

3M™ Fiber Cable Repair Kit

Optimal compatibility with
RFS HYBRIFLEX® Hybrid Feeder Cabling

The Challenge

Cell towers average 50 to 200 feet tall and come in many varieties – lattice, guyed, monopole and others. They are a normal part of the landscape, and as mobile operators expand their coverage and capacity, tower maintenance requires specialists trained and certified to climb and make in-air repairs. Plus, the feeder cabling that extends up the trunk of a tower is usually customized, i.e., tailored to length with a specific fiber count. Lead times for custom cable can take a few days to several weeks.

In late August 2015, a large mobile operator identified damage to its fiber cable at a cell tower caused by animals chewing through the cable. This is a common problem. The damage to these cables was located over 50 feet in the air. The tower was out of service and would stay that way until repairs could be made.

“We see a lot of damage with squirrels chewing up the cables. The squirrels nest in the equipment, and we find aramid yard from the cable in their nests.”

-Tom Rose, installation technician, Redwing Enterprises

The damaged HYBRIFLEX feeder cabling was a unique copper-fiber hybrid from RFS. Each fiber is built with a robust, outdoor-rated jacket suitable for severe environmental conditions. Even with the durable HYBRIFLEX armor, if the fiber is not properly handled during installation – for example, if the minimum bend radius is not met – fibers can be damaged. Consequently, the power and fiber subunits in the armored feeder were “broken out” or exposed at the tower top to reach the RRUs serving the various sectors.

RFS offers other FTTA architectures where this type of damage can be prevented by the use of a fiber breakout and a jumper, future-proofing the design in a way that is scalable to today’s networks. For sites already built using legacy designs, mobile operators are searching for cost-effective ways to address smaller-scale damage to keep their networks up and running. 3M repair kits offer a cost effective alternative to fiber replacement.

Overview

Organization

Large Mobile Operator

Situation

Animals chewed through fiber cables on a cell tower near Philadelphia, Penn., taking it out of service. The mobile operator hoped for an efficient, cost-effective repair that avoided expensive cable replacement and that would bring service back online quickly.

3M Solution

3M™ Wireless Repair Kit
8865WT/C_OM2

RFS Solution

HYBRIFLEX Hybrid Feeder Cabling

HYBRIFLEX cable combines three DC power pairs and three singlemode or multimode fiber optic pairs that serve three singlemode Remote Radio Head (RRHs) for a compact, single cable solution that offers fewer installation materials and steps at cell-sites.

Results

After training on the ground from 3M, climbers scaled the tower and repaired the HYBRIFLEX multimode fiber optic cable breakouts using field-installable splices, connectors and tools in the 3M 8865WT/C_OM2 wireless repair kit.

“The hybrid cable for this repair is on a spool the size of a car. There are a lot of logistics to get it out to the repair site. A solution where we can take a small case out there and make a repair is great.”

-Steve Clinton, national operations manager, Ericsson

The mobile operator had contracted its network management and maintenance service out to Ericsson, who reached out to 3M looking for a more cost effective repair solution. If the mobile operator and Ericsson couldn't find an alternative, the cost of replacing the cable started around \$50,000 USD and, in a worst-case scenario, exceeded \$200,000 USD.

The Solution

3M has a large portfolio of fiber optics products. Our goal is to solve problems in the boardroom and out in the field, so we collaborate with our clients on developing precise solutions.

Fiber cable replacement is expensive and time-consuming. Knowing that mobile operators are looking to reduce maintenance and operation costs, we considered the best ways to facilitate fiber repairs in the field. The result is the 3M™ Wireless Repair Kit 8865WT/C_OM2, which includes:

- 3M™ No Polish Jacketed LC Multimode Connector 6832WT/50 (24/kit)
- 3M™ Fibrlok™ II Fiber Splice Holder 2539 (12/kit)
- 3M™ Easy Cleaver
- Alcohol wipes
- Ring tool
- Fiber stripper
- Cable tie-downs
- Aramid yarn shears

The 3M kit supports OM2 multimode fiber installations and includes splice holders compatible with singlemode and multimode fiber. In addition to tools and supplies, the 3M kit is designed for in-air tower repair. It's lightweight and compact for ease of climbing. The 3M kit straps conveniently to the antenna mount or RRU chassis and folds down to create a flat workstation. All of the tools and supplies are secured to the kit with retractable locking lanyards to help prevent them from dropping.

HYBRIFLEX in 3M Labs

The RFS HYBRIFLEX cable is a market-leading feeder cabling solution widely used by mobile operators at cell-sites across the country. 3M performed extensive testing with HYBRIFLEX cable to ensure optimal compatibility and performance with 3M 6832WT/50 connectors.

Test	Result
Insertion Loss and Reflection	Average insertion loss and reflectance of 0.11 dB and -37.1 dB, respectively, at 1300 nm.
Thermal Age and Cycle	Maintained insertion loss below 0.75 dB, and none increased more than 0.30 dB during the thermal age and thermal cycle (-40°C – 75°C).
Vibration	All connectors passed a vibration test with the largest insertion loss increase of 0.05 dB.
Mechanical Proof	All connectors passed the 10 lbf straight-pull and 3.3 lbf 90° side-pull tests.

Passing test results help mobile operators anticipate positive field results with minimal insertion loss when using HYBRIFLEX feeder cabling and 3M 6832WT/50 connectors.

Arriving on site near Philadelphia, 3M met and trained climbing contractor professionals from Redwing Enterprises on 3M No Polish Jacketed LC/Multimode UPC Connector 6832WT/50 to repair fiber cables. The 3M 6832WT/50 connector enables fast, field termination of jacketed multimode fiber cable with its one-piece, pre-assembled design. They can be quickly and easily installed with common fiber prep tools and the 3M Easy Cleaver, which is light-weight and virtually maintenance-free.

The 3M Wireless Repair Kit contains the tools necessary to complete field repairs of multimode OM2 fiber cable, whether on the ground, on a rooftop site, or up on a tower. After a brief overview and some trial exercises, the Redwing Enterprises climbers were ready to make repairs.

On-the-Ground Fiber Repairs

The 3M Wireless Repair Kit is an asset on the ground and in the air. In 2015, 3M answered two similar requests to assist with fiber repairs at cell site base stations in New York and New Jersey.

In both cases, multiple fiber connectors had incurred damage, resulting in an intermittent light signal or no signal at all. 3M quickly assisted Ericsson technicians installing 3M 6832WT/50 connectors and restored the connections in about an hour. This saved the mobile operator from having to hire a crew, rent a crane and to make the unnecessary fiber cable replacement.

The Results

Redwing Enterprises installation technicians successfully repaired the damaged HYBRIFLEX fiber feeder cable using 3M 6832WT/50 connectors. Start-to-finish and including training, the process took roughly half of a day and service was restored later that same day.

In addition to the main repair, the climbers identified and were able to replace additional cabling at the base showing signs of damage. The kit is compatible with many kinds of cell-sites and especially convenient on rooftops.

“Normally, we’d have to pull a whole new fiber cable and that takes 4 to 6 hours on the rooftop. If we have the kit, we can make the same repair in 1 to 2 hours.”

-Tom Rose, installation technician, Redwing Enterprises

The collaboration of RFS and 3M created reliable and efficient repair solutions yielding many advantages for mobile operators in an increasingly competitive marketplace. Responding quickly to common outages (such as damage due to animals) helps keep more of the network online, minimizing downtime and helping prevent customer churn due to reliability issues. Plus, the savings by mitigating repair costs may be re-allocated for other critical maintenance or infrastructure upgrades in other parts of the network.

“On the tower depending where the fibers are broken, field mount connectors are the best bet. They’re quick and easy for the guys. The kit straps work well and it’s beneficial to have that fold-out work surface.”

-Tom Rose, installation technician, Redwing Enterprises

For maintenance contractors, the 3M wireless kit equips them for additional services that they can provide to their clients to meet immediate, ongoing needs.

“The 3M Kit empowers our field technicians to make repairs traditionally reserved for more specialized teams. So now with a bigger talent pool to draw from, we can execute repairs in a shorter time frame at a lower cost, generating savings for our customers.”

-Steve Clinton, national operations manager, Ericsson



The Future

3M professionals on the ground that day in Philadelphia listened closely to the climbers' feedback using the 3M™ Wireless Repair Kit. They described the difficulty of working in windy conditions. Engineers in the 3M lab went to work and added side wind shields to help protect the working surface in the final product. The climbers also suggested a place to dispose of packaging waste in the air, so a shard container was included.

As fiber networks grow, so should the solutions to maintain, repair and improve them. 3M remains committed to evolving solutions that help improve fiber networking across the country and around the world.

“Prior to working with 3M, we were more limited with fiber repairs both on the ground and on the tower. But the repair kit has substantially added to our toolbox and given us another capability with limited additional tools and skillsets.”

–Steve Clinton, national operations manager, Ericsson

The 3M Wireless Repair Kit and its compatibility and performance with the industry-leading RFS HYBRIFLEX cable is a step in the right direction. It offers a cost-effective way to make common repairs and maintain equipment. Looking ahead, we'll continue to make additions and upgrades to streamline our customers' workflow, whether it's balancing budgets in the office or making repairs 200 feet in the air.

“It was great to work with 3M and give feedback. As a tower climber, it was refreshing to have a company rep there to take input and design equipment that really works in the field.”

*–Tom Rose, installation technician,
Redwing Enterprises*



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