RFS Technologies
an Amphenol Company

White Paper

DragonSkin:
The Practical Future of Fire Safety

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Fire-safe communication systems in any environment

Overview

Dragonskin is a unique standalone fire-resistant coaxial cable that offers a simple and effective way to install fire-safe communication systems in any environment. This paper drills into the specifics of DragonSkin with real-world data and case studies to demonstrate DragonSkin as a practical answer to ensuring continuous communication in the event of a fire.

Introduction

The Importance of Fire Safety

No one wants to tackle decision-making looking through a worst-case scenario lens. But unfortunately, fire and the damage it causes is an unignorable risk.

In the US alone, the scale of the impact of fire on property and human life is huge. According to data collected by the NFPA:

- In 2023, local fire departments responded to an estimated 1.39 million fires in the United States.
- These fires resulted in an estimated 3,670 civilian fire deaths and 13,350 reported civilian fire injuries.
- The property damage caused by these fires was estimated at $23 billion.

The numbers put into context that although fire may be a grim possibility, it is a possibility that needs to be considered and prepared for to ensure the safety of people and property.

Why Communication Matters

Communication doesn't prevent fire in and of itself. However, it is critical to manage and mitigate the consequences.

Being able to communicate effectively during a firefighting operation is critical for both efficiency and safety. Firefighters rely heavily on robust communication channels to coordinate responses, manage resources effectively, and ensure the safety of both emergency personnel and civilians – if those channels fail, it has a significant impact on:

- Delays in coordinating rescue efforts.
- Inability to provide evacuation instructions to occupants.
- Increased risks for first responders due to communication failures.

Most standard communication systems are not equipped to deal with the extreme temperature and destruction caused by a fire. Instead, buildings need to be fitted with specialized communications infrastructure that can withstand extreme conditions and remain operational.

There are several approaches that can be taken, and in this paper, we will take a closer look at DragonSkin - a standalone fire-resistant cable engineered to enable the efficient rollout of robust, mission-critical communication systems that stand up in the event of a fire.

This paper will cover:

- **DragonSkin: The Facts** – What is DragonSkin? What are the testing data that show why it is the future of fire safety?
- **In Practice** – Real-world case studies demonstrating the advantages of DragonSkin in different environments.
- **Conclusion** – Who is responsible for ensuring fire-safe communication systems?

DragonSkin: The Facts

To say that DragonSkin is the 'future of fire safety' is a bold statement and one that needs to be substantiated.

In this section, we take a closer look at what DragonSkin is and the testing data that demonstrates the efficacy of the solution. We also look at the practicality of the solution for real-world deployments and the benefits it offers.

What is DragonSkin?

DragonSkin is the first coaxial cable to achieve UL certification independently, without requiring metal conduits or additional protective enclosures. It is purpose-built to withstand extreme fire conditions, conforming to the stringent survivability standards defined by NFPA 72.

DragonSkin Credentials

HIGH-PERFORMANCE

- Best-in-class cables to support cellular and public safety radio communications.
- Minimal attenuation, even at 1010ºC, for continued robust performance.
- Long life expectancy of product to minimize the need for further investment.

SAFE

- Designed to withstand temperatures up to 1010˚C (1850˚F).
- Generates minimal to no smoke to ensure the cable does not add toxic gases or decrease visibility for rescue workers.
- The jacket has "zero drip" properties; this means it maintains structural integrity and does not contribute to fire spread.

COST-EFFECTIVE

- While high safety certifications typically imply higher costs, DragonSkin is more cost-effective than alternative approaches as it is a standalone solution that does not require complicated installations and additional protective casings.
- Its standalone capability allows reduced installation complexity and time for further cost savings.

Putting DragonSkin to the Test

DragonSkin has been put through the most rigorous fire testing in the U.S. to meet the NFPA 72 survivability standards and UL 2196 certification. It is the first standalone communications cable to achieve this and offers the same fire resistance properties that other solutions only achieve using additional casing and conduit.

Pull out box: NFPA 72 Survivability Standards Explained.

NFPA 72 Survivability Standards outline the requirements for ensuring communication pathways remain operational during fire emergencies.

These standards define different Pathway Survivability Levels, determining how communication infrastructure must perform under varying conditions of fire severity. To meet pathway Survivability Levels 2 and 3 requires, it that circuits maintain integrity when exposed to fire conditions for two hours.

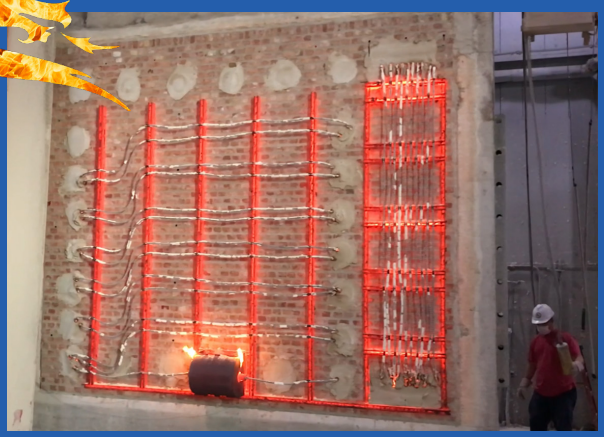
Compliance with NFPA 72 standards ensures communication systems remain functional, providing critical support for first responders and enabling effective evacuation and emergency management. The UL 2196 standard works in combination with NFPA 72 to evaluate the integrity of equipment when exposed to fire.

UL 2196 Testing

DragonSkin meets the UL 2196 standard, validated through rigorous testing at certified UL laboratories. As part of this, DragonSkin cable underwent a two-hour exposure to fire temperatures reaching 1010°C (1850°F), followed by a powerful mechanical shock from a fire hose stream to simulate realistic firefighting conditions.

This allowed testers to determine DragonSkin's:

- Ability to tolerate prolonged exposure to extreme heat conditions.
- Structural integrity under duress.
- Operational reliability throughout simulated fire events.



This image demonstrates the harsh testing conditions used as part of the certification process, with cables being subjected to extreme heat.

NO PERFORMANCE COMPROMISE

DragonSkin successfully passed these demanding tests without additional protective measures like metal conduit or extensive wrapping, demonstrating durability and reliability.

The table on the next page shows the consistent high performance of the cables at 1010°C.

ATTENUATION AND POWER RATING

FREQUENCY [MHZ]	ATTENUATION [DB/100FT]	ATTENUATION [DB/100M]	AVERAGE POWER [KW]
150	0.93	3.05	2.36
450	1.73	5.68	1.27
700	2.25	7.39	0.97
800	2.44	8.01	0.90
900	2.63	8.64	0.83
1000	2.79	9.1	0.78

Attenuation at 1010°C (1850°F) Tolerance +/- 5% max, Additional .185 dB (800 MHz) per ft of DragonSkin being affected by fire.

ATTENUATION CALCULATIONS

PUBLIC SAFETY BAND	LINK BUDGET AT LENGTH (DB)*	DESIGN GOAL COMPLIANT	LINK BUDGET AT LENGTH (DB)*	DESIGN GOAL COMPLIANT	LINK BUDGET AT LENGTH (DB)*	DESIGN GOAL COMPLIANT	LINK BUDGET AT LENGTH (DB)*	DESIGN GOAL COMPLIANT
	0' AFFECTED BY FIRE		10' AFFECTED BY FIRE		30' AFFECTED BY FIRE		50' AFFECTED BY FIRE	
700 MHz	30	YES	CALCULATION SUM(0.0225*10)+1.85+(.5 X 2)		CALCULATION SUM(0.0225*30)+(1.85*3)+(.5 X 2)		CALCULATION SUM(0.0225*50)+(1.85*5)+(.5 X 2)	
			26.9	YES	22.8	YES	18.6	YES
800 MHz	30	YES	CALCULATION SUM(0.0244*10)+1.85+(.5 X 2)		CALCULATION SUM(0.0244*30)+(1.85*3)+(.5 X 2)		CALCULATION SUM(0.0244*50)+(1.85*5)+(.5 X 2)	
			26.9	YES	22.7	YES	18.5	YES
450 MHz	30	YES	CALCULATION SUM(0.0173*10)+1.85+(.5 X 2)		CALCULATION SUM(0.0173*30)+(1.85*3)+(.5 X 2)		CALCULATION SUM(0.0173*50)+(1.85*5)+(.5 X 2)	
			27.0	YES	22.9	YES	18.9	YES

Compliance/Design Parameters: Composite signal +30 dBm at DL Port, Minimum signal strength of -95 dBm in 90% of the area/ 100% of Critical Areas. Loss at Length is Link Budget value at the input of the antenna considering no other loss (e.g. splitters, couplers, etc).

*Link Budget at Length Calculation = BDA Output - Connector Loss (.5 x 2)- (1.85 dB Insertion Loss x # of 10 ft sections) + Standard DragonSkin Attenuation) x (number of ft affected by fire)

Getting Practical: Minimizing Room for Error

Although it is undoubtedly the biggest piece, lab testing, and certifications are only part of the puzzle for achieving robust, reliable, fire-resistant communication systems. It also needs to be a solution that functions effectively in the real world, and part of that is installation considerations.

Weak points of Non DragonSkin installations

Even the most perfect solution becomes imperfect if it is not correctly installed. Especially when it comes to fire safety, any mistakes in the installation process compromise the integrity of the entire communication system.

As soon as a solution requires multiple steps or elements to meet fire safety standards, there is a possibility of introducing weak points into the system.

Complex installation processes inherently increase the risk of error or require more skilled and experienced installers to ensure a watertight deployment, which increases the overall cost.

DragonSkin offers a stand-alone option that has been designed with installers and integrators in mind to reduce the risk of introducing vulnerabilities during roll-out.

DragonSkin: Standalone for Simplicity

DragonSkin simplifies installation by offering a single, resilient solution that is:

- Lightweight, making it easy to install and transport around site.
- Compact with a standalone cable diameter of only .54 inches, making it easy to install discreetly.
- Flexible with a bend radius of 7 inches, it makes it easier to navigate through tight spaces, walls, and structures without compromising performance.

Choosing a straightforward, standalone solution like DragonSkin directly addresses the practical challenges and inherent risks associated with complex installations. By simplifying the installation process, DragonSkin significantly reduces the potential for human error, ensuring reliable communication systems that perform effectively in the event of a fire.

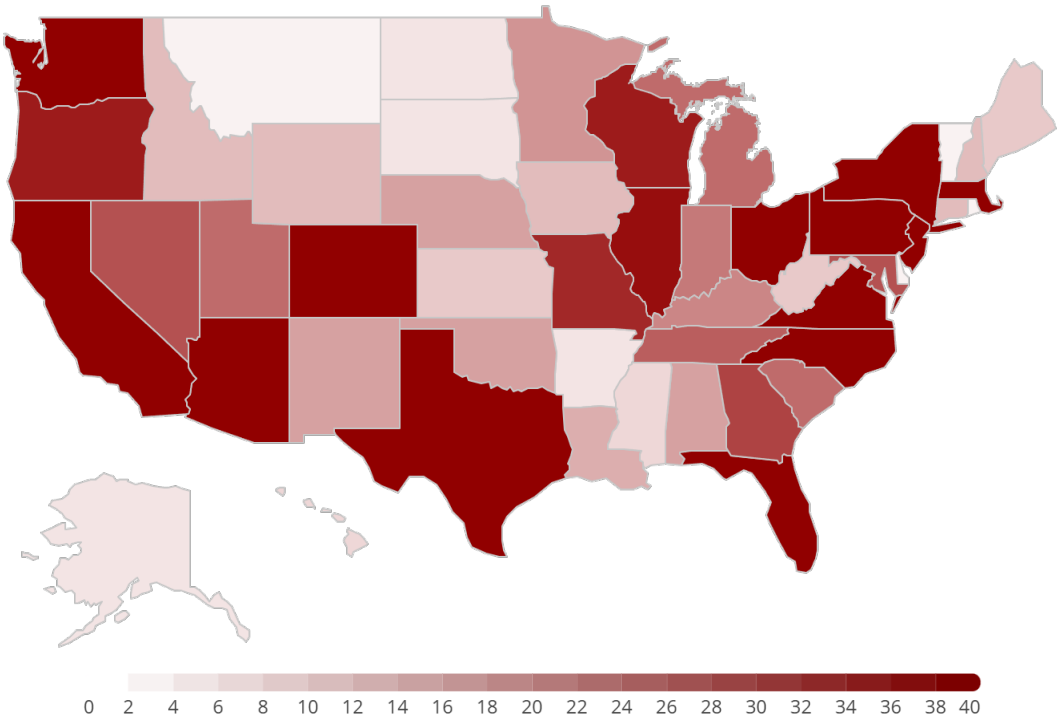
DragonSkin in Practice

Since DragonSkin was introduced to the market in 2020, it has been installed across the U.S. to help stakeholders in a vast number of environments bolster their mission-critical communication capabilities.

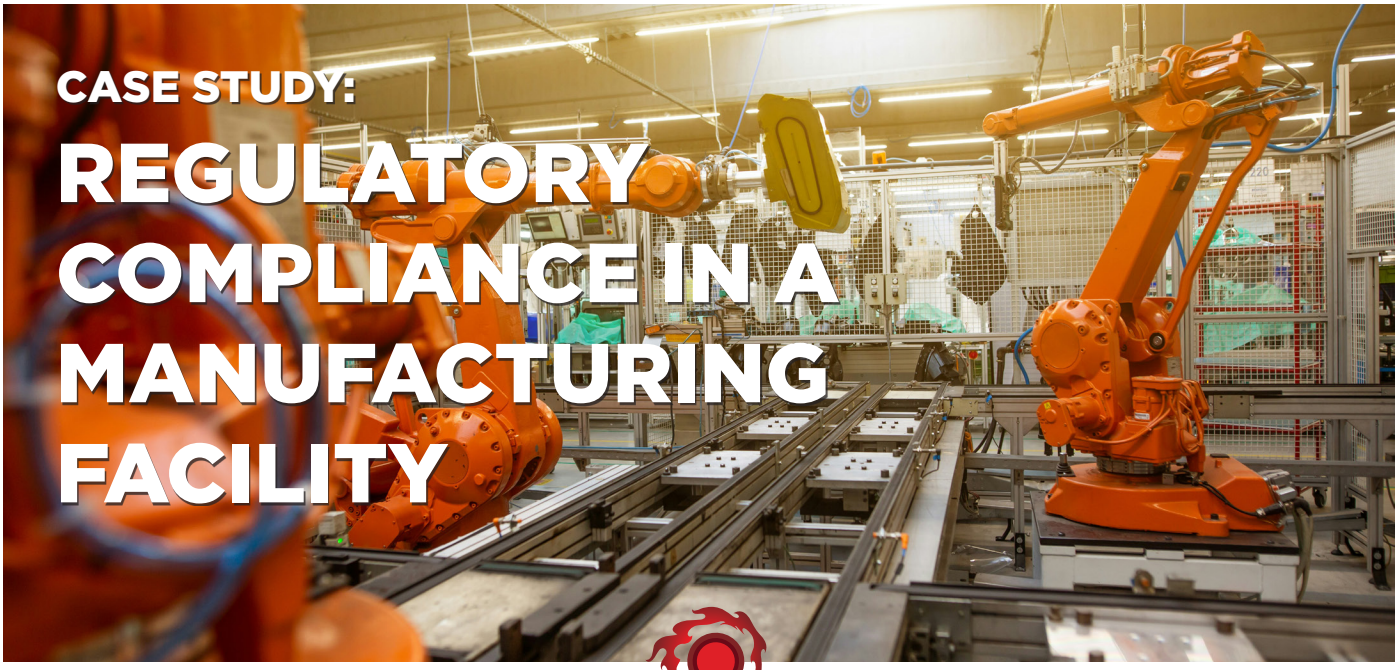
DragonSkin across the U.S.

Here you can see a map of where DragonSkin is being utilized in buildings across North America to achieve more robust critical communication systems.

DRAGONSKIN DEPLOYMENTS ACCROSS NORTH AMERICA



Let's drill into a selection of these projects to see how DragonSkin works for RFS Technologies' customers.



CASE STUDY:

REGULATORY COMPLIANCE IN A MANUFACTURING FACILITY

Overview

Manufacturing facilities often present unique challenges for connectivity due to physical barriers to RF, like racking, production lines, robotics, and large industrial equipment. These obstacles needed to be overcome to achieve complete coverage for mission-critical systems and meet all necessary safety standards. This project needed to deliver coverage across a 460,000 square foot manufacturing facility in California.

The Challenges

The deployment of DragonSkin was necessary to address the requirement for 2-hour survivability of the BDA/riser as an essential part of the overall building's Emergency Responder Communication Enhancement System (ERCES). As the facility lacked a 2-hour survivability room or a pre-existing chase to the roof, an alternative solution was needed to allow the riser to be rated to the necessary standards.

The Solution

As a stand-alone product with no need for additional conduit, DragonSkin provided a workaround for the issues arising from the lack of a chase. This was the only product on the market able to address the issue and ensure the fire-safe connectivity needed to ensure the building was compliant with safety regulations.

The Result

The project took place in mid-2024 and is now fully implemented. DragonSkin is supporting a robust public safety radio system that adheres to regulatory obligations and provides a dependable system capable of functioning effectively in extreme conditions.

dragonskin

Overview

The original use case for DragonSkin, high-rise buildings pose unique communication challenges and result in a high risk to occupants and rescue personnel if communication fails in the event of a fire. This customer needed a backbone to comply with fire as a component of its in-building infrastructure inside a 26-storey 'class A' office building in Phoenix, AZ.

The Challenges

This deployment was part of a retrofit where there was no pre-existing 2-hour pathway that could be used for the backbone. The installer needed a way of meeting regulatory requirements without escalating costs from multipart solutions or increased installation costs.

The Solution

DragonSkin was used in this scenario on the vertical chase to deploy a backbone that met NFPA 72 Survivability Standards using a single solution. The compact and easy-to-install nature of DragonSkin allowed for a straightforward and cost-effective deployment, equipping the building with a backbone that met all regulatory requirements.

The Result

Jim Bowen, DAS Sales Director at Windy City Wire, a major RFS Technologies distributor involved in the project, commented, "DragonSkin created an easier and more cost-effective installation on a retrofit. The customer needed to create a 2-hour rating on the backbone of an existing building that did not have a 2-hour pathway. If the customer had gone with a typical cable wrap, the coax run would've cost 3-4x as much while requiring more labor to install. DragonSkin really simplified what would've been a tough install."

Overview

Over 1.2 million Americans reside in nursing homes, with another 30,000 communities providing assisted living. Residents often need additional support with mobility, so the idea of a fire in this setting is a challenging thought, but the fact it is difficult to think about underlines why fire-safe communication is even more important.

The Challenges

Nursing homes often have complex facility layouts and multiple barriers to connectivity, from construction materials to medical equipment. As a fully occupied nursing home, it was pivotal that any solution would not affect resident comfort or daily operations.

The Solution

DragonSkin was comprehensively deployed across the community to ensure complete coverage. A solution that maintains performance in extreme heat for two hours was essential due to the nature of the environment, as it extended the window for emergency workers to evacuate residents, many of whom would require significant assistance. Additionally, the simple installation process of the cable meant the project was completed on time with minimal disruption in daily activities and resident care.

The Result

DragonSkin provided a dependable communications network capable of functioning effectively even during fires, significantly enhancing resident and staff safety. Its implementation reassured families of the community's proactive safety measures and supported administrators in meeting their legal and ethical obligations for resident safety.

Overview

Millions of commuters use subway systems across the world every day as one of the most convenient ways to travel around busy cities. However, the complexity of these networks—with underground stations and deep tunnels—presents a unique challenge in ensuring continuous communication, especially in an emergency like the event of a fire.

The Challenges

Subway systems have complex tunnel structures built using materials like reinforced concrete and metal, which significantly impact the ability to deliver complete coverage. Additionally, subway operators need to avoid disruptions that impact daily commuters, meaning any system needs easy installation and low maintenance.

The Solution

DragonSkin was extensively deployed throughout the subway system, ensuring robust communication coverage across every route, station, and connecting tunnel. The system was designed to allow complete coverage across the full length of each tunnel, overcoming the challenges usually associated with difficult, tight spaces. Additionally, its intuitive, single product installation approach made it possible to install in overnight blocks to minimize any disruption to regular subway service and commuter schedules.

The Result

The deployment of DragonSkin has established a reliable, fire-safe communications network capable that will continue to operate in the harshest conditions. Additionally, it was achieved with minimal disruption for the subway operator and commuters.

Where Does the Responsibility Lie?

The decision to adopt fire-safe communication technology like DragonSkin often falls between multiple stakeholders, leading to gaps in accountability. Yet, given the importance of installing resilient communication systems outlined in this paper, clarifying this responsibility becomes critical.

Who is making the decision?

The answer is that it depends, and it varies. Different industries have different structures for the decision-making process, and more often than not, it is multiple stakeholders who are responsible.

Fire marshals, Authorities Having Jurisdiction (AHJs), integrators, building owners, building managers, communications specialists, IT professionals, health, and safety officers – these are just some of the job titles attached to decision makers looking to improve site safety with DragonSkin.

Am I responsible?

If you have to ask the question, then the chances are that at least some aspect of your role makes you responsible for fire safety. One of the biggest barriers to making infrastructure upgrades like ensuring a fire-resistant communications set-up is the potential of a long, complicated, and drawn-out process. DragonSkin is deliberately designed to combat this with high-performance and simple installation that makes it easier than ever to make the decision to enhance the fire safety credentials of any building or environment.

Speak to RFS Technologies

If you think that it is time to look at the communication capabilities of your building and bolster them for fire safety, get in touch with the team. RFS Technologies has decades of experience and a team that can work with you to make the process of achieving compliant and robust communication simple with no compromises on performance, whatever the conditions.

GET IN TOUCH

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