VIAVI Solutions

Application Note

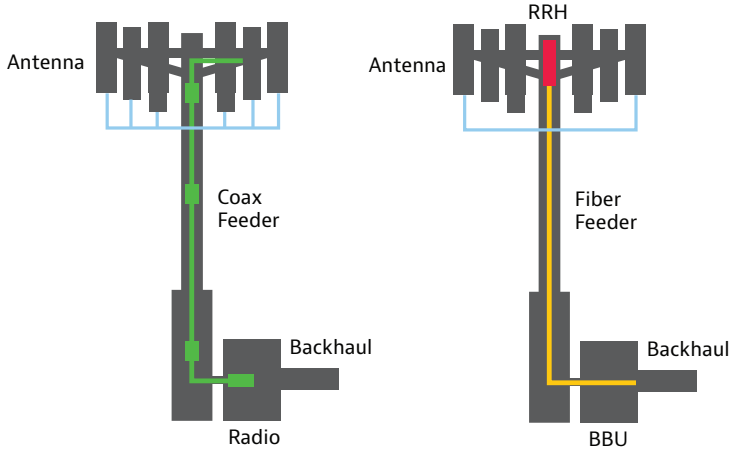
RFoCPRI Technology for RF Analysis at Fiber-Based Cell Sites

Conventional cell sites locate radio equipment at the base of the tower, transmitting RF signals via coax to antennas at the top of the tower. However, these coax-based feeders produce the majority of problems in cell sites due to inherent loss, susceptibility to interference, and cable and connector deterioration that creates signal reflections and intermodulation.

Modern cell sites have a distributed architecture with two radio elements: the radio equipment control (REC) or base band unit (BBU) installed at the base of the tower, and the radio equipment (RE) or remote radio head (RRH) installed at the top of the tower. These two elements communicate via the common public radio interface (CPRI) protocol over fiber links.

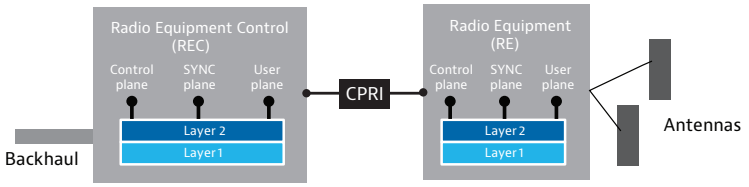
This distributed architecture replaces coax-based feeders with fiber-based feeders, and therefore, significantly reduces the problems of signal loss and reflections. However, since all RF interfaces reside on the RRH, any RF maintenance or troubleshooting requires reaching the tower top to gain access to the RRH. This increases OpEx and safety concerns.

Turning up a cell site requires analyzing the standard RF metrics (for example, DTF, VSWR, and RF power) and optical power as well as fiber inspection (IEC 61300-3-35).



Conventional cell site

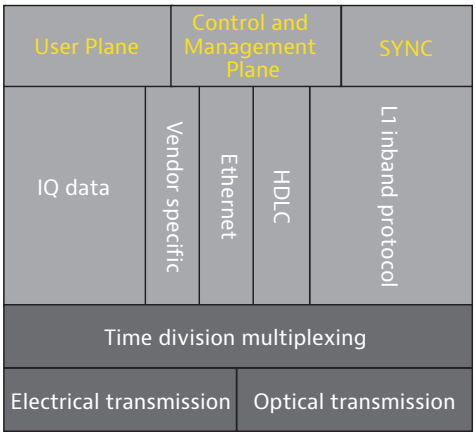
Distributed cell site



CPRI multiplexing

The CPRI Protocol

A cooperative industry effort defined CPRI as a specification for the interface between the REC and the RE, typically when fiber is deployed. Three different information flows are multiplexed over the interface: user-plane data, control- and management-plane data, and synchronization-plane data.



CPRI protocol overview

VIAVI Solutions RFoCPRI Technology

RFoCPRI™ enables performing RF maintenance and troubleshooting activities at ground level via fiber at the BBU. This has significant benefits:

- Minimizes cell tower climbs and improves safety
- Minimizes the number of instruments you need
- Significantly reduces maintenance time and operational expenses

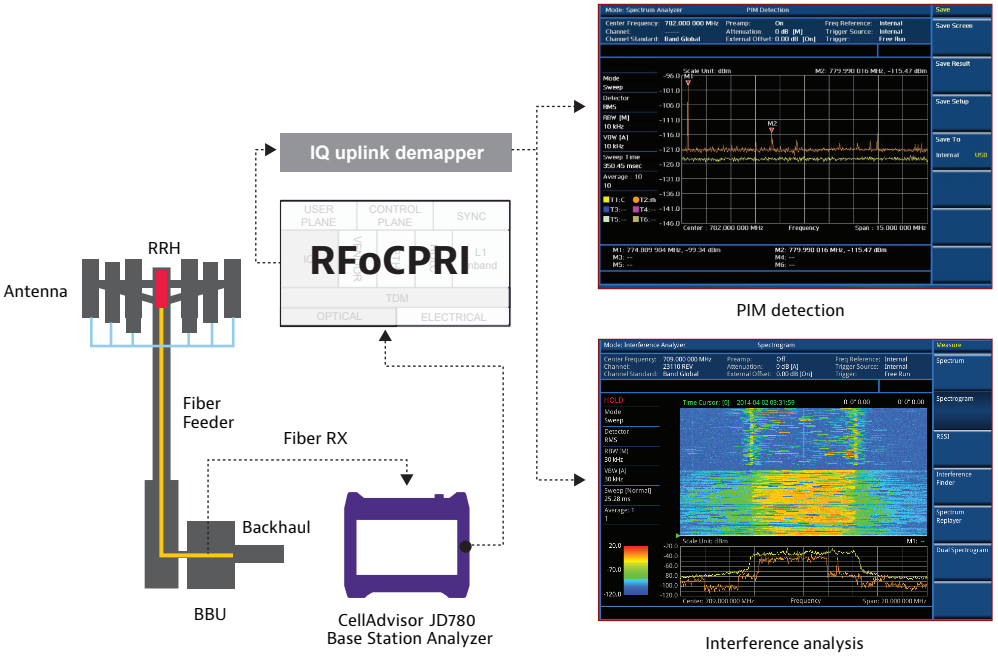
RFoCPRI technology verifies the CPRI control signals and extracts the RF (IQ) data transmitted between the BBU and RRH, permitting the monitoring and analysis of the interference of mobile terminals (uplink), as well as the radio's signal analysis (downlink).

Interference Analysis with RFoCPRI

RFoCPRI technology enables interference analysis by performing spectrum and spectrogram analysis in the uplink for intermittent interferes as well as by detecting passive intermodulation (PIM).

RF interference primarily affects the transmitting signals of mobile terminals due to their limited transmission power. This interference might be generated from external sources or internally to the cell-site as intermodulation products (PIM) generated from the radio's signal.

RFoCPRI technology provides an automated test sequence to analyze interference and detect PIM through CPRI links on the associated fiber without having to climb the tower.



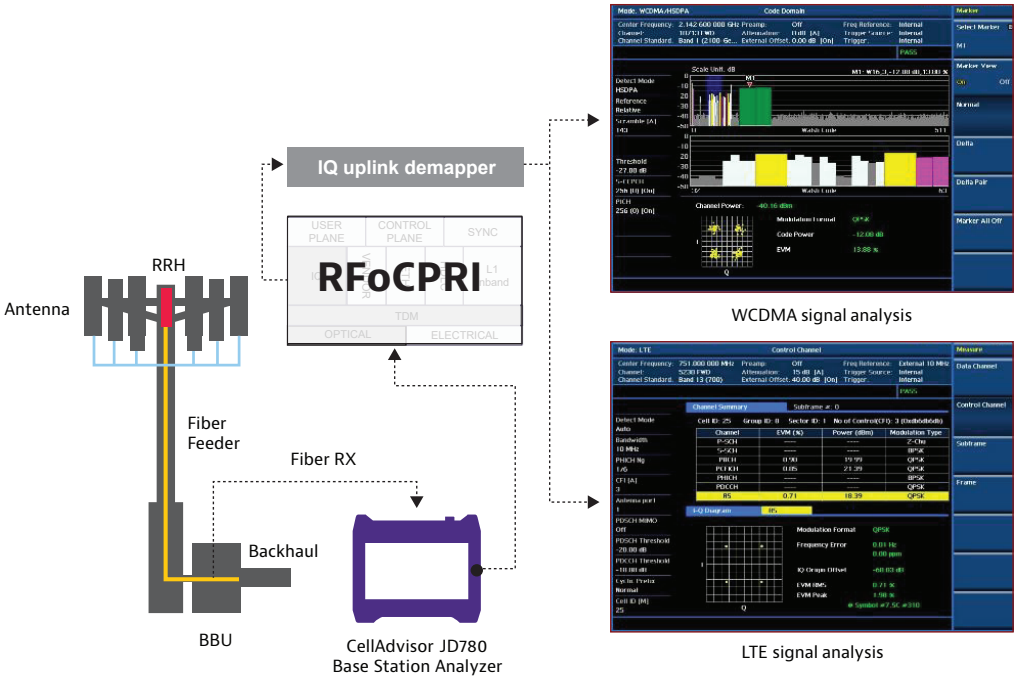
Interference analysis via CPRI

Signal Analysis with RFoCPRI

RFoCPRI technology enables signal analysis by performing conformance verification of the signal transmitted by the radio, including its RF profile and signal quality assessment in terms of modulation performance and MIMO transmission.

Cell-site technicians accept and verify the signal transmitted by the radio for RF integrity and proper modulation quality. These tests can be done from the ground at the BBU thanks to the Base Station Analyzer with RFoCPRI technology. It extracts RF information (I-Q data) and demodulates it to obtain the power and modulation performance of control signals such as pilot channels or cell identifiers as well as data channels.

In addition, RFoCPRI technology performs Layer 1 CPRI measurements such as optical wavelength and transmission rates as well as Layer 2 CPRI maintenance tests. These standard-specified tests include: loss of frame (LOF), loss of signal (LOS), remote alarm indication (RAI), and SAP detect indication (SDI). These capabilities provide a comprehensive assessment of a CPRI control plane and user plane.



Signal analysis via CPRI

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