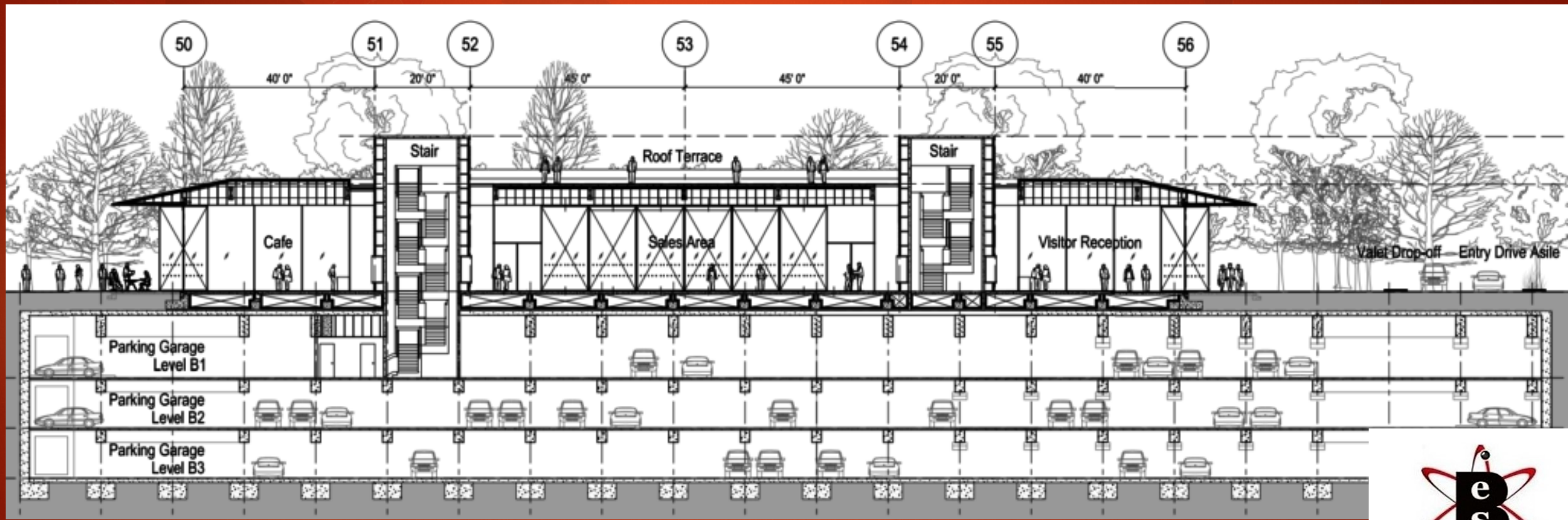
- ▶ 2015 IFC 510.4.1
 - ▶ At a minimum a -95 dBm signal strength received in 95 percent of all non-critical areas on each floor of the building
- ▶ 2016 NFPA 1221 9.6.7.4
 - ▶ At a minimum a -95 dBm signal strength received in 99 percent of critical areas (ex. elevator lobby, fire pump room, exit stairwells)

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What Affects In-Building Coverage?



Subgrade Floors



<https://www.buildzoom.com/blog/what-it-takes-to-build-apple-park>



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Building Construction & Configuration

Material Attenuation Chart	
Material Types	800-900 MHz Attenuation (dB)
Cubicles	1
Light Plaster	0.5
Heavy Plaster	2
Drywall	2.5
Light Concrete	3
Glass Window	2
Heavy Concrete	6
Low E Glass	20



Building Location



2019

<https://www.youtube.com/watch?v=UWOuKMLLH6w>

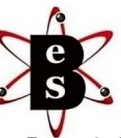


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Donor Tower Location and Strength

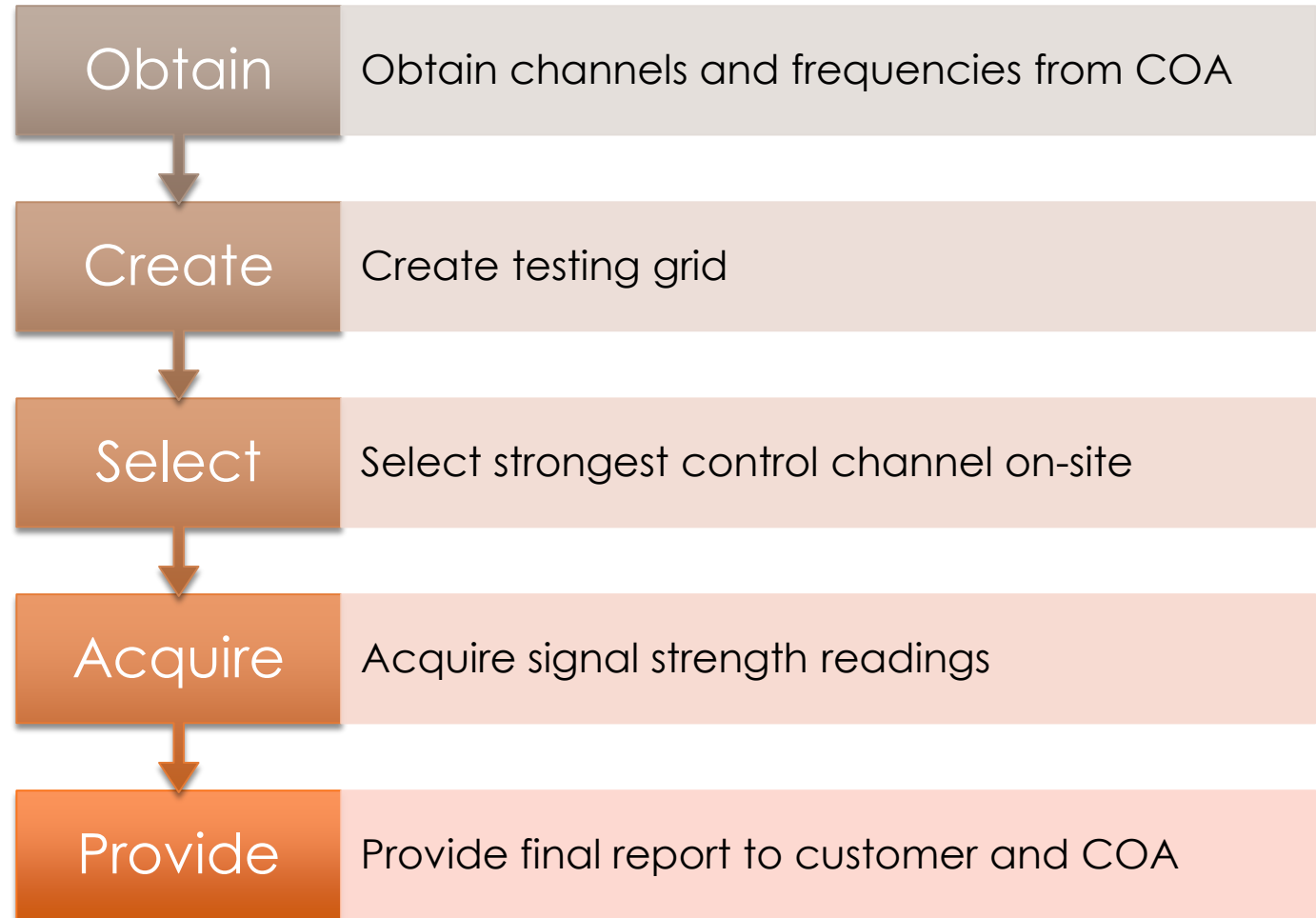


<http://purvispublicsafety.com/2015/04/27/how-radio-provides-a-lifeline-to-fire-station-alerting-systems/>

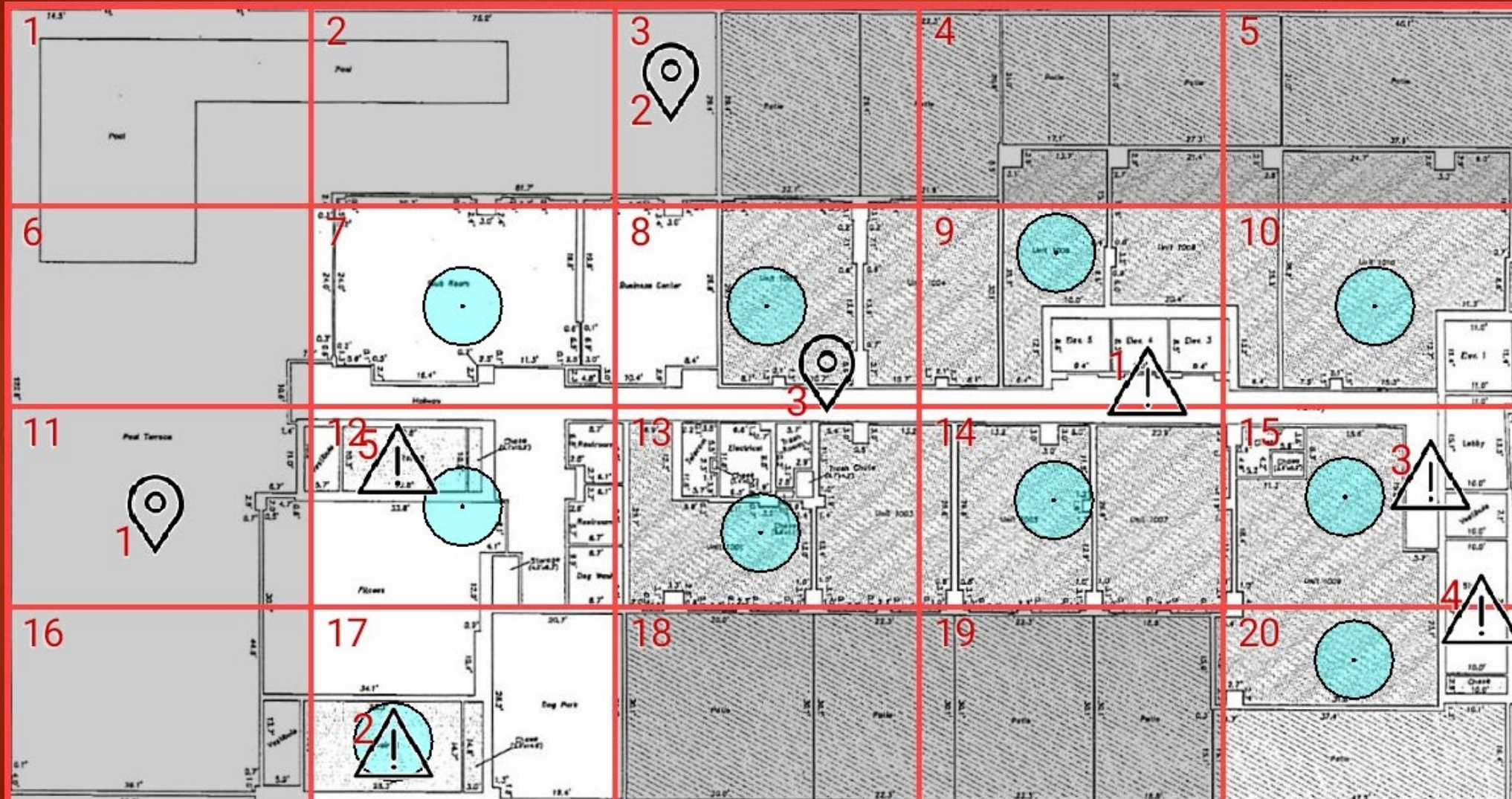


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Testing Procedures

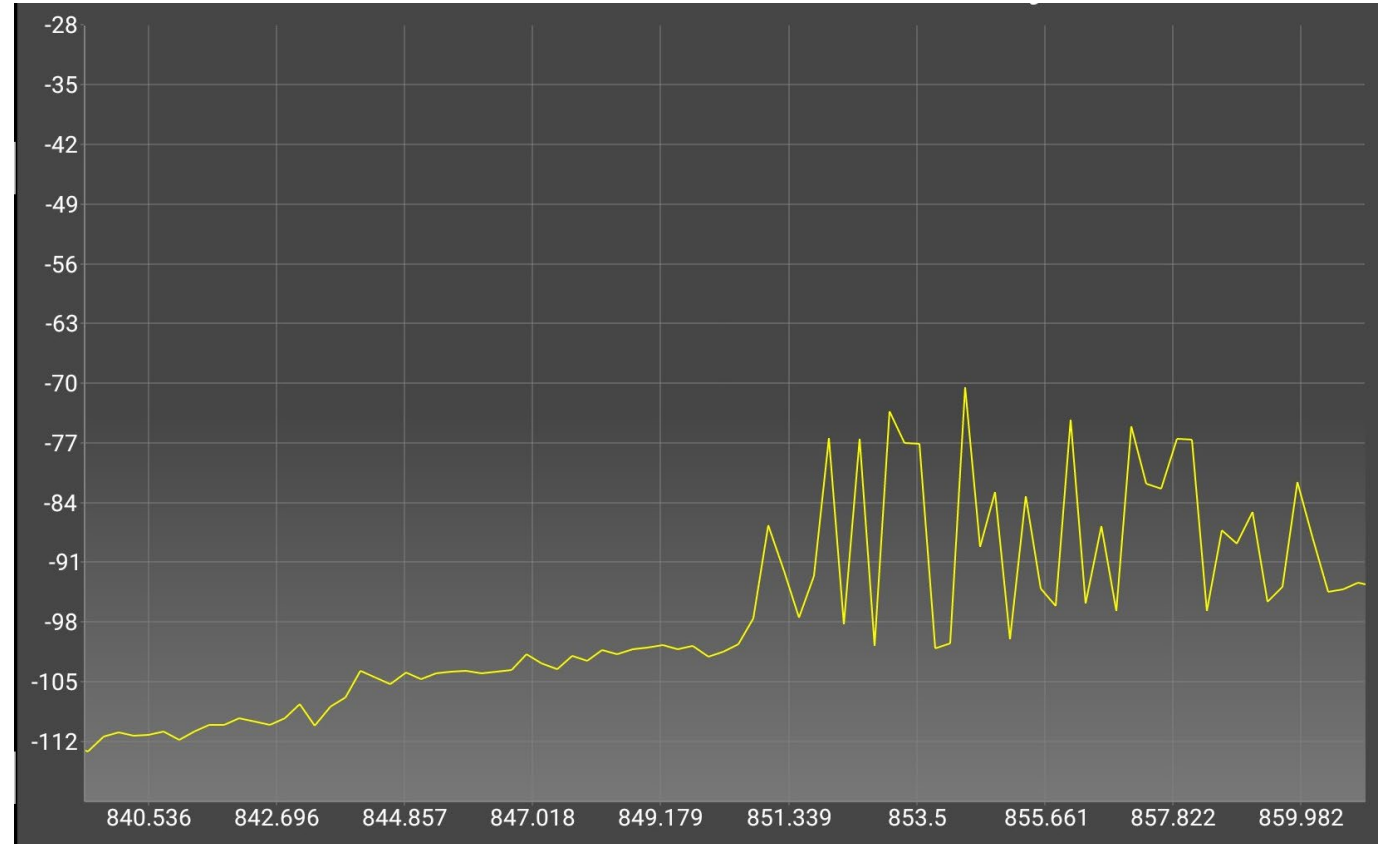


Testing Grid

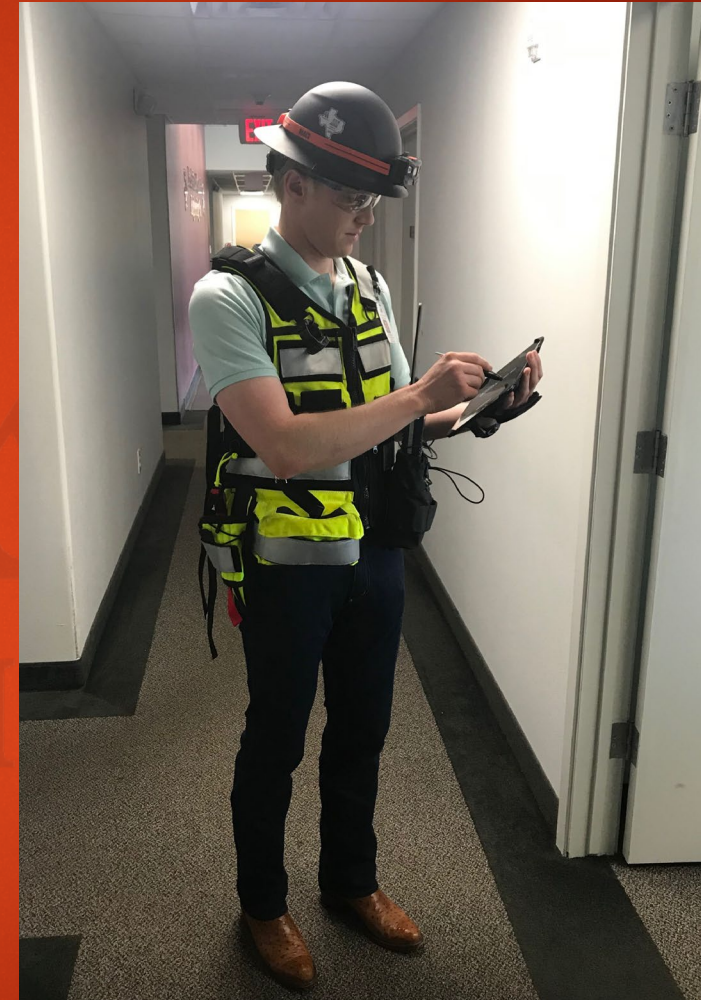


Select Control Channel

- ▶ Select channels with the strongest signal at customer's site



Signal Acquisition



Building: Building
Result: Fail

Number of Floors Tested:	5	Grading Approach:	By area per floor
Number of Areas Tested:	100	Area Pass Criteria:	95%
Number of Critical Points Tested:	29	Critical Points Pass Criteria:	99%
DL Power Threshold (dBm):	-95	UL Power Threshold (dBm):	-95
DL Critical Point Power Threshold (dBm):	-95	UL Critical Point Power Threshold (dBm):	-95
DL SINR Threshold (dB):	18	UL SINR Threshold (dB):	18
DL Critical Point SINR Threshold (dB):	20	UL Critical Point SINR Threshold (dB):	20
DAQ Threshold:	3.0		

Equipment

Vendor	Application	Device	Calibrated Date	Antenna info
PCTEL	SeeHawk Touch rel 2.6.0.0	SeeGull IBflex Device rel 2.4.0.0 SN: 081806050	9-6-2018	UHF/VHF/700-800MHz

Test Report Summary

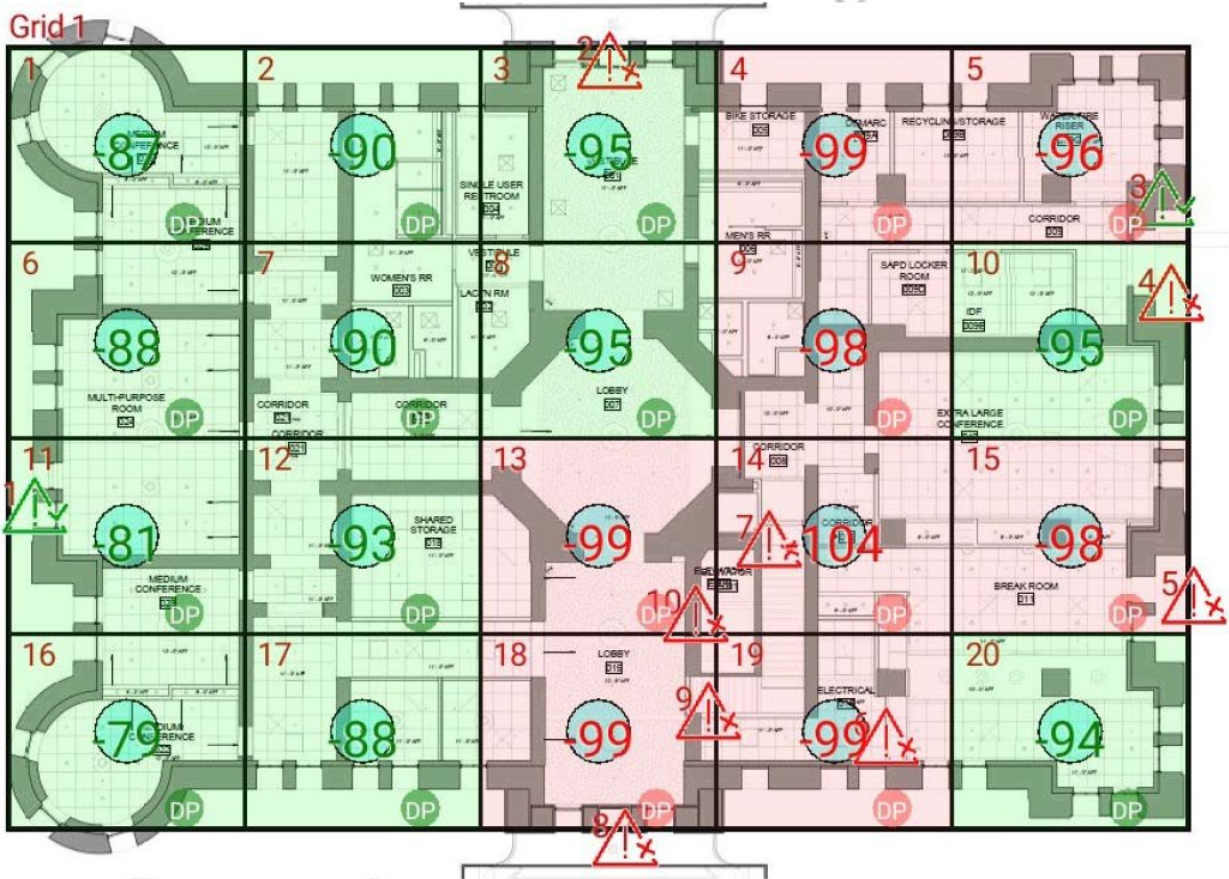
Channel/ Ch Group	Freq (MHz)	Ph	Type	Ant gain	Cable loss	Result	Areas passed (%)	Critical Points passed (%)
1	873.16250			0.00	0.00	Fail	92/100 (92%)	21/29 (72%)
2	879.82750			0.00	0.00	Fail	88/100 (88%)	20/29 (68%)

Display:
 - Pass or Failure
 - Frequencies tested



Channel: 1
Result: Fail

Areas Tested:	20	Area Points Pass Criteria:	95 %
Critical Points Tested:	10	Critical Points Pass Criteria:	99 %
Total Grid Size:	14831.3 sq. ft	Frequency (MHz):	873.16250



Signal
Strength
Values on
Testing Grid



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Reference Point Report

Reference Point	Power (dBm)	DL SINR (dB)	Selected	Comment
None	N/A	N/A	N/A	None

Critical Point Report

Critical Point	DL Power (dBm)	DL SINR (dB)	DL DAQ	UL Power (dBm)	UL SINR (dB)	UL DAQ	Result	DL Loss (dB)	Comment
1	-89.59						Pass		Exit Door (facing West)
2	-96.42						Fail		Exit Door (facing North)
3	-93.82						Pass		Sprinkler Riser (Northeast corner)
4	-99.64						Fail		Exit Door (facing East)
5	-96.24						Fail		Exit Door (facing East)
6	-101.02						Fail		Electrical Room
7	-102.79						Fail		Electrical Room
8	-100.46						Fail		Exit Door (facing South)
9	-98.05						Fail		Existing Stairwell (not demolished)
10	-95.87						Fail		Elevator Lobby

Area Report

Grid	Area	DL Power (dBm)	DL SINR (dB)	DL DAQ	UL Power (dBm)	UL SINR (dB)	UL DAQ	Result	DL Loss (dB)	Comment
1	1	-86.04						Pass		
1	2	-89.47						Pass		
1	3	-94.38						Pass		
1	4	-98.09						Fail		
1	5	-95.35						Fail		
1	6	-87.53						Pass		
1	7	-89.42						Pass		
1	8	-94.29						Pass		
1	9	-97.84						Fail		
1	10	-94.92						Pass		
1	11	-80.88						Pass		
1	12	-92.71						Pass		
1	13	-98.26						Fail		
1	14	-103.15						Fail		
1	15	-97.59						Fail		
1	16	-78.62						Pass		
1	17	-87.28						Pass		
1	18	-98.45						Fail		
1	19	-98.61						Fail		

Display:

- Testing points
- Critical points
- Reference points



How to Proceed?

Pass

- ▶ You can provide the report to the fire code official inspecting the building
- ▶ Recommend having building tested annually due to the constantly changing RF environment

Fail

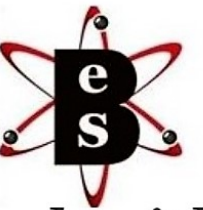
- ▶ Contact company to design, install, and commission a system





Design a System

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Personnel Qualifications

- ▶ IFC Section 510.5.2
 - ▶ Valid FCC-issued general radio operators license
 - ▶ Certification of in-building system training issued by nationally recognized organization
 - ▶ Certificated issued by the manufacturer of the equipment being installed

OR

- ▶ These qualification shall not be required where demonstration of adequate skills and experience satisfactory to the fire code official is provided



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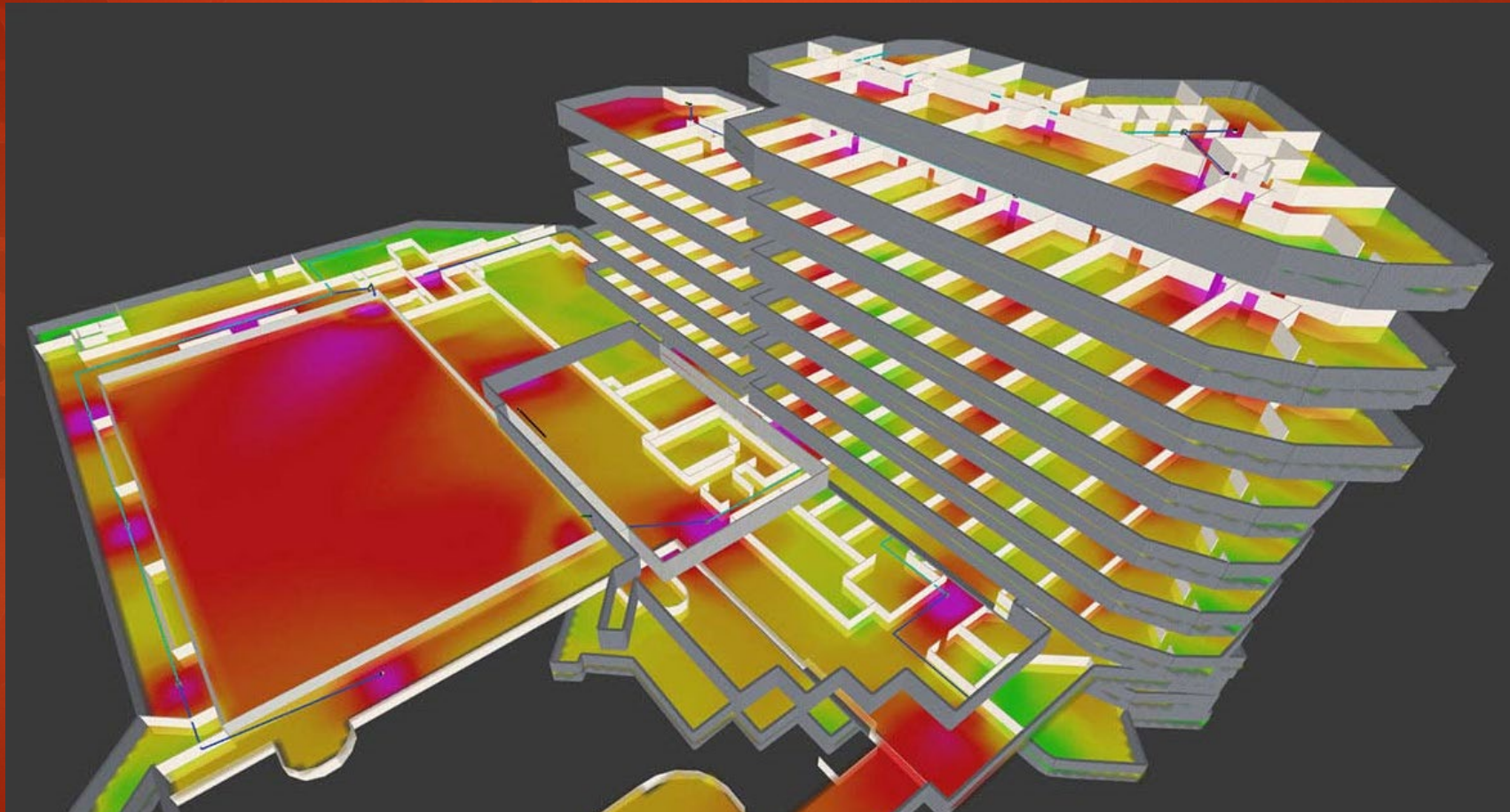
Design

- ▶ Two types of solutions for existing buildings:
 - A. Provide coverage only in areas that are found inadequate in test
 - B. Provide coverage for entire building



Predict Coverage

- ▶ Use tools such as iBWave or RanPlan to predict how the antennas in the design will propagate within building providing coverage



<http://www.ibwave.com/ibwave-design>

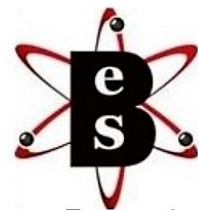


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Installation

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2016 NFPA 1221 9.6 Two-Way Radio Communication Enhancement Systems

- ▶ Goes into greater detail about installation of system
- ▶ Mostly compliments 2015 IFC Section 510



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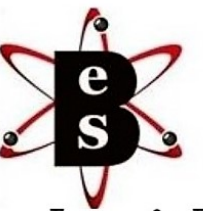
Notable Building Affecting Requirements

- ▶ 2016 NFPA 1221 Section 9.6.2.1.3
 - ▶ Riser coaxial cables should be rated as riser cables and route through a 2-hour—rated enclosure
- ▶ 2016 NFPA 1221 Section 9.6.3
 - ▶ Systems shall have lightning protection that complies with NFPA 780
- ▶ 2016 NFPA 1221 Section 9.6.13.2
 - ▶ A dedicated monitoring/annunciating panel for the ERRC system that is connected to the fire alarm system
- ▶ Roof penetrations
- ▶ Floor Coring



Commissioning

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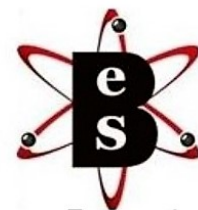
Typical Steps

1. Test cables, connectors, couplers, etc.
2. Set BDA
 - ▶ Select frequencies
 - ▶ Set gain
 - ▶ Make sure to you have good isolation (making sure amplified signal does not get fed back into roof donor antenna)
 - ▶ Verify system monitoring points being monitored correctly
3. Conduct another site survey to verify installed system provides adequate coverage
4. Submit final report to customer and COA



Annual Testing

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2015 IFC Section 510.6.1

- ▶ Site survey
- ▶ Verify BDA gain
- ▶ Test battery backups
- ▶ Verify operation other active components (remotes and BBUs for remotes)
- ▶ Submit report to customer and COA

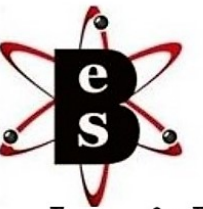


Other Notable Points

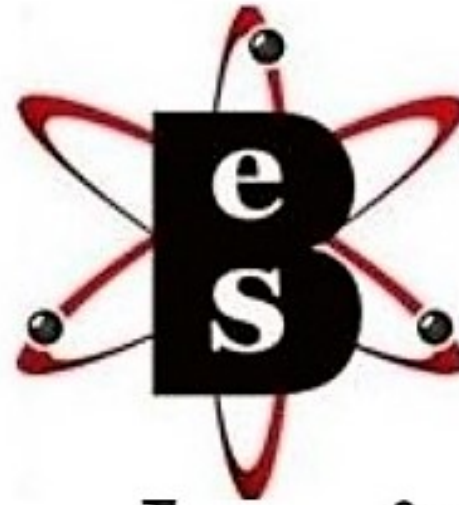
- ▶ DAQ (Delivered Audio Quality) testing
 - ▶ Requires radios on PS network so COA will conduct this type of testing
 - ▶ COA just expects companies to complete the signal strength test
- ▶ Typically when a PS signal does not penetrate a building, cellular signals likely won't penetrate



Conclusion and Questions



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Thank you!