REDUCE TOWER CLIMBS, GET READY FOR C-RAN AND CARVE THE PATH TO 5G WITH CPRI PANEL SOLUTIONS FROM RFS

RFS' new Common Public Radio Interface (CPRI) panel enables easy RF over CPRI testing at the bottom of the tower, reducing the need for unnecessary tower climbs, to minimize maintenance costs and overall OPEX for customers.

An RFS Guide to Common Public Interface Panels

The population's dependence on high-speed wireless communications continues to increase with no end in sight. Overcome densification challenges, migrate to 5G and future-proof your network for C-RAN with end-to-end flexible CPRI solutions from RFS.

CPRI Overview

CPRI provides an interface between Optical Base Band Units (BBU) and Remote Radio Heads (RRH), allowing cell operations and system performance engineers to ensure the best performance without having to disconnect the fiber optical system or disrupt service. Hybrid towers have a distributed architecture where the base-station transceiver subsystem (BTS) is composed of both BBU and RRH.

The advent of C-RAN, in conjunction with fiber and CPRI, gives MNOs the ability to centralize base station deployments up to 40 km away, enabling low-cost, highly reliable, low-latency and high-bandwidth interconnected networks.

Traditionally, base transceiver stations (BTSs) consisted of the two functional units: the base band unit (BBU) at the bottom of the tower and the radio head unit (RRH) at the top of the tower- close to the antennas. The BBU connects to the network via the backhaul and to the RRH via Fronthaul.

The RRH transmits and receives the carrier signal that is transmitted over the air to the end user smartphone.

- Baseband unit (BBU) performing base band functions in the digital domain and located at the base of the tower.
- Remote radio head (RRH) performing radio frequency (RF) functions on an analog domain located next to the antennas at the top of the tower.
- This architecture creates challenges for cell site for installation, maintenance and testing since both units communicate in different language.

- The BBU and RRH communicate via a standard interface called Common Public Radio Interface (CPRI). It functions as a translator that speaks both analog and digital languages.

It is imperative to understand that the ability to detect interference can be a challenging and expensive task on cell sites where RF access is only available at the top of the tower at the RRHs. In fact, testing requires costly tower climbing crews.

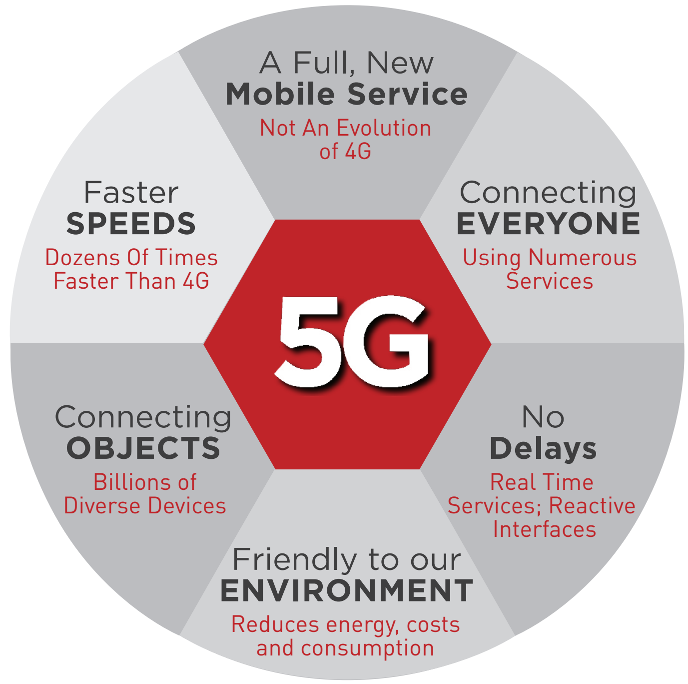
Operators are looking for more cost-effective ground-based test methods, and CPRI provides that tool. CPRI links allow RF measurements and provide a powerful tool for detecting interference and PIM without climbing the tower. This has significant benefits, including eliminating cell tower climbs, improving safety, and minimizing maintenance time and operational expenses.

RF over CPRI (RFoCPRI) allows testing to be done at the base of the tower, minimizing tower climbs and reducing maintenance and troubleshooting expenses. RFoCPRI allows RF maintenance and troubleshooting activities to be performed via fiber coupling at the BBU. In a nutshell, RFoCPRI allows performing RF testing at the BBU level, thus performing RRH functional test by emulating the BBU.

Why CPRI Testing?

It is recommended that technicians perform some basic tests. Starting with an inspection and validation of fiber/connectors, technicians can isolate any issues with dirty connectors and/or fiber damage. Following these tests, a CPRI test will be needed in order to verify that the RRH is operational and that the correct optics are installed.

It is extremely important to have a smooth process with no installation failures. Because of the special skills and certification needed for tower climbing, unnecessary field errors can be quite costly. Therefore, it is essential to have tools and procedures to conduct tests from the bottom of the tower – and CPRI is the only test interface available at the bottom of the tower.

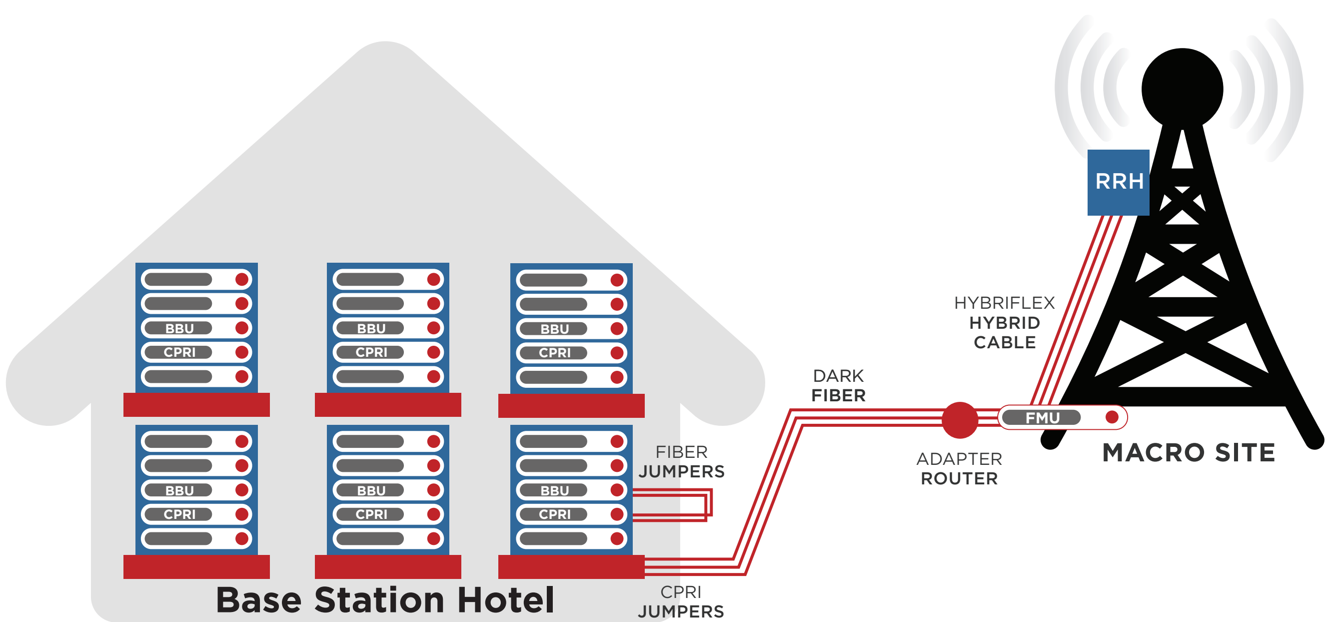


Migrate to 5G and future-proof your network for C-RAN with end-to-end CPRI solutions

C-RAN Architectures and CPRI

A Centralized Radio Access Network (C-RAN) is an architecture where the BBUs are placed at a centralized location, and the RRUs are placed at distances up to several kilometers away from the baseband site. The connection from a BBU to a remote radio unit is typically a fiber facility which is referred to as "fronthaul" to differentiate it from backhaul which connects the baseband unit to the network.

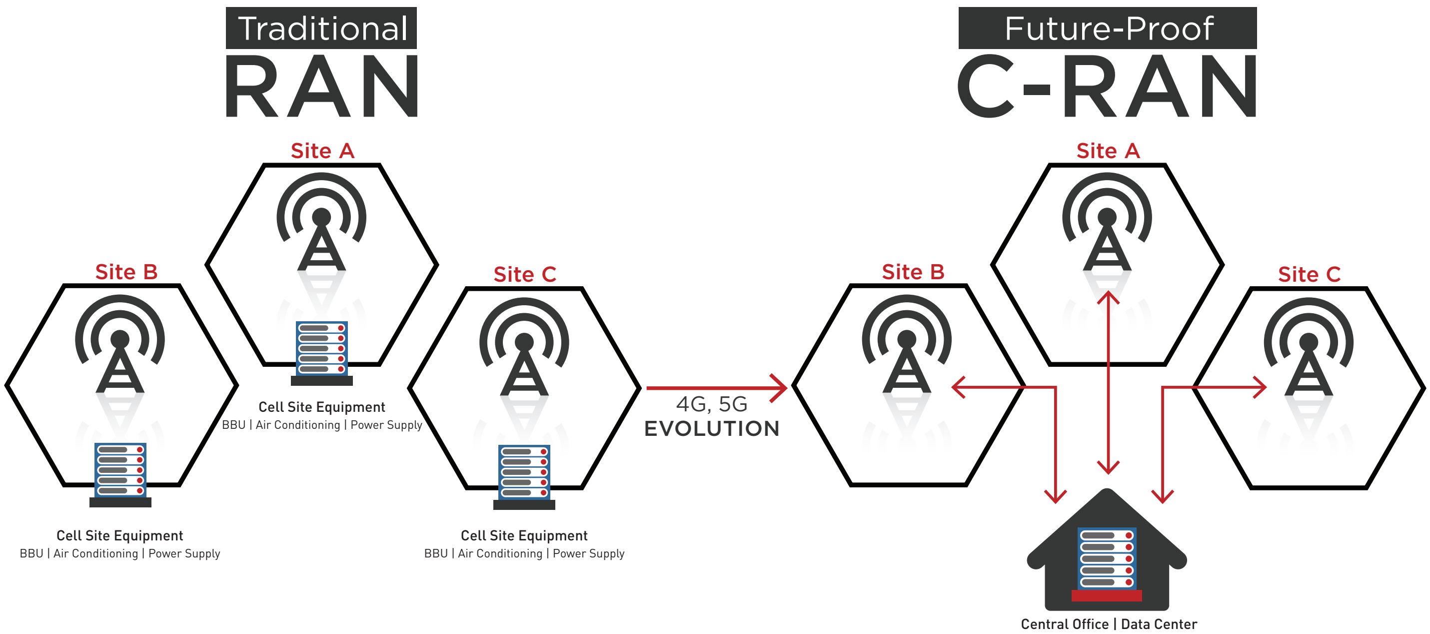
With the significant growth in mobile data traffic, operators are moving baseband units (BBU) from macro cell sites to a central location, allowing greater flexibility and cost savings. The connection from the BBU to the Remote Radio Head (RRH) is most commonly via CPRI.



One of the primary reasons to use C-RAN architecture with CPRI fronthaul is to enable the coordination between a mixed – also called Heterogeneous – network (Het-Net) that combines small cells to improve the coverage and traditional macro to increase capacity provided by base stations. In the network, several small cells can be distributed within the area covered by a macro cell, sharing the same frequency bands, to fill in the gaps in coverage and to provide extra capacity. The process of organizing macro cells and small cells is called SON- Self Organizing/Self Optimization Network. This becomes critical when more macro and small cells are introduced into the structure in a process known as densification. The efficient use of SON can both reduce OPEX and increase capacity.

nally designed as an internal interface for radio base stations. The main function of the CPRI is to enable independent technology such as RFoCPRI to test and evaluate on both sides of the interface fronthaul and backhaul.

As a new CPRI role, BBU can be located further away from the RRU. With CPRI, the link between BBU and RRU can be extended to several miles allowing the positioning of additional RRU in densely populated areas where the demand for wireless internet services may challenge the available capacity of macro cells. The wireless internet traffic can be offloaded and distributed from macro cells.



Technology Solutions to Overcome Capacity Challenges

As the demand for capacity in city areas has grown and macro cells have reached its limits, providing services to densely-populated locations becomes a near necessity. There are two major technologies to address this issue:

1. Small Cells Technology: Small cells are one major technology that is being deployed in significant volumes for dense cities to increase capacity. Small cells are low-powered access nodes that function as a base station. They can be mounted on rooftops and poles without a substantial footprint and utility cost.
2. CPRI Technology: Unlike a small cell, a distributed system is deployed in which the RRH remains on the poles, but the BBU are separated and moved to a location from the bottom of the structure and placed in central location, BBU Hoteling, a few kilometers/miles away. Fiber-based CPRI technology lets the BBU be moved to a central location; this technology was enabled by CPRI and fiber.

CPRI can be used between one BBU and RRU; or, it can be between one BBU and multiple RRUs. As we noted earlier, CPRI was origi-

Also, using CPRI technology offers major advantages when deploying BBUs. Typically BBUs need power and air-conditioning, which is costly. By not having a BBU at every site, it reduces the power consumption and footprint. Leasing/purchasing costs are also significant contributors to the OpEx/CapEx of cellular networks.

Lowering the equipment footprint and power requirements at the cell site can result in major savings, especially if the large cabinets that house the BBU are no longer needed. Furthermore, by stacking BBUs belonging to different RRU in one location it can improve the utilization and reliability of radio access networks

RFS' CPRI Panels

RFS' CPRI panels facilitate the connection between the macro network and small cells. By enabling fiber connectivity to be tested between optical BBUs and RRHs, these CPRI panels allow cell operations and system performance engineers to ensure the best performance without having to disconnect the fiber optical system or disrupt service.

RFS' rugged, lightweight aluminum CPRI Interface Panel provides bidirectional continuity and uniformity in attenuation over the full CDWM spectrum while utilizing included optical terminators to

reduce optical return loss in the communication link. Engineers can access the transmit data stream or uplink or downlink through a monitor port that does not affect service, eliminating the complications and downtime associated with disconnecting the RRH from the continuous communications optical link.

RFS' CPRI solution can be purchased with either 1 or 3 factory-loaded modules, thus allowing up to 18 CPRI ports in only 1 RU of space, which is the densest and most compact solution in the market today, fully aligned with C-RAN applications.

The CPRI panel can be bundled with RFS' high-quality fiber optic jumpers (available in several length options), providing an end-to-end solution that includes HYBRIFLEX® fiber-to-the-antenna DC and F/O solutions.

> By bundling the RFS CPRI with our popular fiber jumpers, we are able to offer our customers a cost-effective 'whole package' solution and eliminate any potential compatibility issues that might arise due to different fiber grade.
>
> – Mohamed Alameh, Regional Product Manager, RFS

Conclusion

The advent of new Centralized-RAN (C-RAN) networks, in conjunction with fiber and CPRI, gives MNOs the ability to transition from homogeneous to heterogeneous networks and centralize base station deployments up to 40 km away, enabling low-cost, highly reliable, low-latency and high-bandwidth interconnected networks to accommodate increasing data traffic demands.

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Glossary of Terms

BBU Hotel
A single location that houses the BBUs of many distributed RRHs, a BBU hotel can be many kilometers from the radio heads, typically using fibers running CPRI protocols between the two. By locating multiple BBUs at one location, radio resources can be allocated dynamically as demand changes. The radios can be mounted closer to the antenna to reduce RF cable losses and may improve PIM performance.

Macro Cell
Providing network coverage via a high-power base station, the macro cell may be mounted on a tall building or dedicated tower. Typically, the base transceiver station (BTS) radios are located in an equipment room at the tower base or on the rooftop. High-power radios provide coverage up to 20 km, with a microwave link or optical fiber serving as the connection back to the core network.

Small Cell
Small cells are low-power radios used in the cellular network to provide densification in urban environments over a limited range of typically 0.5 km to 4 km. Usually; the integrated radio is mounted on existing street infrastructure, such as lamp posts, or on the side of a building.

SON
SON enables the efficient use of heterogeneous networks (HetNets), a mixed network that includes small cells to improve the coverage and capacity provided by traditional macro base stations. Several small cells can be distributed within the area covered by a macro-cell, sharing the same frequency bands, to fill in the gaps in coverage and to provide extra capacity. The efficient use of SON can both reduce OPEX and increase capacity. However, if they evolve in an unplanned manner then problems may arise. Adequate coordination is essential in order to avoid capacity reduction. Dynamic adaptation is needed to maximize the gains that can be obtained.