WIRELESS TECHNOLOGY TRAINING SEMINAR SERIES 1 OF 3

IN-BUILDING CELLULAR AND PUBLIC SAFETY RADIO SYSTEMS

UNDERSTANDING CALIFORNIA FIRE CODE SECTION 510

April 10, 2019
Fairfield Inn by Marriott Tustin
Orange County, CA

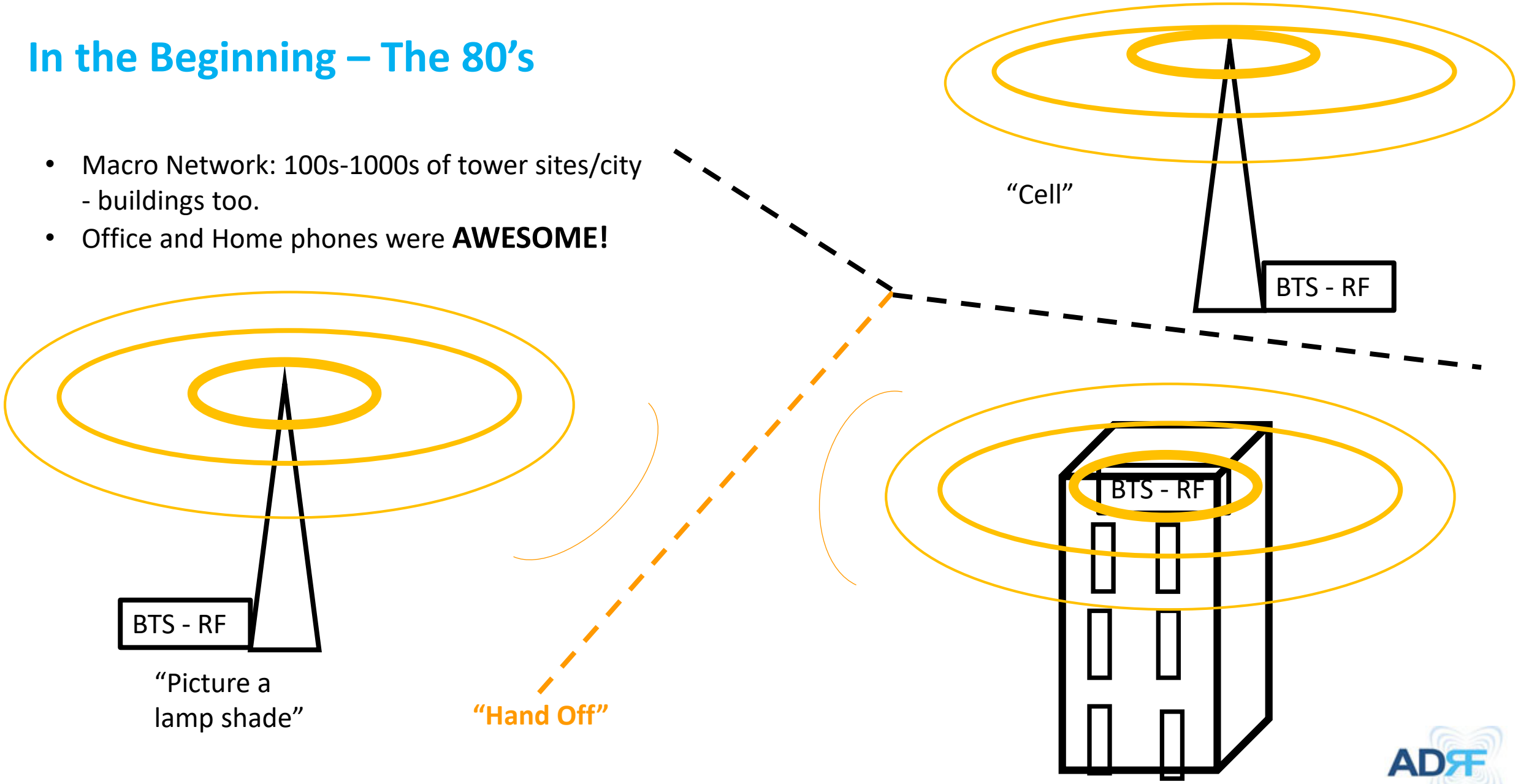
HOSTED BY DASpedia

Introduction to 'In-Building DAS and Public Safety Radio Systems'

ADRF THE SIGNAL FOR SUCCESS.

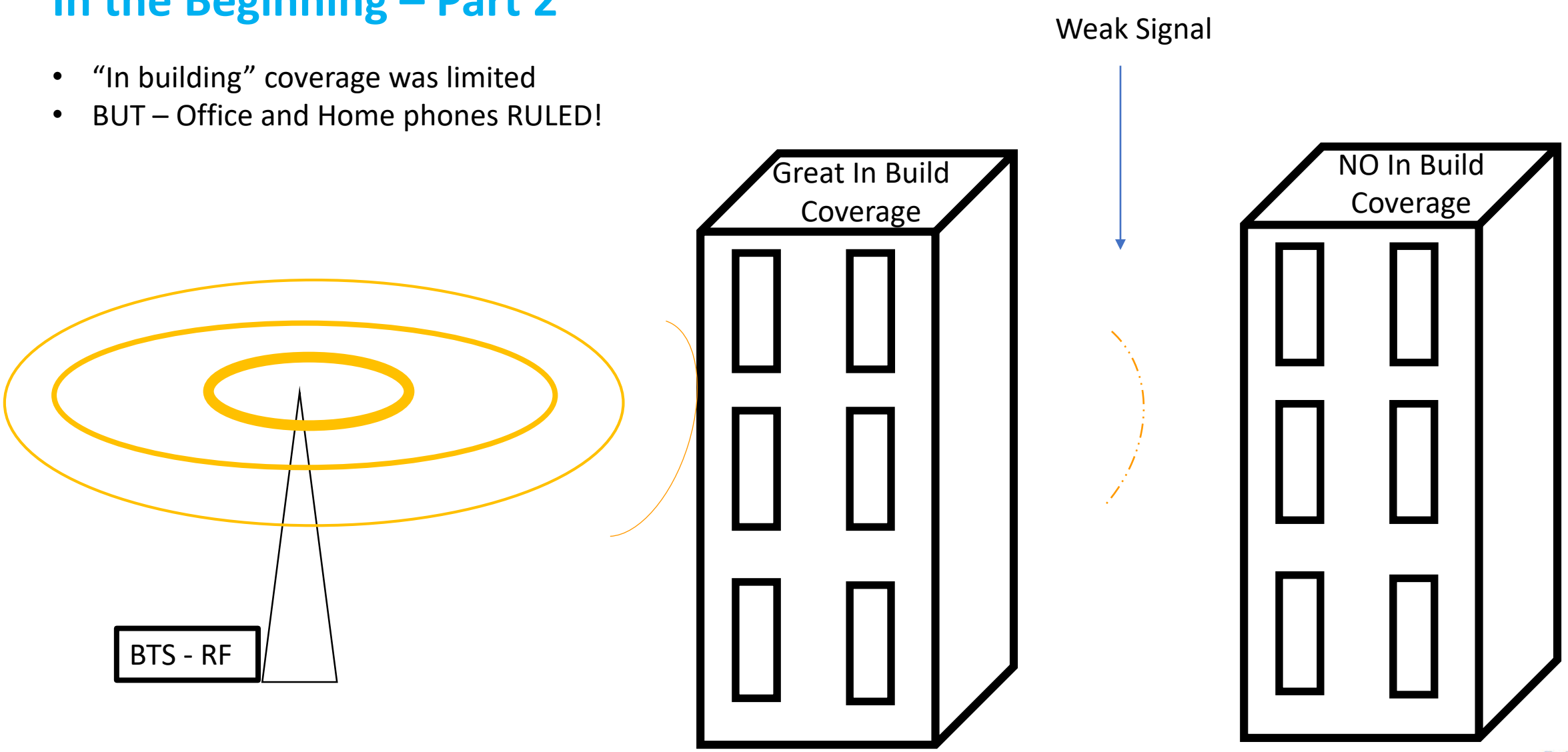
In the Beginning – The 80's

- Macro Network: 100s-1000s of tower sites/city - buildings too.
- Office and Home phones were **AWESOME!**



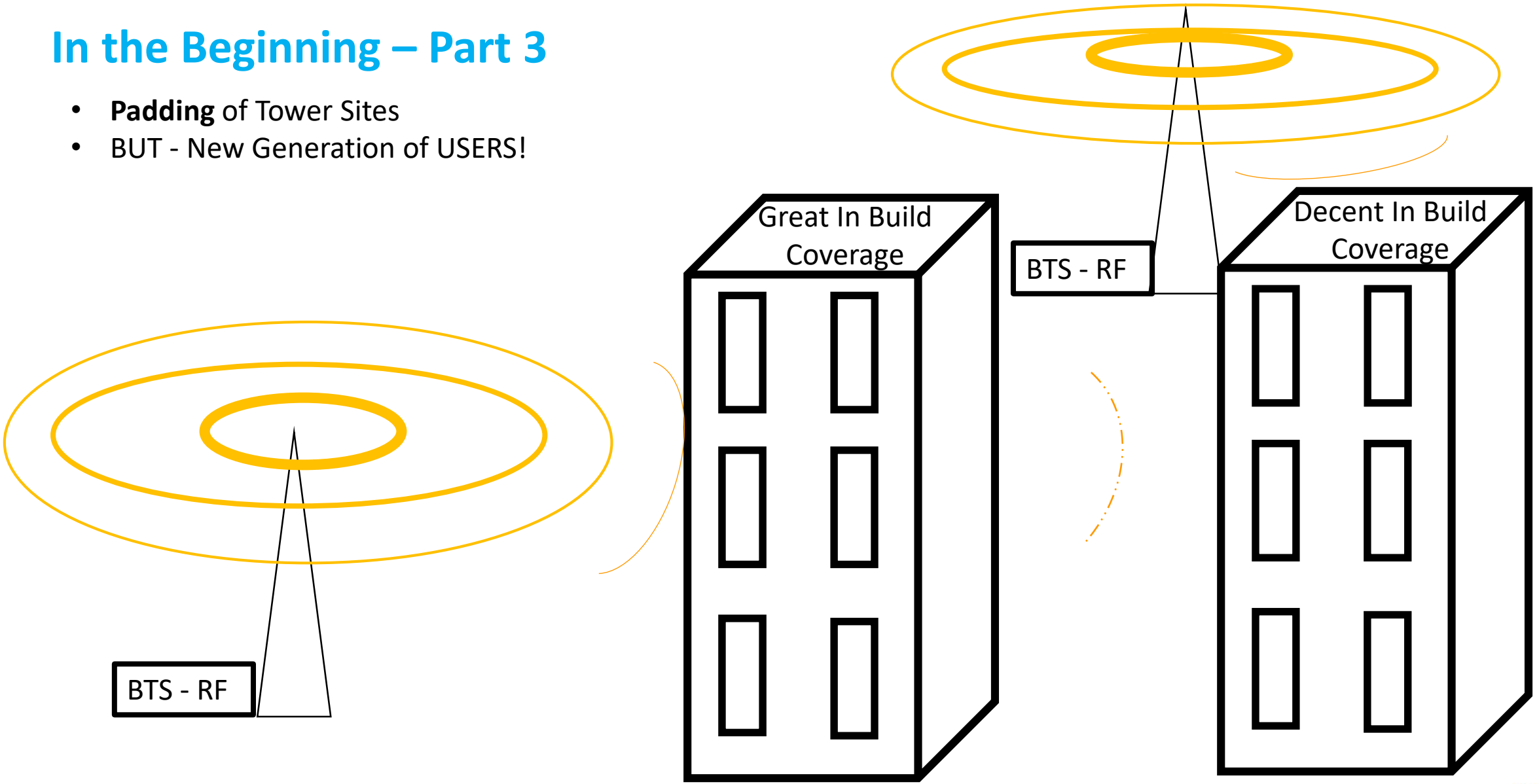
In the Beginning – Part 2

- "In building" coverage was limited
- BUT – Office and Home phones RULED!



In the Beginning – Part 3

- **Padding** of Tower Sites
- BUT - New Generation of USERS!



Where We Are Today

- Mobile all the time NOW(75% or more of calls made indoors)
- The coverage and capacity need is **ASTONISHING**
- Macro sites are tapped out – zoning laws and cost
- New buildings are more energy efficient than ever – **Windows = Concrete**

RF principles and understanding ← Exhibit A (slide 6/ next slide)

- Frequency
- Power (watts)

What can we do today ← Exhibit B (slide 7)

- Passive- Repeater (BDA)
- Active- DAS utilizing fiber

We do MORE than just Commercial ← Exhibit C (slide 8)

- Public Safety – almost always in red.
- We do Both – PS (Public Safety) and Commercial

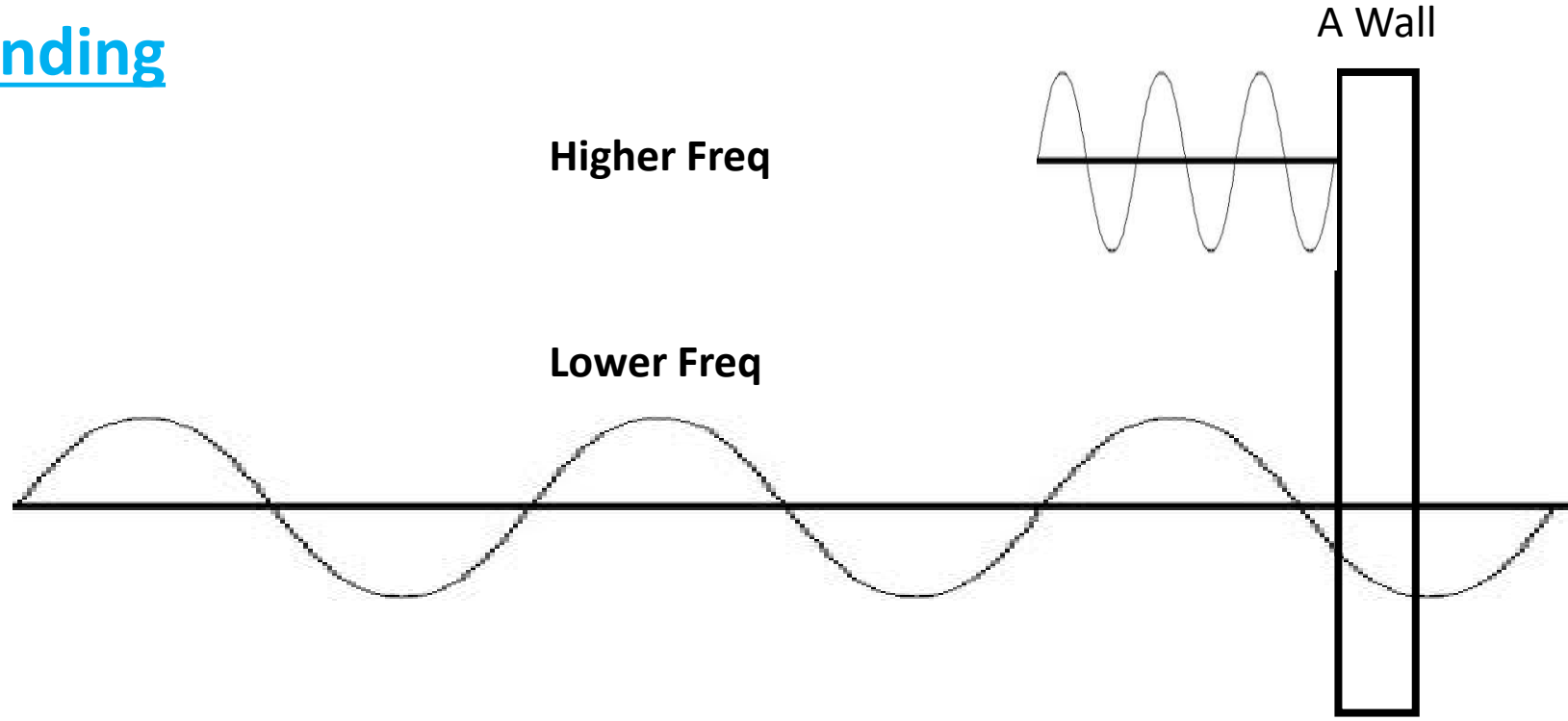
RF Principles and Understanding

Frequency ranges – Low to High

150 - VHF
450 – UHF
600 - Commercial
700 – First Net – Band 14
700 - Commercial
800 – Public Safety
850 – Commercial
1700 – 2100 – AWS Commercial (4&66)
1900 – PCS - Commercial
2.3 – WCS – Commercial
2.5 – Sprint Only
3.6 – CBRS – Private LTE, **NEXT BIG THING?**

Power-Watts & dBm elaborated

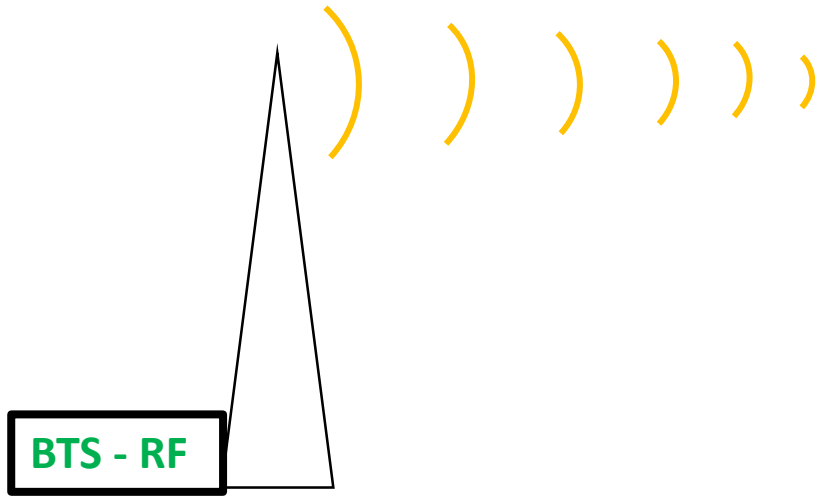
1w = 30dBm
2w = 33dBm
4w = 36dBm
20w=43dBm (High Pwr)



Nomenclature:

- *Head End – location of DAS/RF equipment (not fiber remotes)*
- *2Hr Safe Room – Head End that can survive 2 hrs of fire*
- *iDAS – indoor, oDAS outdoor (stadium)*
- *NFPA 1221 and IFC – Public Safety Codes*
- *SNR – Signal over noise (signal to noise ratio)*
- *AHJ – authority having jurisdiction (fire marshal)*
- *5G – not frequency but "generation"*

What Can We Do Today



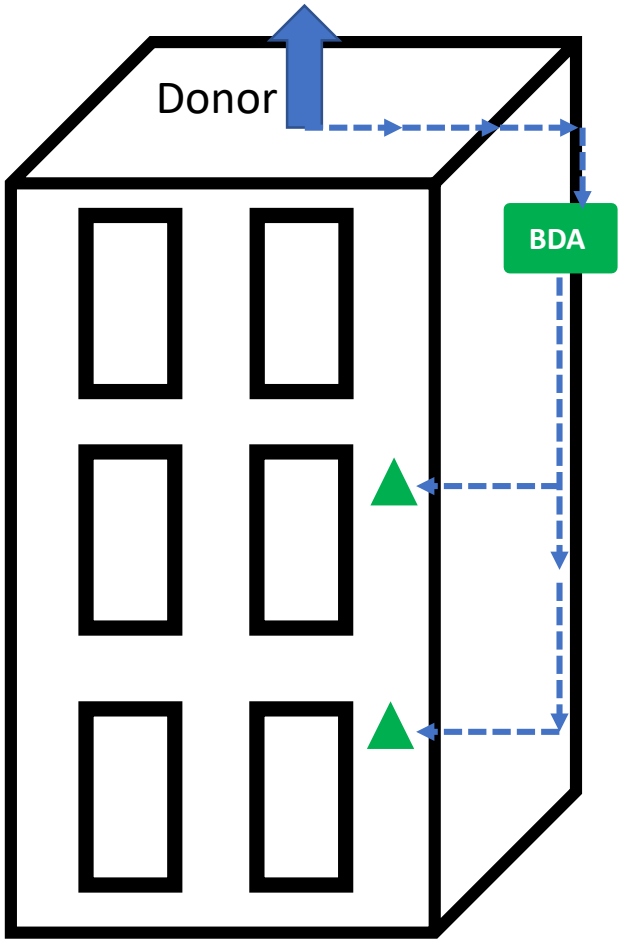
- Repeater (BDA) – Passive and low cost
- DAS – Active and additional cost

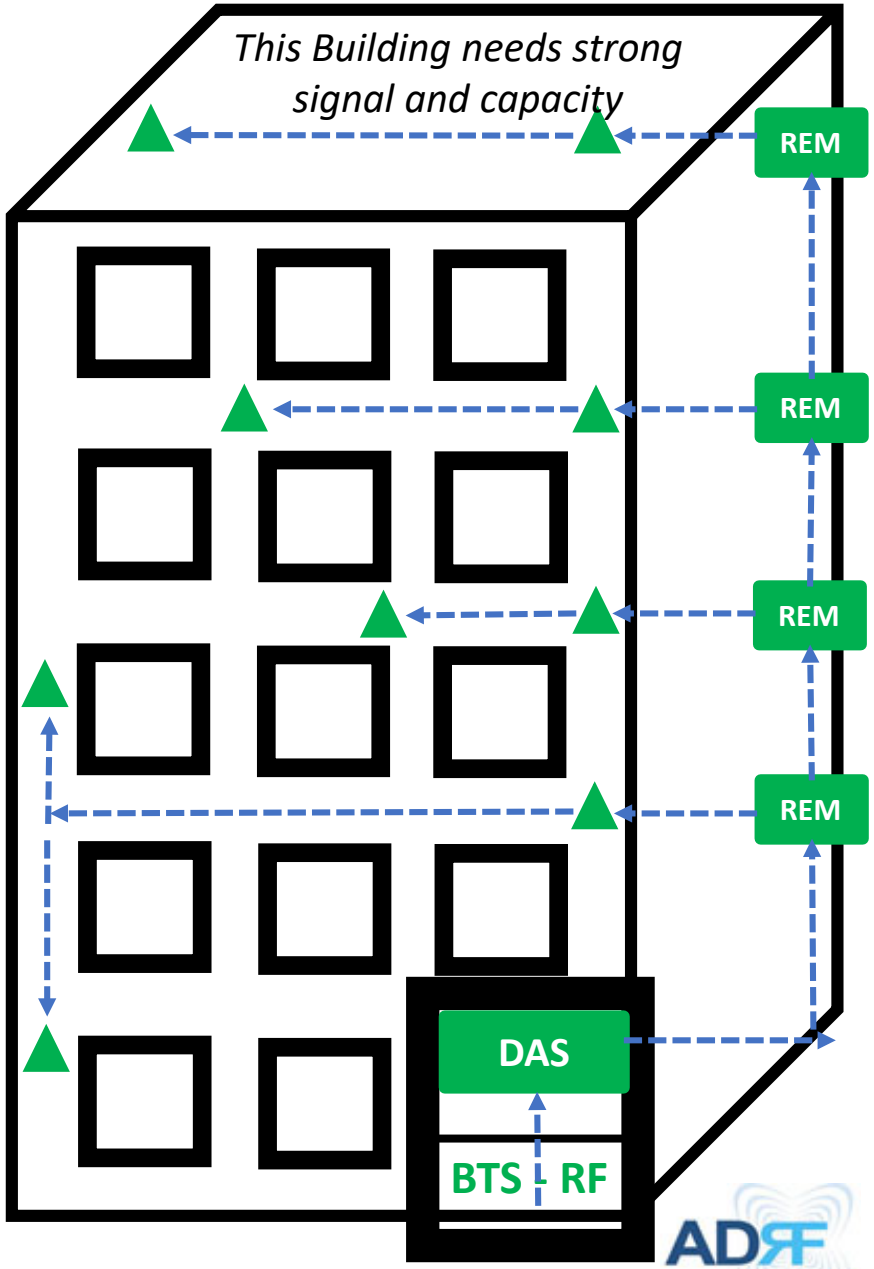
Note: (showing downlink only)

BDA = Repeater

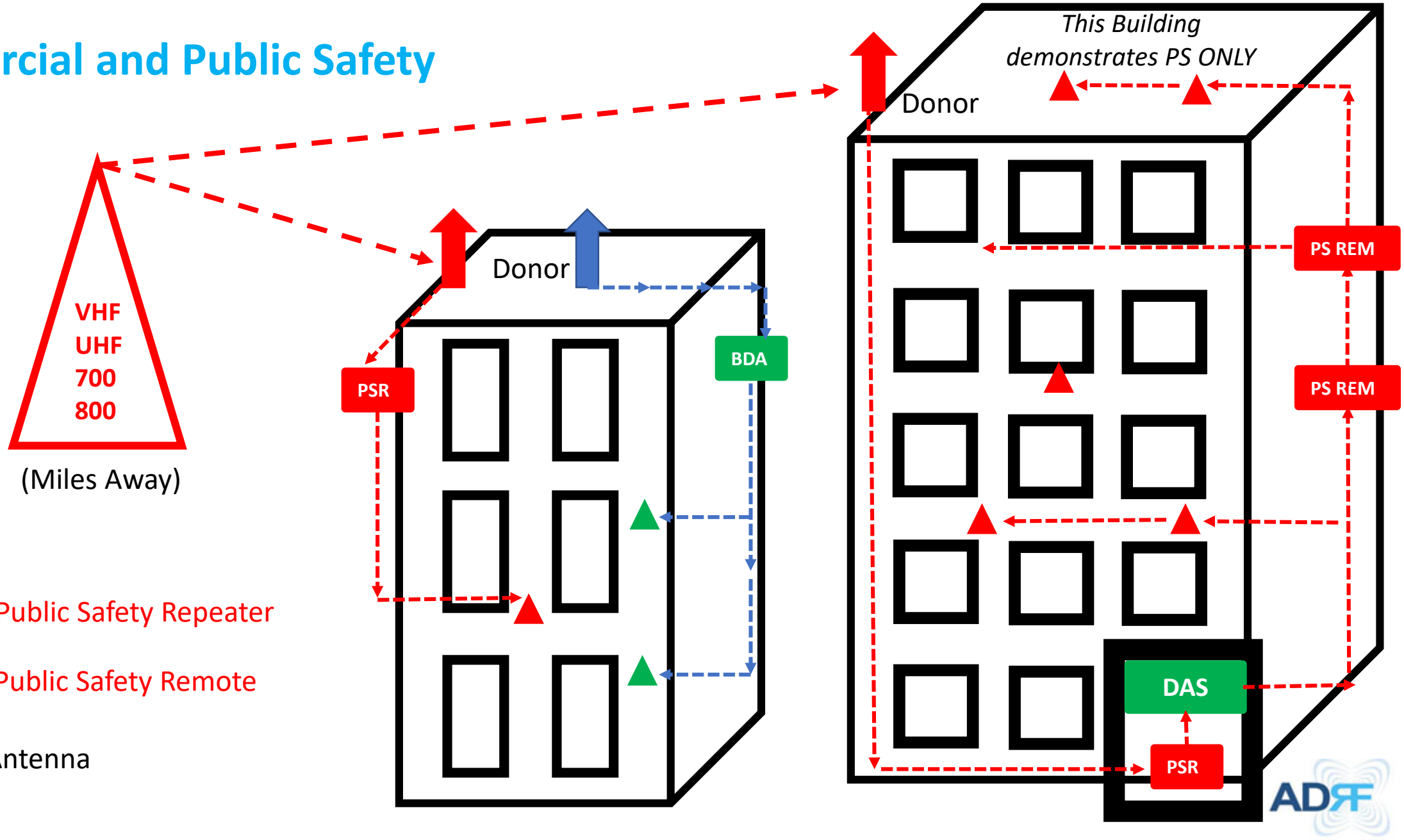
REM = Remote

▲ = Antenna





Commercial and Public Safety



ADRF's Daily Role

Compelling Event:
1. Do you need an occupancy permit?
2. Do you have coverage in your building?

Is there a budget?
1. Enterprise funded?
2. Will a Carrier help?

Utilities
1. Electricity
2. Water
3. Landlines
4. **WIRELESS COVERAGE?**

Public Safety (PS) – laws and liability compliance (Fear Uncertainty Doubt)

Cellular		Public Safety
Most people expect wireless coverage.	⟷	Enterprises cannot get a permit without Public Safety coverage.
General/High traffic areas need coverage.	⟷	Elevators, stairwells, and edges need coverage (99% mission critical)
Battery backup not required	⟷	Battery backup REQUIRED: 12hrs, UL2524
Not Mission critical	⟷	Mission Critical – survive fire/water – NFPA & IFC code requirements: UL2524 (we comply)
Coverage and Capacity sought	⟷	Just Coverage is most important
Carrier approval for RF sources	⟷	Authority Having Jurisdiction(AHJ) approval – RF source transmitted by city/county

Both Cellular/Commercial services and Public Safety(PS) are critical in the event of an emergency (911 CALLS) and Emergency Personal Communication

Types of Inbuilding DAS

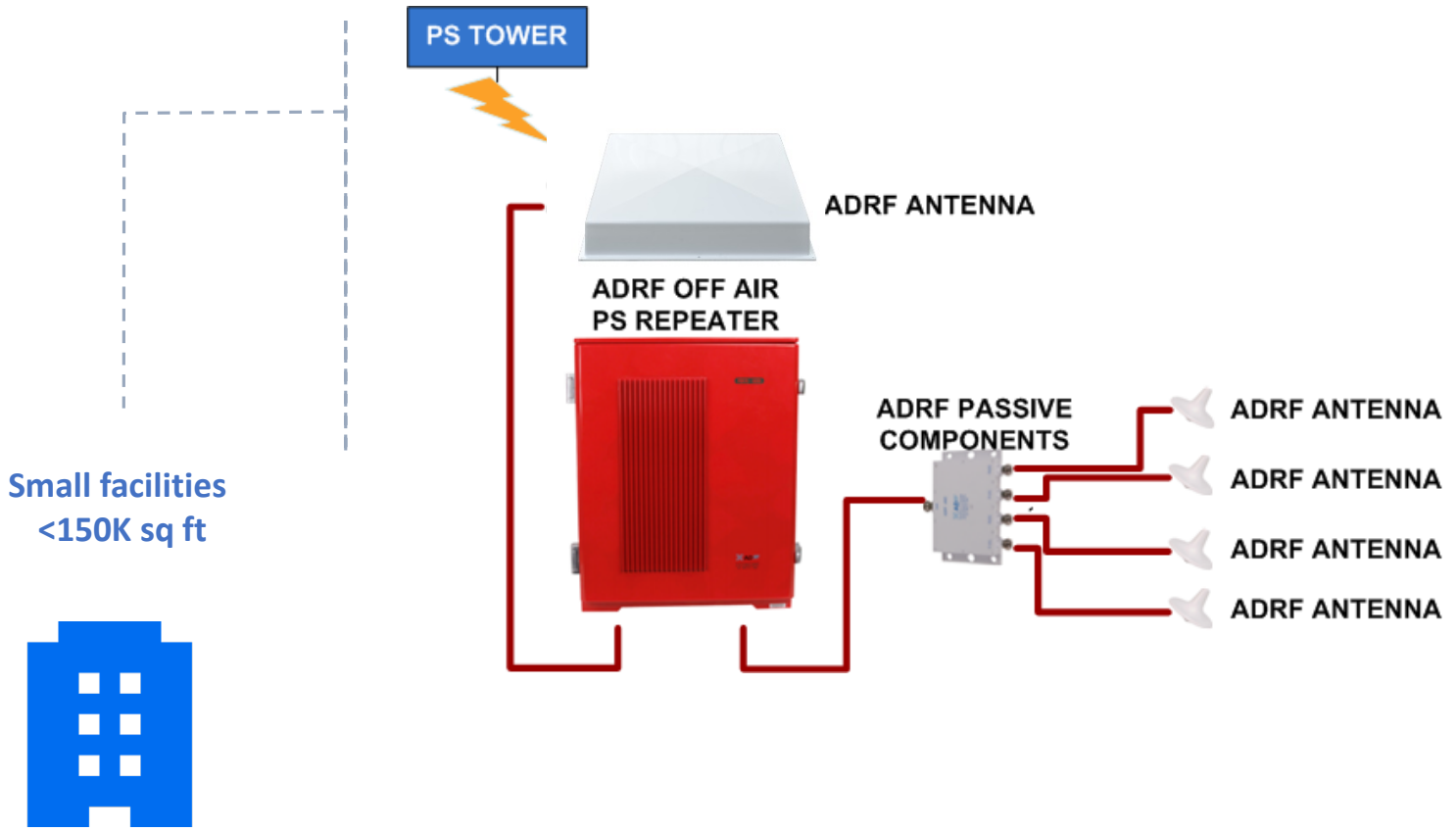
Passive DAS:

- A passive DAS is comprised of signal source, typically a repeater (BDA), that feeds a network of passive components to feed server antennas and provide coverage throughout a building.
- Typically used in small to medium sized buildings.
- More common solution for Public Safety than Commercial due to the use of lower frequency bands. This allows for better propagation and ability to cover larger areas with the same RF output power.

Active DAS:

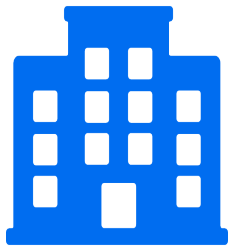
- An active DAS (also known as fiber DAS) is comprised of a signal source, typically a repeater (BDA) that feeds into a fiber DAS headend. The signal is converted from RF to optical and distributed over fiber to multiple remote amplifier locations where it's converted back to RF and distributed to passive networks of components and antennas
- These systems are typically used in medium to large sized venues.

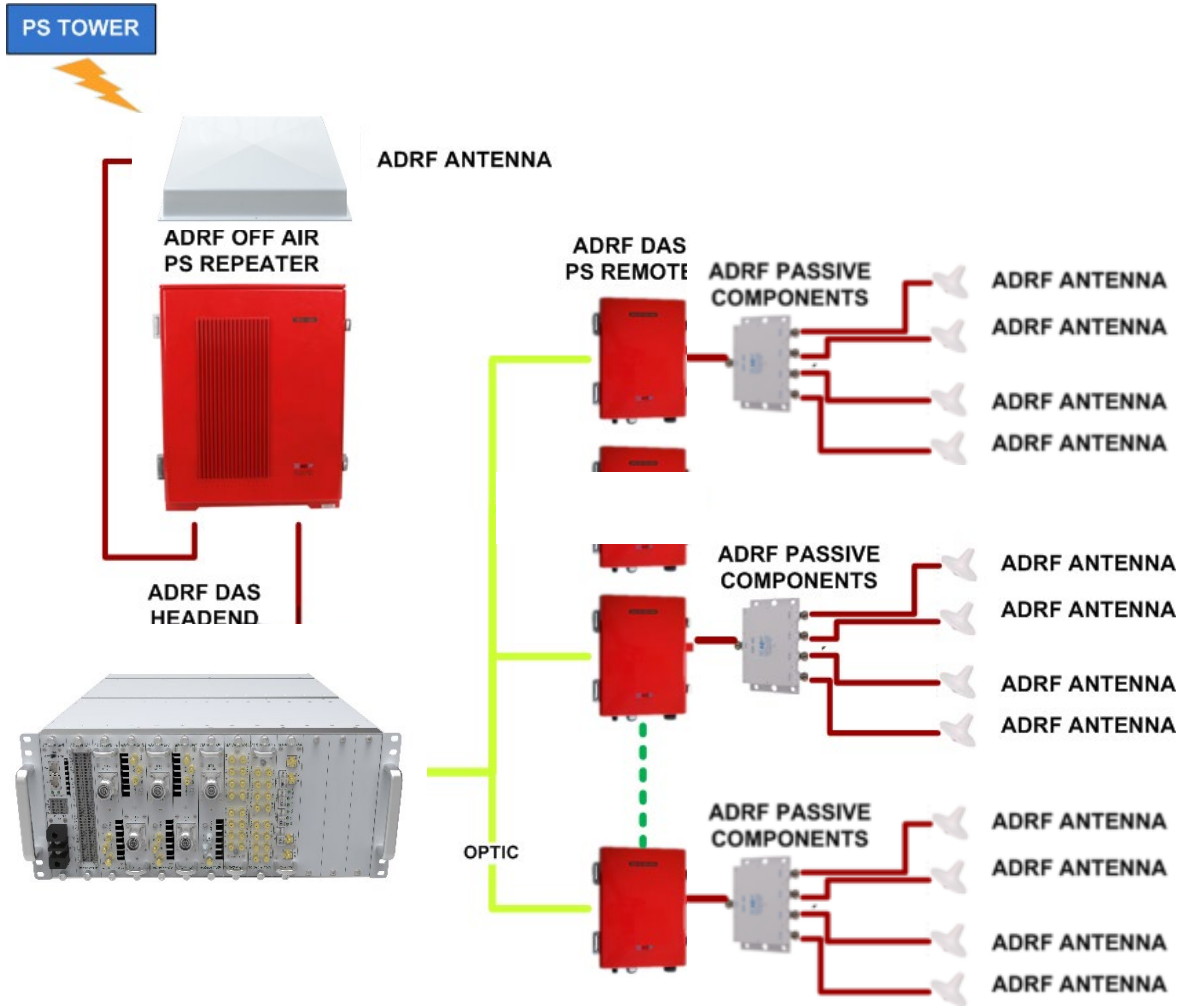
Small Deployment: Public Safety Passive Repeater System



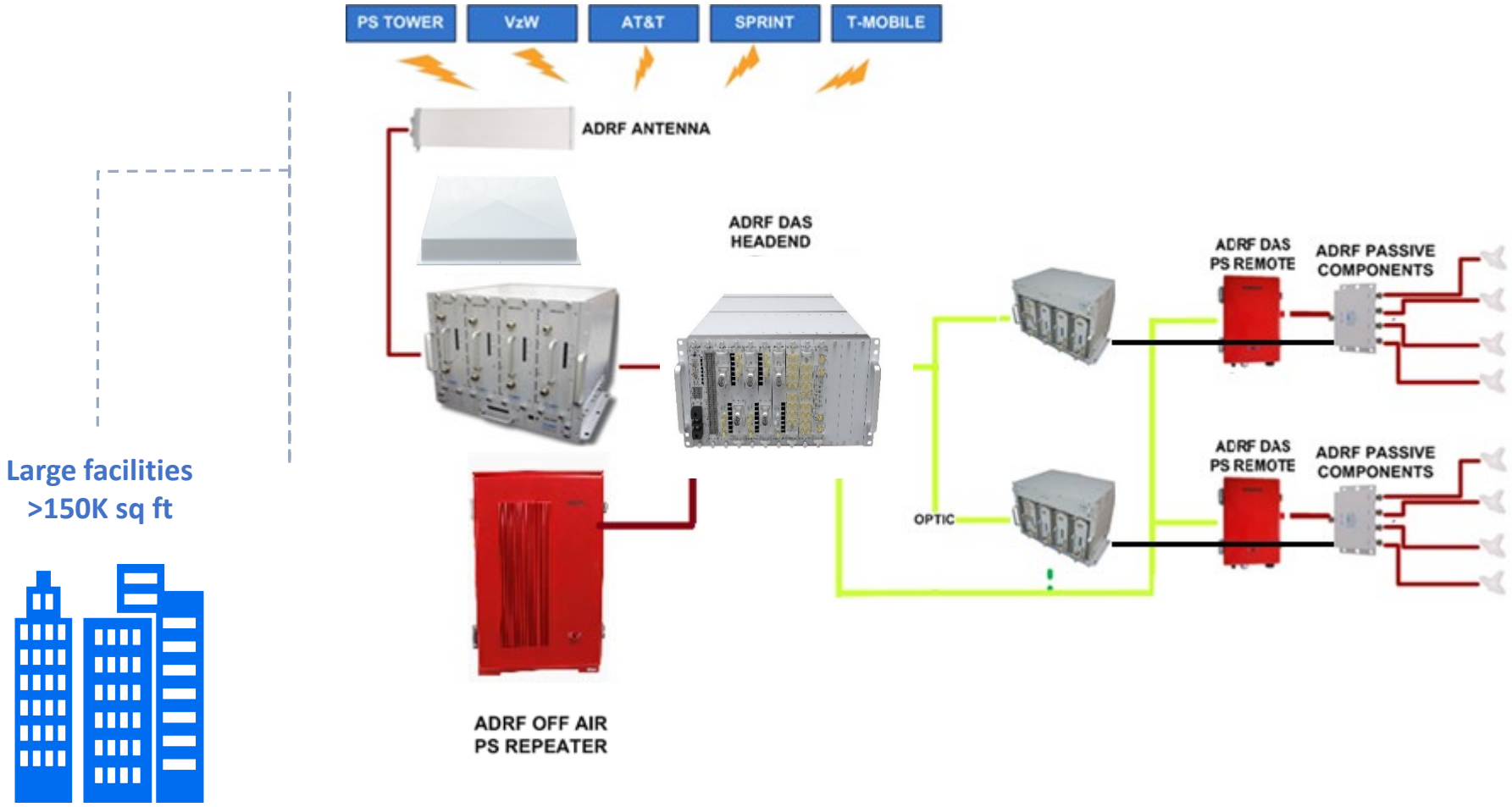
Medium Deployment: Public Safety Active Fiber DAS

Medium to large facilities >150K sq ft





Large Deployment: Commercial + Public Safety Active Fiber DAS



Public Safety Codes

Quick Code Reference*	NFPA 72 - 2013	NFPA 1221 - 2016	IFC 510 - 2015	IFC 510 - 2018
In-Building Solution Required	NFPA 1 Section 11.10	NFPA 1 Section 11.10	Sec. 510.1	Sec. 510.1
Pathway Survivability for Coaxial Cable Required	2 Hour for Riser Coaxial Cable – Sec. 24.3.13.8.4	2-Hour for Riser Coaxial Cable - Sec. 9.6.2.1.3	Not Specifically Addressed in Section 510. Referenced in NFPA 72 Sec. 24.3.13.8.4	Yes, Section 510.4.2. Reference to NFPA 1221. ** Also See NFPA 1221 TIA 16-2
Plenum Rated Coaxial Cable Required	Yes, Riser & Feeder Coaxial Cable Sec. 24.3.13.8.3	Yes, Riser & Feeder Coaxial Cable – Sec. 9.6.2.1.1.1	Not Specifically Addressed in Section 510. Referenced in NFPA 72 Sec. 24.3.13.8.3	Yes, Sec. 510.4.2. Reference to NFPA 1221
Lightning Protection Required	Not addressed in Section 24.5.2	Yes, In accordance with NFPA 780 – Sec. 9.6.3	Not Specifically Addressed in Section 510	Yes, Sec. 510.4.2 Per NFPA 780 as Referenced in NFPA 1221
Isolation of Donor Antenna Required	Yes, 15 db – Sec. 24.5.2.3.3	Yes, 20 db – Sec. 9.6.9	Not Specifically Addressed in Section 510	Yes, 20 db – Sec. 510.4.2.4 (4)
Battery Backup Required	12 Hours – Sec. 24.5.2.5.5.2	12 Hours – Sec. 9.6.12.2		12 Hours – Sec. 510.4.2.3 or 2-Hours Battery w/ Emergency Generator
Signal Strength & Area Coverage Required	-95 dBm – Sec. 24.5.2.3	DAQ 3.0 - Sec. 9.6.8	-95 dBm – Sec. 510.4.1	DAQ 3.0 - Sec. 510.4.1.1
	90% General – Sec. 24.5.2.2.1	90% General - Sec. 9.6.7.5	95% General – Sec. 510.4.1	95% General - Sec. 510.4.1
Monitoring By Fire Alarm Required	Yes – Sec. 24.5.2.6	Yes – Sec. 9.6.13	No	Yes – 510.4.2.5
Cabinets for Equipment & Battery Backup Required	Yes, NEMA 4/NEMA 4X – Sec. 24.5.2.5.2	Yes, NEMA 4/NEMA 4X – Sec. 9.6.11.2	Yes, NEMA 4 – Sec. 510.4.2.4 (1) & (2)	Yes, NEMA 4/NEMA 3R – Sec. 510.4.2.4 (1) & (2)
Monitor Antenna Malfunction Required	Yes, Donor Antenna – Sec. 24.5.2.6(2)(a)	Yes, Donor Antenna – Sec. 9.6.13.1(2)(a)	Not Specifically Addressed in Section 510	Yes, Donor Antenna – Sec. 510.4.2.4(4)
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

Thank You

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