### Brochure

# VIAVI Verifying Wireless Fronthaul Networks

CPRI and eCPRI test options for T-BERD/MTS-5800, T-BERD/MTS-5800–100G, and MAP-2100

Fronthaul test options enable users to verify various transport parameters with measurements on CPRI and eCPRI fronthaul links. The transport parameters consist of bit error rate, packet throughput and delay metrics. Beyond transport test, fronthaul links also allow users to detect Passive Intermodulation (PIM) or external interference issues present at the connected radios.

# VIAVI Solutions

### **Value Proposition**

Introduction of Centralized Radio Access Networks (CRAN) and 5G has driven a massive deployment of fronthaul networks in access networks. The prominent fronthaul network protocol is Common Public Radio Interface (CPRI) which is a simple light protocol for controlling Remote Radio Heads (RRH) from the Baseband Unit (BBU). While simple, it is inefficient for large amount of fronthaul traffic that are necessary with deployments of 5G enhanced Mobile Broadband (eMBB) applications. This problem led to the development of enhanced CPRI (eCPRI) which is a packet-based transport protocol. Since mainstream operator networks will need to support both 5G and 4G services, fronthaul transport networks need to support both protocols. Rather than supporting two protocols in fronthaul, operators are planning to deploy Fronthaul Gateways (FHGW) that convert CPRI protocols to Ethernet with Radio over Ethernet (RoE), and thus create a single packet-based transport network in fronthaul.

### **Benefits**

- Validate the health of fronthaul transport networks with CPRI BERT/delay and eCPRI packet throughput and delay measurements
- Verify the proper operation of Radio over Ethernet (RoE) transport functions with CPRI control word and user plane (AxC) transparency test
- Detect the presence of any PIM or external interferers with RFoCPRI<sup>™</sup>

### **Intended audience**

- Wireless technicians who install, turn up, or troubleshoot radio access networks
- Engineers who design, maintain, or troubleshoot synchronization equipment in the lab or field

Verifying the proper function of the fronthaul transport networks is essential for proper operation of radio networks. CPRI links can be simply checked by performing Bit Error Rate Test (BERT) in CPRI signals. eCPRI verification can be done by performing packet loss and throughput measurements lin. These BERT and packet measurements characterize the health of the transport network for fronthaul traffic. One additional parameter critical for the operation of radio units is the delay between the radio and the baseband unit. Delay measurements are therefore critical for proper network qualification. Testing FHGW necessitates adequate validation of the RoE mapping function. This can be accomplished by checking the transparency of CPRI control words and the embedded Antenna Carrier Channels (AxC).

Beyond transport network validation, fronthaul CPRI links provide a unique access point to detect the presence of any Passive Intermodulation (PIM) or external interferers on feeder lines attached to the radio units. VIAVI Solutions first introduced the RFoCPRI test applications that decode the In-Phase Quadrature (IQ) data of the uplink base band signal and display it as a spectrum or spectrogram.

### **CPRI BERT**

CPRI signal is a simple Time Domain Multiplexed (TDM) structure with dedicated bytes for control words and remaining bytes assigned to time domain IQ data. Checking proper operation of CPRI transport networks should be started by performing a BERT test that populates the IQ data bytes with common Pseudo Random Bit Sequence (PRBS) patterns and conducting a bit error rate measurement at the remote site.

PowerMeter 🧕 🥸 Sy	vstem	Fiber Optics		V; 🕩 🖪	10:01 PM
Select - Port 1: Rates 1-7 C	PRI Layer 2 BERT T	• X • Port 2: Rates 1-7 CPRI Layer 2 BERT T.	Timing Sour What's This?		
Select Port 1: Rates 1-7 C Interface CPRI Service Disruption Capture Timed Test	PRI Layer 2 BERT T Control Word 1910 Conservation User Plane RTD	NEM User Plane Payload BERT Payload Pattern Mode BERT Payload Pattern	None Bulk BERT ITU 2^23-1 ITU		Results

### **CPRI Transparency (RoE) test**

Radio over Ethernet (RoE) mappers convert CPRI signals to Ethernet frames at the client ports of a FHGW, and demap them back to CPRI at the remote FHGW. The simplest method to verify the function of a FHGW is a CPRI BERT as described above. A CPRI BERT is useful when a structure agnostic mode of RoE is used. In this mode, the RoE mapper maps the entire CPRI frame (including the 8/10b or 64/66bit encoding) into Ethernet frames. This is a simple, but not efficient RoE method.

In structure aware RoE mode, the mapper is aware of the structure of the CPRI signal; more specifically it is aware of equipped AxC(s) inside of the CPRI IQ block, and only maps those used parts of the IQ block. In this mode, the AxC channels and the control words are separated and transported in dedicated Ethernet frames. Testing the structure aware mode is best accomplished if one tests the control words and individual AxC separately. T-BERD/ MTS-5800 CPRI PROOF and AXC PROOF test options perform these tests. Control words include Fast C&M, Slow C&M, Ctrl AxC, and VSD channels.

System 🔛 Test	Fiber Optics		N 😽	🕩 💦 4:40 PM
Select - Port 2: Rates 1-7 (	CPRI Layer 2 BERT T	× Port 1: Rates 1-7 CPRI Layer 2 BERT T	Iming Sour What's This?	
Interface ORI Service Disruption	Control Word CW Transparen User Plane	Transparency Check Rx = Tx Slow CM Ctrl AxC VSD Fast CM		huda
Capture Timed Test		Payload Type Byte	Pattern	
		Fast C&M Tx Disa	xled d	
		Fast C&M Rx Disa	sled a	
Reset Test to				Dust Set. View

### eCPRI Transport Test

eCPRI protocol is a packet-based network protocol. It resembles the Ethernet protocol, but it has a different Ethertype. eCPRI provides message types for different types of fronthaul data. They include IQ, Control Data, and One-Way Delay message types. Testing eCPRI transport networks should include a basic eCPRI packet throughput measurement as a minimum. eCPRI One Way delay measurement is a useful measurement that validates the maximum One-Way Frame latency between two test points. This measurement can be done by either using two book-ended testers or by performing a test against an eCPRI Radio that supports this message type.

System 🔛 Test	😽 Fiber Optics				<u>M</u>	📣 🌒 💦 5:06	6 PM
Port 2: 10Gig eCPRI Layer 2 St	reams Select Test	✓ Port 1: 10Gig eCPRI	ayer 2 Strea	ms T 🗙 🛛 🏹	ming Sour What's This?	- i i i i i i i i i i i i i i i i i i i	
No messages	Status Signal Present Sync Acquired Link Active Frame Detect ToD Sync History	<u>i i i i</u>	<u>.</u>	Frames Frame Detect VLAN History	;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;		
	Stream 1	L2 Link Results	•	Graphs	Throughput	•	
	eCPRI Message Type Total Util % 🗄		IQ Data	e, 🔍 Sca	le 🔍 Mean 🔍		
	Frame Size E		512	1,000 -		→	
	Current Minimum		512 512	1000 1000 1000 1000 1000 1000 1000 100		Stream Figure	
	Rx Mbps, Cur L1		1,000.0	400 T	1		
	Rx Mbps, Cur L2 Tx Mbps, Cur L1		962.4	E o	*****		
	Round Trip Delay (us	8	0.0	17.5454	1735344 2 3 3 4 5 4 6 11 7 11 8	17.06.54	
	0		ta a silah la l	•		1.4	
	Laser Actio	ns Peak IFG	Errors F	Faults Capt	ure		
Reports Tools View Help	Laser On Con	nal 0 1	+1 Freq Offs	-10	+10	Dual To View	-

## **RFoCPRI Test**

CPRI links provide an invaluable test access point for verifying the presence of any internal PIM or external interferers at the radio. The RFoCPRI test application performs a baseband analysis of the CPRI signal. The IQ data in embedded AxCs is decoded and displayed as a spectrum diagram. The spectrum diagram indicates presence of PIM or externa interferers. Spectrogram diagrams are also available, and useful for detecting intermittent problems.

lect 🗸 j	Port 2: Rates 1-7 CF	PRI Layer 2 BERT T	Port 1: Rates 1-7 CPRI Layer 2	BERT T Timing Sou	r What's This?	
°ī				Single	Amplitude Reference Level (dBm)	-
-8-				Rx1	0 Casta (Dis (40)	-
-		ALANNA ALANARAS	Nutrie Arts and Alter		25.0	
-50 -		100.010-011.000	a decimante en el		Ext. Offset (dB)	7
1	mand				Auto Scale	freq. Bard
-75 -				trong .		
-100 -						Ange
1						
-125						54
3				Sweep		1
-150 ]		Center	(MHI2): 1000 Span (	MH23 7.68 Hold	>>Hide	
Stat	tus Zoom	T1 Rx1 W	Sweep Time: 24.2ms AxC Group: 1	Average: 1 RBW: 30 kHz	Signal Present Sync Acquired	1.fa
			Condex Development of the P. S. Miles	LEVEL DO LATE	Frame Sync	-

# **Ordering Information**

Description	Part Number
T-BERD/MTS-5811 and T-BERD/MTS-5822	
T-BERD/MTS-5882	Various packages are available. Please contact your sales
T-BERD/MTS-5800-100G	representative for a free initial consultation
MAP-2100	
CPRI Rates 1-7	C5CPRI1-7
CPRI Rates 8-9	C510GCPRI; C5122GCPRI
CPRI Rate 10	C5243GCPRI
eCPRI 10G	C5eCPRI
eCPRI 25G	C5eCPRI
CPRI PROOF	C5CPRIPROOF
AXC PROOF	C5AXCPROOF
RFOCPRI	C5RFOCPRI



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

To reach the VIAVI office nearest you, visit viavisolutions.com/contact

© 2021 VIAVI Solutions, Inc. Product specifications and descriptions in this document are subject to change without notice. wirelessfronthaul-br-tfs-nse-ae 30192978 900 0221