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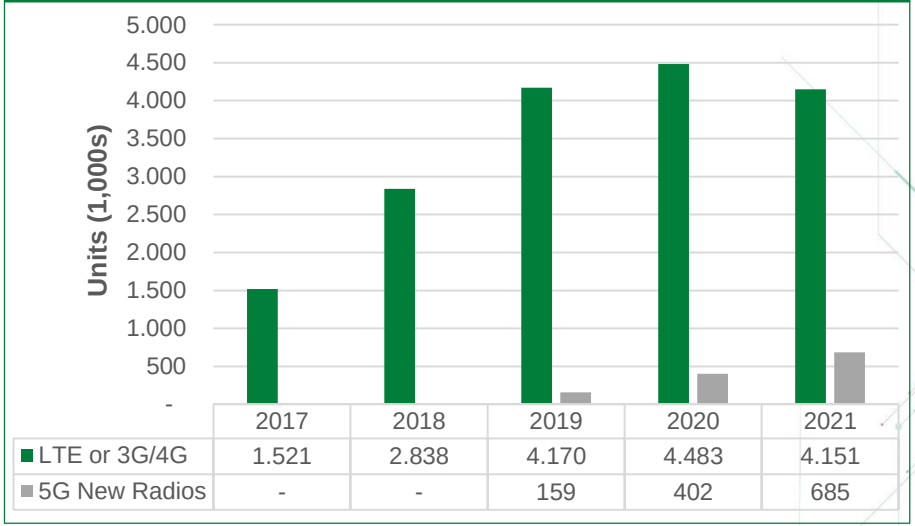
Outdoor Cellular Antenna Protection (4G and 5G)

REV0119

Cellular Infrastructure Build-out Continues For 4G And Increasing For 5G

- Rural and suburban cellular build-out driving 4G
- 5G New Radios (NR) promise very high data speeds and low latency for next generation services such as autonomous cars and smart cities
- 5G NR has shorter range and is susceptible to interference from buildings and other obstructions
- Achieving capabilities of 5G requires more radios

Worldwide Small Cell Deployment Forecast



	2017	2018	2019	2020	2021
LTE or 3G/4G	1.521	2.838	4.170	4.483	4.151
5G New Radios	-	-	159	402	685

Realizing the potential of 5G requires more cellular antennas

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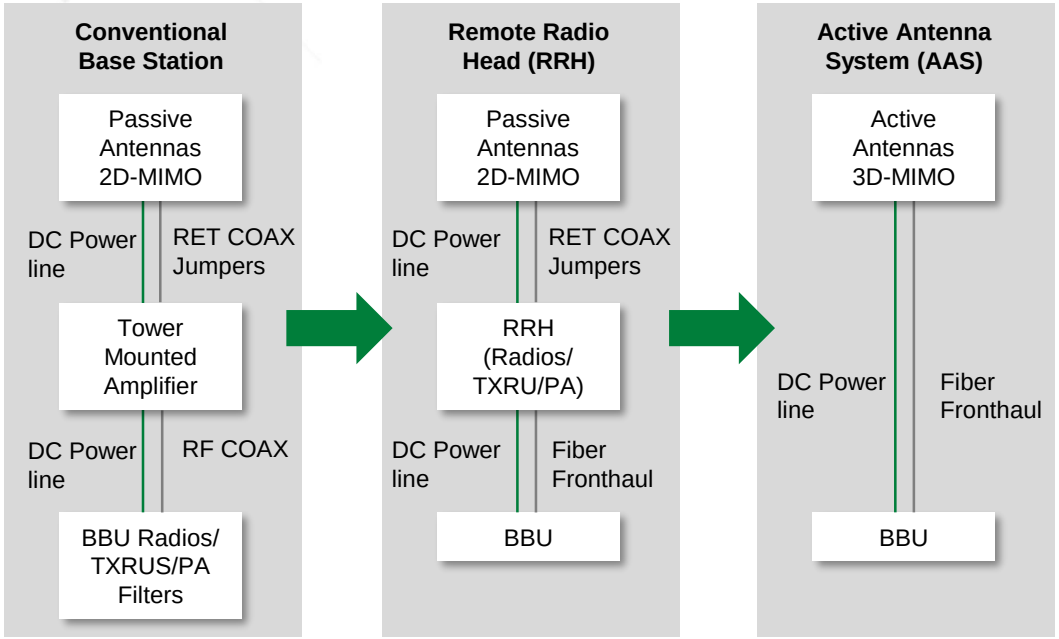
4G & 5G use Active Antennas Which Continue To Evolve



- Reduced footprint
- More efficient delivery of power
- Small cell is key element of 5G
- COAX transitioning to more Fiberoptic
- DC power lines susceptible to electrical hazards

Protecting DC power lines is critical for high reliability of antenna

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Cellular Tower with Active Antenna

Active Antenna:
- Fuse for overcurrent protection
- TVS Diode for surge protection
- MOV for surge protection
- GDT for surge protection

Remote Radio Unit:
- TVS Diode Array for surge protection
- MOV for surge protection
- SIDACtor for surge protection
- PTC for overcurrent protection

Baseband Unit:
- Fuse for overcurrent protection
- MOV for surge protection
- SIDACtor for surge protection

Power Supply
- Fuse for overcurrent protection
- MOV for surge protection

Surge Protection Device
- MOV for surge protection

Protect Control Sense

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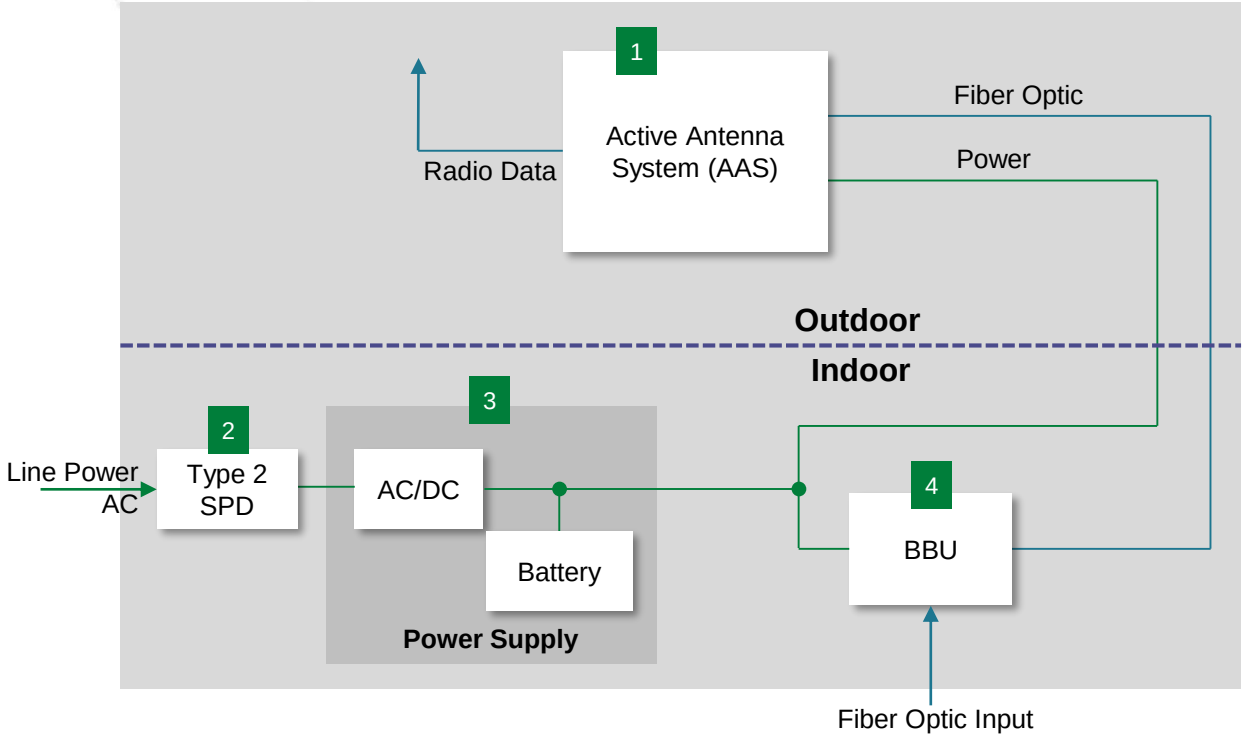
Cellular Tower with Active Antenna Block Diagram



	Technology	Series
1	Fuse	688
	MOV	LV UltraMOV
	GDT	CG
	TVS	AK
	Surge Protection Fuse	LVSP
2	MOV	CIII
3	Fuse	L17T
	MOV	CIII
4	Fuse	TLS
	MOV	LV UltraMOV
	SIDACtor	Pxxx0SD

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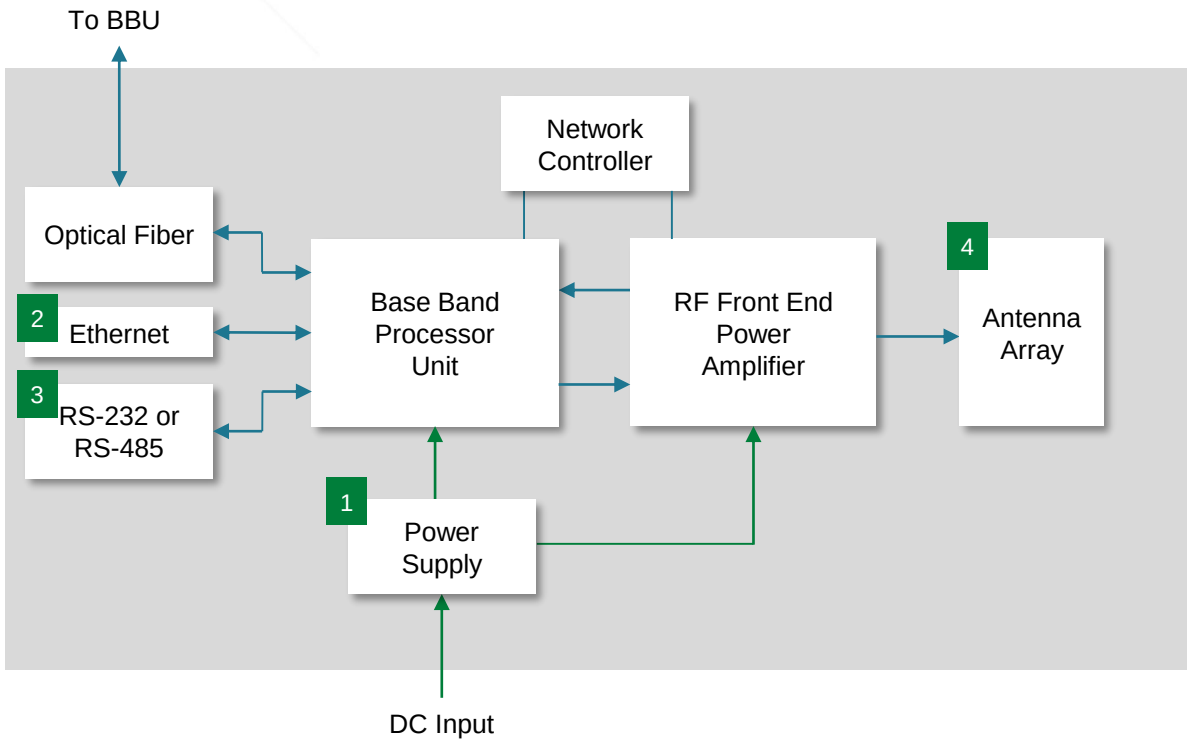
Integrated Active Antenna System (AAS) Block Diagram



	Technology	Series
1	Fuse	456 688
	MOV	LV UltraMOV
	GDT	CG
	TVS	LTKAK
2	Resettable PTC	PolySwitch T-Line
	SIDACtor	SEP
	Diode Array	SP3400
	TVS Diode	SMxx
3	TVS Diode	SMCJ SMDJ
	Resettable PTC	PolySwitch T-Line
4	Polymer ESD	XGD

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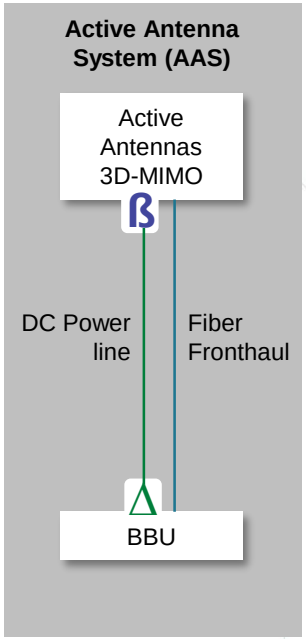
We Are Your Partner For Coordinating Surge Protection

- Primary protection at furthest point up-stream = Δ
  - Typically highest surge withstand capability
  - May be slow to react
  - Standards prescribe high test-levels

- Secondary protection at equipment = ß
  - Fast-acting current diversion nearer to most sensitive electronics
  - Protects until primary engages
  - May not withstand primary protector tests by itself

- Coordination…
  - is needed for safe operation
  - assures that primary protection engages before secondary protection fails



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Reliability Testing Defined By Multiple Standards

- **Telcordia GR-1089**
  - First and Second Level Lightning Surge Tests
  - AC Power Fault Tests
  - Current Limiter Test
  - Short Circuit Test
- **ITU-T K.20**
  - Lighting Surge
  - Power Fault
- **TIA-968-A**
  - Voltage Surge

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