

HELIAX® FiberFeed Solutions

Reduce total cost of ownership for remote radio unit deployments

HELIAX®
3.0

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Smaller footprint, greater efficiency

Remote radio units (RRUs) are replacing conventional base transceiver station (BTS) units on the cell tower for a significant portion of new builds. This new technology has created a change in the cabling system needed to support antenna applications. Optical fiber is replacing coaxial cabling for the communication link between the RRU at the top of the tower and the base band unit (BBU) at the base.

There are two basic ways to provide this connectivity: a hybrid cable containing both fiber and power or separate power and fiber cables run in parallel. CommScope®, your wireless solutions provider, offers both alternatives with its HELIAX® FiberFeed connectivity products. Combining power and fiber conductors in a single, high-performance cable, the hybrid configuration delivers efficiency, capacity and savings. A single cable provides multiple fiber and power conductors to support multiple RRUs.

Figure 1 shows a typical design using a HELIAX FiberFeed hybrid cable. The cable runs from the BBU up the tower to a weatherproof junction box at the top. The junction box provides the interconnection point for power and signal between the tower cable and the cords leading to the RRUs. The junction box can include over-voltage protection (OVP), or the protection could be handled elsewhere. In this example, the trunk cable contains eight size 12-AWG (American Wire Gauge) [equivalent to 3.31mm²] conductors and 16 optical fibers (eight pairs). This configuration fully supports the power and data requirements for four RRUs with the potential for spare fibers. At the base, the hybrid cable is routed directly into the cabinet area for connection to the BBU. A fiber slack box or another junction box for hybrid cords at the BBU is optional. Towers containing multiple sectors can be supported by multiple hybrid trunks. For example, one trunk can support 12 RRUs with only three RRU trunk cables running up the tower.

HELIAX FIBERFEED SOLUTION

Sector Application for 4 Remote Radio Units (RRUs)

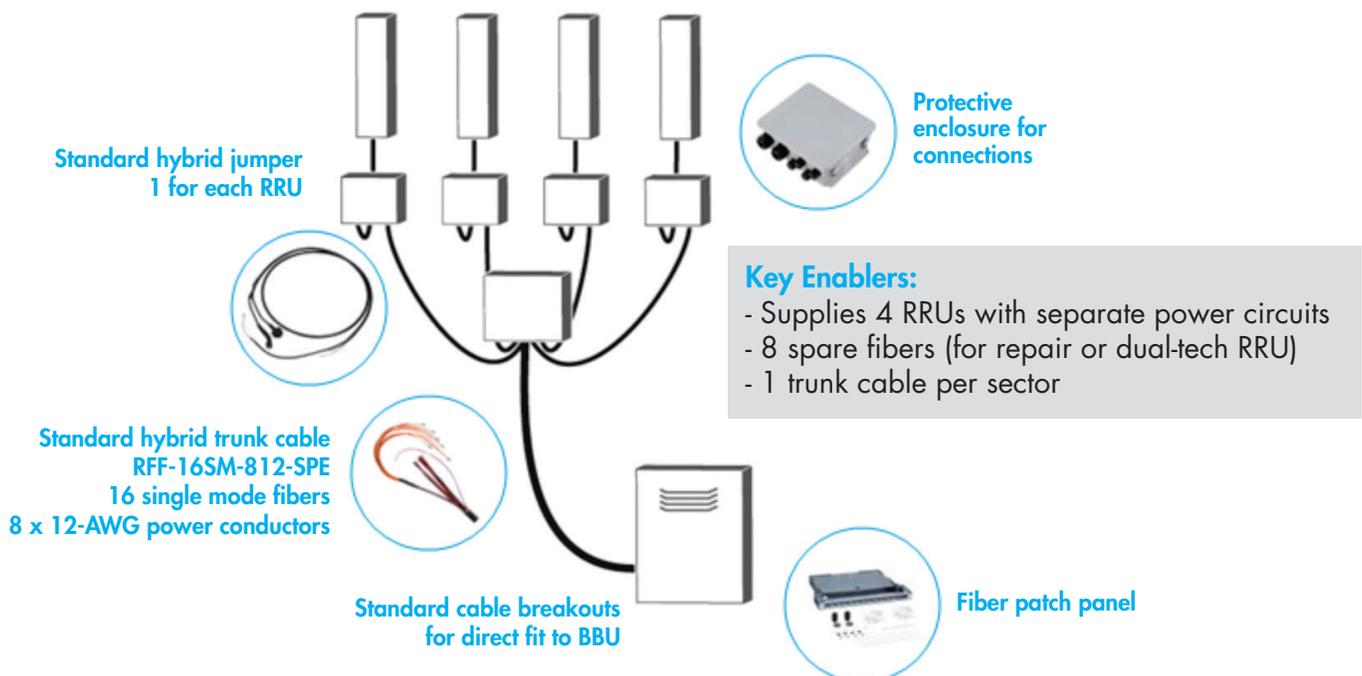


Figure 1: HELIAX FiberFeed—hybrid cable tower scenario

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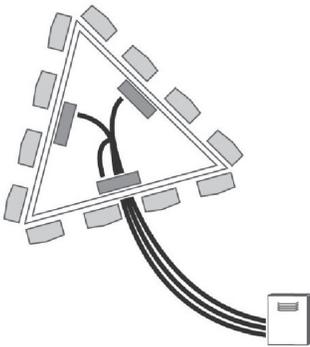


Figure 2: HELIAX FiberFeed site view

The expense of hybrid cable is more than offset by the cost of the protective conduit required for non-armored cable installations, reducing delays and increasing the likelihood that the system will be operational.

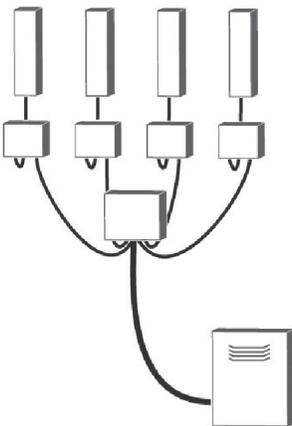


Figure 3: HELIAX FiberFeed sector view

HELIAX FiberFeed advantages:

- **Reduced capital (CAPEX) and operational (OPEX) costs**
- **Reduced tower loading and lease-hold costs** — fewer cables and supporting hardware lessens overall weight
- **Reduced installation costs** — fewer cables and precise lengths means faster installs and easier operation for easier management (one pull per sector)
- **Improved durability** — corrosion-resistant armor prevents damage from animals, crushing forces (i.e., installations, foot traffic) or the environment
- **Redundancy and expandability** — spare high-bandwidth optical fibers help future-proof your tower

Now let us examine a realistic scenario for supporting 12 RRUs on a single tower. A hybrid cable design can be compared to separate power and fiber runs to evaluate the benefits of each.

A three-sector site with 12 RRUs

- Four RRUs per sector
- Support for each RRU requires two conductors and four optical fibers, so the sector requires eight conductors and 16 optical fibers.
- Trunk cables run from the junction box at the top of tower to the BBU cabinets (see **Figure 1**) located at the tower base. If the tower is 40 meters high, the horizontal run from tower base to the BBU cabinets is five meters. [Height variations will have minimal impact on cost comparisons.]
- Five-meter hybrid cords run from the junction box to the RRU.
- Standard accessories are utilized for support, grounding, etc.

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The **HELIAX FiberFeed Solution Comparison Table** contrasts inputs and cost of a hybrid design to a separate fiber and power cable configuration. Inputs for materials and labor can vary greatly from region to region, so a cost range is specified below. Specific values can be adjusted to account for local factors.

TABLE 1: HELIAX FIBERFEED SOLUTION COMPARISON

Site Data		Separate Fiber and Power Cables				Hybrid Cable			
		Item	Qty	Length (m)	Cost (\$USD)	Item	Qty	Length (m)	Cost (\$USD)
Tower Height (meters)	40								
RRU to OVP (meters)	5	CABLING				CABLING			
BBU to Tower (meters)	5	2F SM cable	24	50	\$3,350 – 4,050	RFF Trunk 45M	3	45	\$3,450 – 3,650
Sectors	3	12AWG Power	12	50		Hybrid Cord (TOP)	12	5	\$900 – 1,050
RRUs per Sector	4	CONDUIT & ACCESSORIES				CONDUIT & ACCESSORIES			
Accessories include: Hoist grip (ea) Hangers (kit of 10), btm and vert Hangers (kit of 10), top Grounding (ea)		Conduit 1.5" EMT	3	45	\$750 – 950	Conduit 1.5" EMT	0	0	\$0.00
		Total Accessories			\$210 – 270	Total Accessories			\$195 – 235
		Installation, conduit		135	\$1,290 – 1,450	Installation, Conduit			\$0.00
		Installation, fiber		150	included w/Cu	Installation, Hybrid Cable		135	\$950 – 1,150
		Installation, copper		150	\$1,000 – 1,300				
		Total Material Cost			\$4,400 – 5,100	Total Material			\$5,000 – 6,000
		Total Installation Cost			\$2,450 – 2,650	Total Labor			\$900 – 1,200
		Total Cost			\$6,700 – 7,700	Total Cost			\$6,200 – 7,200

The expense of the hybrid cable is more than offset by that of the protective conduit required for non-armored cable installations, and the time saved by using the hybrid cabling reduces delays and increases the likelihood that the system will be operational.

More durable hybrid cable solutions are expected to provide significant operational cost savings during the entire lifetime of the system.

Another potential cost savings is the reduced loading factor that a hybrid cable places on the tower. Since the hybrid cable requires a smaller surface area — compared to a group of cables or larger conduit — it lessens the load on the tower, freeing capacity needed by the RRUs. The total load of RRUs plus the hybrid cable will be less than the total load of RRUs plus separate power and fiber cables. This extra margin may mean the site can be installed as planned without the need for tower reinforcement or the forced locating of RRUs at the base. Although not built into the cost model, additional savings may be generated from the use of smaller towers and a smaller foundation in a greenfield opportunity where the design can take advantage of fewer, lighter-weight components.

Lifetime operational benefits

Initial implementation is just the beginning. The HELIAX FiberFeed cables are more durable and are expected to provide significant operational cost savings over the lifetime of the system. Other benefits include an extended lifespan and the ability to upgrade without pulling in new cable.

Service disruptions can adversely affect reliability perceptions and cost operators more than \$10,000 per event in customer support expenses and lost revenue.

Cell tower cabling is exposed to many hazards. Animals such as birds and rodents can damage the investment, causing expensive downtime for the operator and its customers. High winds, severe storms and frequent rain over a long period of time can damage cables.

Extremely severe weather that produces dangerous lightning can instantly destroy ill-protected cable. If only 1 to 10 percent of damaged cabling requires replacement over a five-year period, the operator would incur an additional \$100 to \$700 per site on average for a truck roll (see Figure 1).

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The larger risk is the inevitable service disruption, which could easily cost the operator more than \$10,000 (one percent of this value would equal \$100 per site on average) in customer support expenses and lost revenue, not to mention the damage to their image and reputation as a reliable service provider.

HELIAX FiberFeed—hybrid cable advantages

To combat this tough operating environment, hybrid cable is constructed of aluminum or steel armoring that surrounds and protects all inner components. This advanced protection greatly reduces the chance of damage to the fiber and the conductors.

Using HELIAX FiberFeed hybrid cabling, an operator may only need to upgrade its equipment for 10 percent of its capacity over five years.

While environmental damage may occur at random intervals, technology upgrades are much easier to predict. It would not be unusual for an operator to change out or upgrade its technology for just 10 percent of its capacity every five years. For the same upgrade, one can expect a significant ongoing expense with the separate fiber and power cables run from the BBU to the RRU — \$670 to \$770 per site based on costs depicted in the HELIAX FiberFeed Solution Comparison Table.

By comparison, hybrid cable from CommScope requires very little change to the cabling during an upgrade. If the interface on the new RRU does not match the current one, only the short jumpers would need to be changed out. The bandwidth for optical fiber is also significant. It is unlikely that new technology coming out in the next five, 10 or even 15 years would put a significant strain on optical fiber bandwidth. Since no pulling or new conduit is required, cord replacement would likely cost less than \$100.

If current RRHs are single-technology, our previous scenario using 16 optical fibers would allow for two spare fibers per RRU to support future capacity increases. The terminated fibers would already be in place when the RRUs were upgraded; only replacement patch cords would be required to connect the trunk cable to the RRU. Operators could also use all 16 fibers to support dual-technology RRUs in a sector containing four RRUs from the first day of operation.

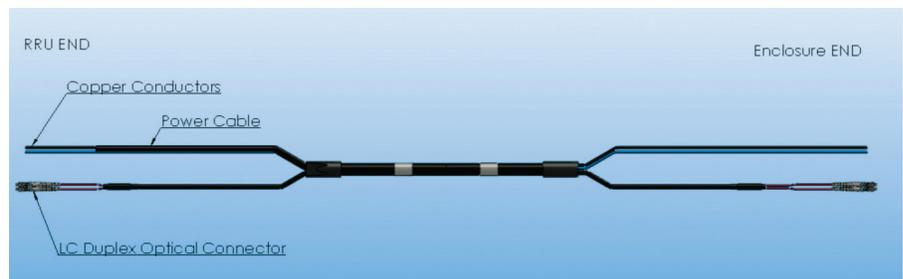


Figure 4: The hybrid patch cord between the RRU and the junction box can be replaced, allowing the trunk cable to be reused.

More cables means greater operational expenses, while a single hybrid cable can do the work of eight or more power and fiber cables, making hybrid cables especially attractive when leasing costs are a factor.

Leasing costs are also a significant issue in some regions of the world. Cell tower owners often charge per cable running up the tower, so adding cables significantly increases ongoing operational expenses. A single hybrid cable does the work of eight or more power and fiber cables, limiting the total number of cables needed to support the RRU sectors and providing dramatic operational savings when leasing costs are a factor.

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The table below indicates that, in total, hybrid cable from CommScope may yield an additional \$730 to \$1,520 in savings compared to other implementations. If leasing costs are a factor, this could add up to be even more. Combine implementation and operational savings, and it is easy to see how HELIAX FiberFeed hybrid cable from CommScope can minimize expenses and save money year after year.

TABLE 2: HELIAX FIBERFEED HYBRID CABLE—OPERATIONAL SAVINGS

Damage (weather/animal)	\$100 – \$700
Downtime	\$80 – \$120
Upgrades	\$550 – \$700
Leasing costs	---
Five-year total per site	\$730 – \$1,520

TABLE 3: HELIAX FIBERFEED CABLE DEPLOYMENT—CUMULATIVE SAVINGS

Year	Separate Power and Fiber Cable		Hybrid Cable	
	Per Year Cost	Cumulative Cost	Per Year Cost	Cumulative Cost
0	7,260	7,260	6,711	6,711
1	200	7,460	0	6,711
2	200	7,660	0	6,711
3	200	7,860	0	6,711
4	820	8,680	100	6,811
Year 0 = Installation			Hybrid Cable Savings PER site	\$1,869
Year 4 cost includes technology upgrade			Hybrid Cable Savings %	24%
			Hybrid Cable Savings 100 SITES	\$186,864

Note: Values for Table 3 are averages of the data shown in Table 1 and Table 2. Variances in local costs, risk factors and specific technologies deployed can affect actual costs.

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Summary

As newer RRU technology replaces conventional BTS units on the cell tower, more advanced optical fiber is supplanting coaxial cable in support of the latest antenna applications. HELIAX FiberFeed hybrid cable from CommScope combines power and fiber conductors in a single, high-performance cable that delivers greater efficiency, capacity and savings. A single hybrid cable can do the work of eight or more power and fiber cables, supporting multiple RRUs.

HELIAX FiberFeed hybrid cabling reduces capital (CAPEX) and operational (OPEX) expenses, tower loading, lease-hold and installation costs. The cable's corrosion-resistant aluminum or steel armor improves long-term durability, mitigating damage from animals, crushing forces or severe environmental conditions and providing significant operational cost-savings over the entire product lifecycle.

HELIAX FiberFeed hybrid cable from CommScope combines power and fiber conductors in a single, high-performance cable that delivers greater efficiency, capacity and savings.

Using hybrid cable, an operator has a much easier upgrade path. Spare high-bandwidth optical fibers enhance redundancy and provide a proactive edge in future expansion. Hybrid cable also provides dramatic operational savings in fee-per-cable leasing situations.

In conclusion, regardless of configuration complexity, HELIAX FiberFeed solutions from CommScope can help operators achieve their fiber and power connectivity objectives for remote radio heads sites, towers, rooftops and distributed antennas. From day one, our solutions mitigate the risk of downtime and provide an easier upgrade path when new technologies become available.



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