Raycap

Future-Proofing Your Remote Radio Head Networks

For mobile operators to remain competitive they must find ways to quickly deploy remote radio head networks to meet their service offering expansion targets before their competitors do.

To make ready for the explosion of mobile traffic, mobile operators are making infrastructure changes to support an ever-increasing consumer appetite for media rich services. They are building new or retrofitting existing wireless networks that will accommodate expanded capacity to support future growth and enable the deployment of next generation networks. While operators are working to make these improvements, they must also manage capital expenditures and balance rising operational costs to ensure their competitiveness in a fast-changing, high-stakes industry.

One of the most important trends being driven by the need for additional network capacity is the deployment of remote radio head (RRH) architectures. The RRH concept (also known as FTTA/PTTA) fundamentally changes the way that cell sites are built by deploying remote radio heads closer to the antennas located on cell towers or roof tops. The RRHs are connected via fibre optic and DC power cables to a base band unit (BBU) and a power supply unit (PSU), typically located inside a shelter or cabinet.

This is a dramatic shift from traditional base station architectures where the base station was installed inside a shelter or cabinet and connection to the antenna was accomplished with coaxial cable to a tower-mounted amplifier, an antenna or both. In summary, in the new feederless architectures the previous long coaxial cable runs are being replaced with fibre optic accompanied by DC power cables routed either independently or via hybrid cable to provide power to the equipment at the tower or rooftop.

New Architectures

Operators are moving to the new RRH architectures to maximize efficient use of spectrum, enable more calls and data throughput, and produce a cleaner radio frequency (RF) signal while also decreasing operational expenses. By using electric power cable to replace coaxial cable, operators save up to 50% (3 dBs) in the RF power budget of the station by eliminating the attenuation resulting through power loss on the coaxial cable.

New Challenges

Moving the radios (RF units) closer to the antenna brings many benefits, but there are also risks. Because the cellular site architecture shift is dramatic and is happening quickly, operators must understand some of the challenges associated with installing the RRHs at cell sites. Considerations include the site location, potential for site expansion, and the equipment to be used including the cable type and the type and series of remote radios. Operators need to consider ways to efficiently manage the DC power and fibre cable runs, minimize installation cost, and deal with the risks associated with moving the sensitive radio equipment out of the shelter and to the tops of towers or roofs where it is ultimately more exposed to harsh environmental conditions, including lightning.

Each RRH architecture presents its advantages and disadvantages, but the biggest challenges involve efficiently managing the fibre and DC power cables, and dealing with excess cable lengths because tower heights and distances to rooftops vary from site to site. Taking a longer term vision, the cable management will be a constantly increasing challenge because more and more technologies are being deployed, and operator site sharing makes cellular sites more and more crowded. Dozens of fibre optic and DC pairs will be running on the sites, increasing exponentially the risk of cable damage. Mobile operators must look for elegant, compact, and future-proof solutions to accommodate growing connectivity requirements and to facilitate future hardware evolution or vendor changes.

Other challenges include adequate DC power protection and specific or proprietary original equipment manufacturer (OEM) connectors and protection boots that require cable suppliers to produce a great variety of combinations and cable lengths. Operators are aware that installing fibre optic connectors requires specialized tools, technicians with special skills, and preventative measures to ensure that the fibre connections are properly made and protected from environmental conditions for many years after the original installation. Just as important is a robust electrical protection solution installed on the DC power circuits to protect the sensitive RRH and BBU equipment from overvoltage damage caused by lightning currents. All of these variables, if not properly considered and executed, will add complexity to the project design and may result in increased operating expense spending.

Lightning Protection

Many operators are unaware that lightning rods do not protect the RRH, BBU and PSU because the DC power cables will act as conduits, bringing the lightning surge right to the equipment (see figure 1). Without adequate lightning surge protection, failures due to overvoltages require costly equipment replacement and expert labour intervention. Furthermore, until equipment is repaired, operators incur revenue loss from downtime periods.

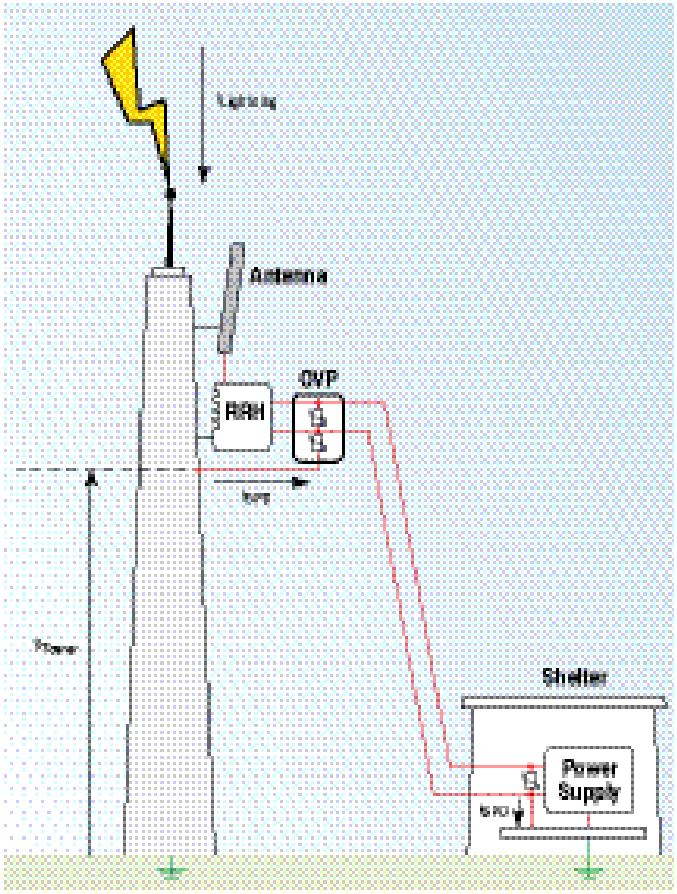

Figure 1. While lightning rods direct the lightning currents down the tower and to the ground, the DC cabling that runs up and down the tower and connects the radios to the power source acts as a direct conduit, bringing the lightning current directly into the equipment. Without the proper surge protective devices installed at critical points, the remote radio head equipment is at high risk of catastrophic failure.

Cable Management Solutions

Weather-proof solutions that combine cable management with robust lightning protection technology provide compatibility, facilitate ease of installation, add to site scalability, enhance equipment dependability and reliability, and address the primary challenges associated with RRH architectures including designing for future upgrades. All fibre and DC power cable management, distribution and protection connectivity solutions can be tailored to customer-specific and site-specific requirements. For example, for a tower application the main fibre and DC power line would be connected into an enclosure at the top and at the bottom. The enclosure would manage the cables and connect one or more remote radio heads with either a separate trunk of fibre and DC power cable, or a hybrid trunk of fibre and DC power cable. Other scenarios might include waterproof "boxless" solutions which connect the RRHs with easy-to-install fiber optic and power jumpers. Additional connectivity enclosures at the bottom of a site provide cable management and electrical protection for the BBU and the PSU. Combined, these smart solutions will support current generation and enable next generation cellular architectures.

Using Proper Surge Protection Solutions

Connectivity solutions should always provide surge protection engineered for safe use in 48 V DC power systems, and should be capable of withstanding repeated lightning impulses while providing continuous protection of both the RRH and BBU equipment. Especially for the tower and rooftop applications, the Surge Protective Devices (SPD) utilized within enclosures should be appropriately certified to withstand lightning currents that are very likely to occur during lightning strikes and that have the capacity to seriously damage the equipment. The IEC 61643-11, 2011 standard "Surge Protective Devices Connected to Low-voltage Power Distribution Systems – Requirements and Tests" defines the testing procedures a SPD needs to go through in order to be classified as a Class I or Class II device suitable for installation in locations where direct or indirect lightning currents may occur. Moreover, the SPDs employed should guarantee a protection level (U_P), as defined by the IEC 61643-11 standard) of no more than 400 V in order to be compatible with the low operating voltage of the sensitive electronics in the remote radio units. All connectivity solutions should be able to accommodate either Class I or Class II SPDs in a flexible, interchangable, and future-proof manner. Adding new bands or sectors on a site should not require time consuming rewiring in order to minimize labour; instead "pluggable" and upgradable protection solutions should be preferred. In addition, the operational safety of SPDs must be considered. Specifically, SPDs protecting equipment atop towers or buildings should not include thermal disconnectors or internal fuses in order to prevent frequent failures and unnecessary maintenance. Finally, because of the DC nature of the application, some of the traditional techniques used to provide surge protection in low-voltage AC circuits (such as spark gaps) may not be appropriate for installations in low voltage DC power-fed systems of an RRH system.

Conclusion

For mobile operators to remain competitive they must find ways to quickly deploy RRH networks to meet their service offering expansion targets before their competitors. The costs of doing so can be minimized by choosing the right RRH architecture, hiring skilled installers and using cable management solutions that also protect the equipment and make installation easier. In the long term, operational expenses will be reduced with RRH architectures through reduced energy costs and equipment failures, while customer satisfaction and loyalty will improve. The risk of lightning damage is a relatively new factor in the operators' considerations for cell site integrity. The telecoms infrastructure industry although familiar with lightning-induced electrical current surge protection techniques for the AC power supply section and for coaxial cables, is now faced with the challenges of operating and maintaining sensitive radio equipment on tower and rooftops. Operators and OEMs that manage the challenges of installation and proper lightning surge protection of the new RRH architectures will have the best chance of success through accelerated rollout and reduced long-term operating expenses.

Specialized cable management, distribution and protection connectivity solutions from Raycap protect single or multiple circuits for remote radios. The weather-proof enclosures are rated IP 67 for environmental protection as well as ISO 4892-2 UV. Flexible mounting designs accommodate mounting via banding, wall, unistrut, vertical or horizontal poles. Systems suitable for indoor installation in shelters or cabinets are also part of the product offering and operate in full compatibility with the outdoor solutions.

Raycap

www.raycap.com

G09-00-074 140626