Easily Test Remote Radio Head Operation with CPRI and OBSAI

With the current mobile backhaul transition to small-cell deployments, field technicians (of service providers and wireless NEM contractors) must verify and install CPRI/OBSAI links between the remote radio head (RRH) and baseband unit (BBU). Applications range from verifying connectivity, emulating the CPRI/OBSAI protocol, and installing links to troubleshooting CPRI connectivity and ensuring there are no code violations, BER errors, and/or framing issues.

T-BERD/MTS-5800, -6000A, and -8000 Platforms

The T-BERD®/MTS-8000, -6000A Multi-Services Application Module (MSAM) and T-BERD/MTS-5800 are the only portable field test instruments capable of testing CPRI/OBSAI transport links. CPRI and OBSAI test options save hours of troubleshooting by enabling installation with BER testing and performing link delay measurements, thereby ensuring proper handoffs for time-sensitive and service-critical applications such as LTE.

- Customers can lower CapEx with a modular, field-upgradeable tester that can seamlessly expand to future technologies like CPRI/OBSAI and the existing Ethernet backhaul technologies like Ethernet, Ethernet OAM, PDH, 1588v2/PTP, and SyncE.
- To promote an efficient service and network-management life cycle, the solution integrates installation tools and advanced troubleshooting analysis in a single test instrument.
- T-BERD/MTS is the leading modular and nonmodular field network installation platform for 614 Mbps to 9.8 Gbps CPRI and 768 Mbps to 6.1 Gbps OBSAI RP3 interfaces that can expand to Layer 2 link installation and troubleshooting.
- Both the T-BERD/MTS-8000, –6000A MSAM and T-BERD/MTS-5800 can be configured as CPRI/OBSAI field-portable tools, only without any other options.
- The instruments support 614 Mbps to 9.8 Gbps CPRI and 768 Mbps to 6.1 Gbps OBSAI rates on interfaces with multi-rate optics.
- CPRI Check simplifies installation tests by guiding the user through various test steps and displaying summary information to quickly validate the test results

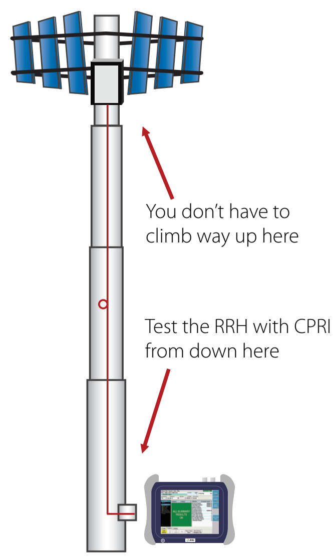
To meet the 4G/LTE networks spectral-efficiency and power-budget requirements, operators are deploying smaller microcell and picocell antennas, assigning fewer subscribers per sector, and building smaller sector sizes to reduce power consumption, improve mobile coverage, and reduce the equipment footprint compared to traditional base-station (macrocell) deployments.

Not Just Another Throughput Test!

This T-BERD/MTS solution is specifically designed for installing and verifying CPRI/OBSA links for small-cell deployments. More specifically, installation and maintenance of CPRI/OBSAI links is performed by BER and delay tests.

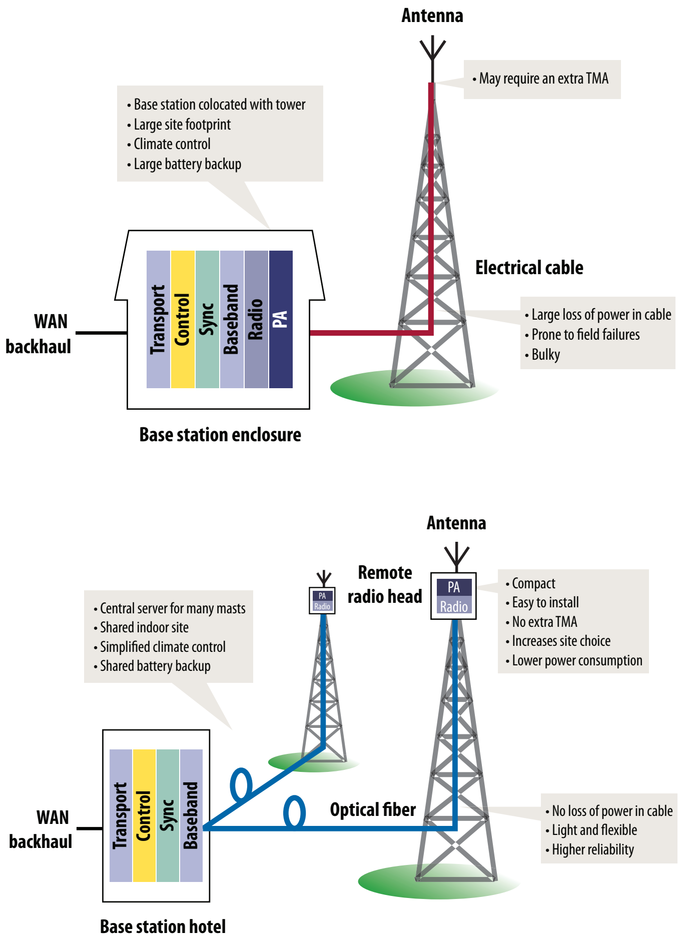
Use Cases

- Installing CPRI and OBSAI links between RRH and BBU
- Monitoring and troubleshooting CPRI/OBSAI links
- Testing RE status without needing to climb the tower or operate an BBU

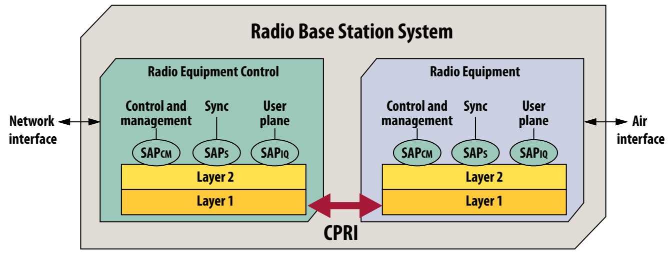


Distributed Antenna System (ODAS) Architecture

A small-cell approach requires an ODAS architecture. This architecture consists of REs at the cell site connected to RECs such as baseband units and baseband hotels at central offices/colocation hotels via protocols such as CPRI and/or OBSAI. Connections between REs and RECs can be single fibers, pairs of fibers with active DWDM/CWDM components, and even over OTN (mapping depicted in the ITU-T G.709 standard), depending on the actual access network and fiber in the network. Functional distances can range from 100 meters to tens of kilometers. A well-implemented and optimized ODAS architecture can dramatically reduce overall system, deployment, and operational costs.



Traditional and ODAS configurations



DAS architecture

CPRI/OBSAI Standards

CPRI and OBSAI standards work to effectively digitize RF signals. They help service providers deploy smaller antennas on the sides of buildings or light poles while collocating controller logic and functions at sites such as the Cos/MSC and collocation hotels. One CPRI standard defines interface rates up to 9.8 Gbps to enable various future LTE channel mappings. This lets service providers initially deploy lower interface rates and then upgrade their networks as bandwidth requirements grow.

CPRI/OBSAI interface rates

CPRI Rates	OBSAI Rates
614.4 Mbps (1x)	
	768 Mbps (1x)
1228.8 Mbps (2x)	
	1536 Mbps (2x)
2457.6 Mbps (4x)	
3072.0 Mbps (5x)	3072 Mbps (4x)
4915.2 Mbps (8x)	
6144.0 Mbps (10x)	6144 Mbps (8x)
9830.4 Mbps (16x)	
10137.6 Mbps (20x)	

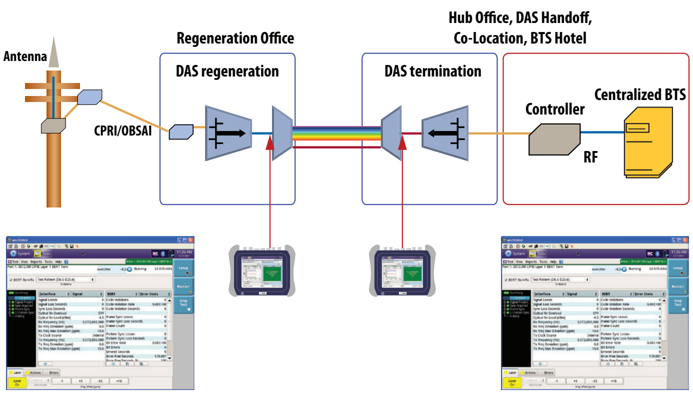
The feature set resembles TDM/PDH types of framing packaged into the 8B/10B-encoded Layer 1 frame (64B/66B-encoded for 10.14 CPRI). While this Layer 1 and Layer 2 technology looks like Ethernet and Fibre Channel, the actual framing structure, and how the RF data is mapped into that framing structure, more closely resembles TDM/PDH technology.

T-BERD/MTS Features and Benefits

Feature	Description	Advantage	Benefit
Install 614 Mbps to 9.8 Gbps CPRI links and 768 Mbps to 6.1 Gbps OBSAI links	Perform installation testing for CPRI/OBSAI links between the antenna and the controller.	Verify the fiber, DWDM clock recovery, and user data digitization at time of installation.	Avoid expensive truck rolls to troubleshoot small-cell deployments as infrastructure goes live.
Layer 1/2 BER testing	Perform BER testing using a test pattern that emulates CPRI/OBSAI framing and traditional PRBS patterns.	Ensure BER rate of 10^{-12} or better for Layer 1 emulated traffic.	Verify that baseline error rates meets standards at time of installation, ensuring the quality of subscriber traffic.
Layer 1/2 delay testing	Measure delay between the antenna and the controller.	Use the delay pattern to confirm that the installation meets requirements before making the system operational.	Confirm that "cable" delay will support positioning services and strict timing requirements between the REC and RE so that users will not experience dropped calls.
Monitor 614 Mbps to 9.8 Gbps CPRI interfaces and 768 Mbps to 6.1 Gbps OBSAI interfaces	Monitor traffic, ensure no errors are occurring, and verify the receipt of correct framing and signal frequency.	Monitor and troubleshoot with or without a splitter, thereby gaining access at various test points. Using a specific test pattern ensures that frames are received with proper CPRI/OBSAI framing without code violation (CV) and additional Layer 1 issues.	Reduce the time required to resolve field problems by having the right tool that makes Layer 1 CPRI framing problems visible.
CPRI C&M channel Ethernet capture	Collect Ethernet frames embedded in a C&M channel and store them in PCAP format.	By capturing Ethernet frames and viewing them in Wireshark, the C&M channel exchange can be displayed and used to identify any error conditions communicated between the RRU and BBU.	Verify interoperability problems between a BBU and RRU.

Installing CPRI and OBSAI Links Between an RE and REC

The link between an RE and REC may be fiber, a DWDM network, or CPRI over OTN. To ensure that the RF signal is carried correctly (without errors), it is important to verify the link between the RE and REC. In CPRI deployments to date, we have not seen service level agreements (SLAs) established for this service. Today, testing is focused on verifying power levels, signals, and link connectivity.

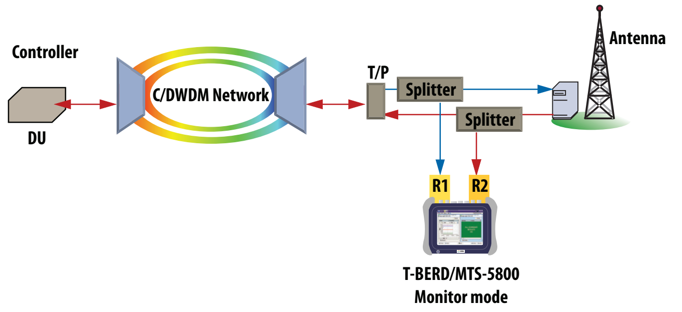


T-BERD/MTS testing of REC in a distributed DAS

In addition, technicians are required to transmit a fixed or a BERT pattern, achieve frame and pattern sync, and verify receipt of traffic without any code violations or BERT errors. Finally, technicians need to check the Layer 1 and Layer 2 delay of the CPRI transport link between the two ends, as the delay (similar to other mobile deployments) plays a critical role in quality-of-service and can cause missed handoffs between radio cells. Therefore, the current birth certificate for CPRI focuses on physical-layer, BER, and delay testing.

Monitoring and Troubleshooting CPRI/OBSAI Links

Depending on fiber structure, a monitoring application may require a splitter. To troubleshoot a link between an RE and an REC, technicians need to configure the unit for Mon/Thru application and verify correct receipt of the signal. It is important to verify receipt of the CPRI/OBSAI frames without any code violations and additional 8B/10B errors. If additional test sets are available, technicians may need to verify delays at various points of the infrastructure, thereby ensuring that initial birth-certificate metrics have not deteriorated. Dual monitor applications require a T-BERD/MTS dual-port option.



T-BERD/MTS testing of REC/RE link

By capturing Ethernet frames and viewing them in Wireshark, the C&M channel exchange can be displayed and used to identify any error conditions communicated between a RRU and BBU.

Frequently Asked Questions

Q: What is CPRI?

A: Ericsson, Huawei, NEC, Siemens, and Nortel defined the common public radio interface standard in 2003. The standard focuses on defining the digitized base station interface between a controller and an antenna. CPRI defines Layer 1 based on the Ethernet standard, using 8B/10B encoding, and it covers Layers 1 and 2 (with a specific hyperframe structure) of the OSI stack. It requires high bandwidth, reliable, and low-latency transport. Currently, CPRI interface rates are defined up to 9.8 Gbps. CPRI Specification V5.0 (2011-09-21) defines this technology.

Q: What is OBSAI?

A: Hyundai, LGE, Nokia, Siemens, and ZTE created the alternative open base station architecture initiative standard in 2002 to foster an open market for cellular base stations. The idea behind this initiative was that an open market would substantially reduce the development effort and costs traditionally associated with creating new base station product ranges. Similar to CPRI, it is defined as a standard 8B/1B encoded Layer 1 and covers up to Layer 2 (with a specific frame structure) of the OSI stack. OBSAI Reference Point 3, Specification Version 4.2 (18/03/2010) defines this technology.

Q: What is a C&M channel?

A: A control and management (C&M) channel is within the CPRI frame used for communication between a BBU and RRU. CPRI identifies an HDLC and an Ethernet mechanism for communication. C5CPRICAPTURE captures the Ethernet mechanism which is the mainstream option used in state-of-the-art BBU/RRU products.

Ordering Information*

Description	Products	Part Number
614 Mbps CPRI 614 Mbps CPRI field-upgrade option	T-BERD/MTS-6000A, -8000 MSAM	CT614MCPRI CT614MCPRI-U1
	T-BERD/MTS-5800	C5614MCPRI C5614MCPRI-U1
1.2 G CPRI 1.2 G CPRI field-upgrade option	T-BERD/MTS-6000A, -8000 MSAM	CT12GCPRI CT12GCPRI-U1
	T-BERD/MTS-5800	C512GCPRI C512GCPRI-U1
2.4 G CPRI 2.4 G CPRI field-upgrade option	T-BERD/MTS-6000A, -8000 MSAM	CT24GCPRI CT24GCPRI-U1
	T-BERD/MTS-5800	C524GCPRI C524GCPRI-U1
3 G CPRI 3 G CPRI field-upgrade option	T-BERD/MTS-6000A, -8000 MSAM	CT3GCPRI CT3GCPRI-U1
	T-BERD/MTS-5800	C53GCPRI C53GCPRI-U1
4.9 G CPRI 4.9 G CPRI field-upgrade option	T-BERD/MTS-6000A, -8000 MSAM	CT49GCPRI CT49GCPRI-U1
	T-BERD/MTS-5800	C549GCPRI C549GCPRI-UI
6.1 G CPRI 6.1 G CPRI field-upgrade option	T-BERD/MTS-6000A, -8000 MSAM	CT61GCPRI CT61GCPRI-U1
	T-BERD/MTS-5800	C561GCPRI C561GCPRI-UI
9.8 G CPRI 9.8 G CPRI field-upgrade option	T-BERD/MTS-6000A, -8000 MSAM	CT98GCPRI CT98GCPRI-U1
	T-BERD/MTS-5800	C598GCPRI C598GCPRI-U1
10.1 G CPRI 10.1 G CPRI Field upgrade option	T-BERD/MTS-5800	C510GCPRI C510GCPRI-U1
768 Mbps OBSAI 768 Mbps OBSAI field-upgrade option	T-BERD/MTS-6000A, -8000 MSAM	CT768MOBSAI CT768MOBSAI-U1
	T-BERD/MTS-5800	C5768MOBSAI C5768MOBSAI-U1
1.5 G OBSAI 1.5 G OBSAI field-upgrade option	T-BERD/MTS-6000A, -8000 MSAM	CT15GOBSAI CT15GOBSAI-U1
	T-BERD/MTS-5800	C515GOBSAI C515GOBSAI-U1
3 G OBSAI 3 G OBSAI field-upgrade option	T-BERD/MTS-6000A, -8000 MSAM	CT3GOBSAI CT3GOBSAI–U1
	T-BERD/MTS-5800	C53GOBSAI C53GOBSAI-U1
6.1 G OBSAI 6.1 G OBSAI field-upgrade option	T-BERD/MTS-6000A, -8000 MSAM	CT61GOBSAI CT61GOBSAI-U1
	T-BERD/MTS-5800	C561GOBSAI C561GOBSAI-UI
CPRI C&M capture	T-BERD/MTS-5800	C5CPRICAPTURE
SFP+ PIM	T-BERD/MTS-6000A, -8000 MSAM	CPSFPPLUS

* All T-BERD/MTS units can be upgraded with these CPRI and OBSAI options.

Contact Us **+1 844 GO VIAVI**
(+1 844 468 4284)

To reach the Viavi office nearest you, visit viavisolutions.com/contacts.

cpri-pb-tfs-tm-ae
30173210 906 0616