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DATASHEET

Spirent TestCenter 5G Fronthaul O-DU and O-RU Device

Emulation with O-RAN and eCPRI

Overview

Open Radio Access Network (O-RAN) is being adopted by service providers and equipment manufacturers to reduce infrastructure deployment cost and lower the barrier to entry for new product innovation.

The O-RAN Alliance is committed to evolving radio access networks with its aim to drive the mobile industry toward an ecosystem of innovative, multi-vendor, interoperable, and autonomous RAN, with reduced cost, improved performance, and greater agility.

Virtualized Radio Access Network

Virtualization entails the migration from custom-built network nodes to network functionality implemented in software running on generic hardware compute platforms. Virtualization for communications service providers began with the core network and subsequently cloud technologies have been evolving at a rapid rate.

In the RAN domain, vendor agnostic commercial off-the-shelf (COTS) hardware has the potential to enable innovation across a range of software ecosystems.

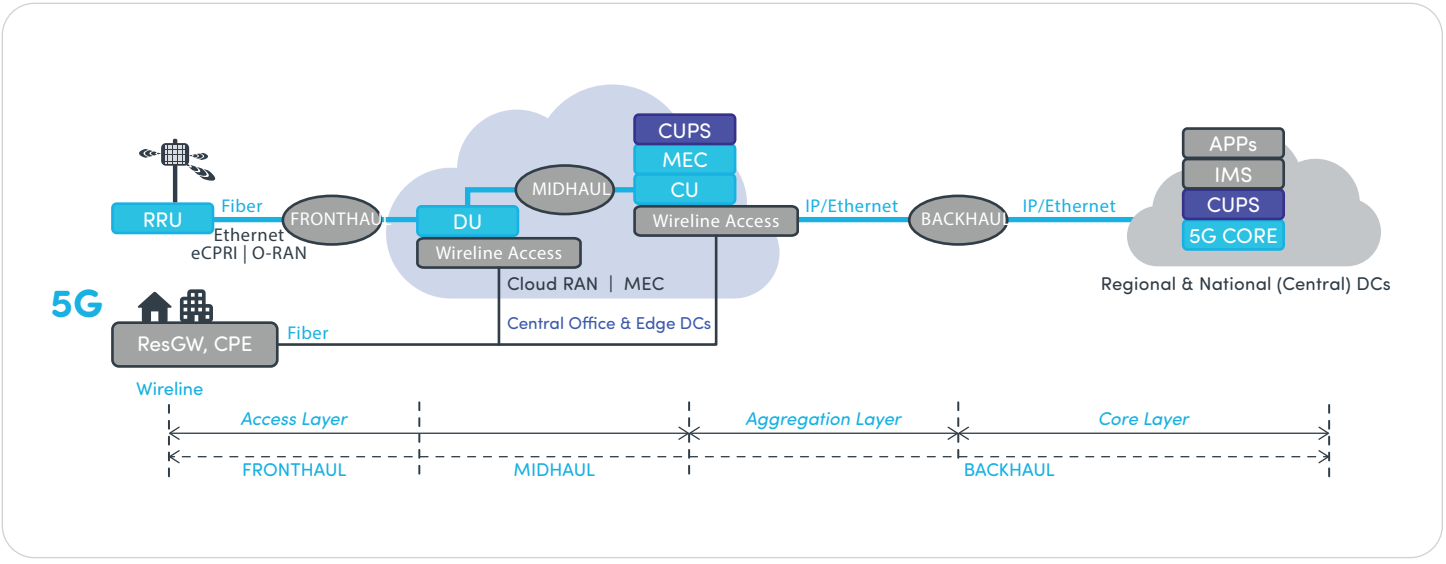
O-DU and O-RU Device Emulation with O-RAN and eCPRI

For full-stack RAN virtualization, the DU (Distributed Unit) is connected to the radio via a packet fronthaul interface known as enhanced Common Public Radio Interface (eCPRI), with multiple ways of dividing functions between the DU and the RRU (Remote Radio Unit).

eCPRI enables efficient and flexible radio data transmission via a packet based fronthaul transport network. eCPRI defines a protocol layer which provides various—mainly User Plane data specific services to the upper layers of the protocol stack.

Spirent TestCenter O-DU and O-RU device emulation with O-RAN helps ensure the success of O-RAN adoption and deployment by enabling equipment manufacturers and service providers to test and integrate virtualized open radio access network in a true multi-vendor environment through comprehensive test methodologies.

5G Fronthaul solution includes NGFI, eCPRI and O-RAN, enabling Network Equipment Manufacturers, Service Providers and chipset vendors to quickly evaluate and troubleshoot functionality, performance, and scalability of 5G fronthaul.



Features & Benefits

- Ability to emulate O-DU and O-RU with user and control plane messages
- User configurable subcarrier spacing (15, 30, 60,120KHz)
- User configurable bandwidth (20, 25, 40, 50, 60, 80, 100, 200, 400MHz)
- User configurable number of PRBs (pseudorandom binary sequence) to be requested in downlink and uplink messages
- IQ data compression using Block Floating Point, Mμ-Law, Block Scaling and Selective RE compression algorithm and 1 to 16 bit IQ width
- Custom slot format by importing symbol map file
- Respond to incoming eCPRI messages from DUT with user defined conditions and messages.
- User configurable gap time between uplink and downlink messages
- Interworking with PTP for time synchronization
- Support configurable slot ID, section ID, reMask and RB parameter values
- Support user configurable gap time between uplink and downlink messages
- Analysis of the incoming messages for conformance to O-RAN specification
- Checks for the validity of CC (Component Carrier) ID, number of PRBs
- Checks if uplink and downlink messages are received in correct sub-frame, slot, and Symbol ID
- Respond to incoming O-RAN messages from DUT with user defined conditions & messages
- Timing accuracy of ±5us for every Radio Frame of 10ms
- Jumbo frame support for user plane and application-level fragmentation
- Configurable slot ID incremental step
- Comparing received IQ data with uploaded standard file
- Configurable reMask parameter for DL and UL allocation
- Beam forming Ext 1 and 11 mixed
- User configurable control message processing time based on radio unit capabilities
- Raw PDU template to construct any O-RAN packet and transport over eCPRI
- Generate O-RAN messages over eCPRI based on IQ vector input file for both downlink and uplink
- Sending user plane messages at 10/25/50/100G line rate
- Next Generation Fronthaul Interface (NGFI) and Radio over Ethernet (RoE) emulation
- eCPRI message concatenation
- User configurable eCPRI common header, PC ID, sequence ID, app header (payload size is auto calculated)
- eCPRI services: One-way delay measurement, Remote Reset, Remote Memory Access
- Delay measurement with Request/Request with Follow up, Remote request, Remote request with Follow up (delay measurement to the accuracy of 1μs)
- Event Indication including Fault Notification, Notification Indication and Synchronization Request
- Facilitate multiple measurement tests and calculates min, max and average delay
- Simulate failures with user configurable success rate for the Remote memory access message
- Continuous RF generation and up to 8 O-RU/O-DU per port on hardware module FX3-100GD, FX3-100GQ, FX3-100GQF32, MX3-100GD, MX3-100GQ, MX3-100GQF32, FX3-25GD, FX3-25GO, MX3-25GD, MX3-25GO

Technical Specifications

Parameter	Description
ORAN-WG4.CUS.0-v01.00 *O-RAN Fronthaul Working Group: Control, User and Synchronization Plane Specification*	
O-RAN packet Generation from IQ samples / captured file	• Downlink Control and Data message • Uplink Control Message • Custom slot format
Transport	• eCPRI over Ethernet • eCPRI over VLAN • eCPRI over IPv4/UDP • eCPRI over IPv6/UDP
Compression Method	Block Floating Point compression, Mμ-Law compression, Block Scaling compression, Selective RE compression and no compression
IQ Width	1 to 16 bit Mantissa
Sub Carrier Spacing (SCS)	• μ = 0 (15 kHz) • μ = 1 (30 kHz) • μ = 2 (60 kHz) • μ = 3 (120 kHz)
Bandwidth	20MHz, 25MHz, 40MHz, 50MHz, 60MHz, 80MHz,100MHz, 200MHz, 400MHz
Frame size	• Default MTU: 1500 bytes • Jumbo frames (up to 9000 bytes) • Auto-calculated number of PRBs based on SCS and Bandwidth • Configurable number of PRBs per packet
Manual scheduling	• Radio Frames Generation at 10ms time • Support for Gap between Downlink and Uplink messages • User configurable Control packet processing time based on Radio unit's capability
O-RAN analysis	• Deep packet analysis of all the incoming uplink messages • Validates CC ID and number of PRBs in uplink message • Checks for the valid sub-frame, slot and Symbol IDs in incoming uplink message • Pre-defined Health indicator to alert for any discrepancy in the incoming O-RAN packets
Raw PDU template	Support for all the O-RAN Control Section types and Data message
Wireshark decoder	Wireshark decoder to analyze the packets at the O-RAN level
eCPRI Specification V1.2 [eCPRI_v_1_2_w_06_25]	
eCPRI Packet generation	• eCPRI message types [Type 0 – Type 7] • eCPRI over Ethernet, Ethernet – VLAN, IPV4- UDP, and IPV6-UDP • eCPRI message concatenation
Auto Frame Response*	• User defined filters on eCPRI header fields for packet matching • User configurable eCPRI response PDU for incoming eCPRI messages • Auto-Frame response is supported on FX and MX series hardware modules.
eCPRI Control and User data messages	• IQ Data • Bit Sequence • Real Time Control Data • Generic Data Transfer
Remote Memory Access	• Message types: – Read request – Write request – Read response – Write response – Write no response • User configurable success rate for simulates success and failure responses • Pre-defined Health indicators to validate requests and response messages
One-way delay measurement	• Action types: – Request – Request with Follow-up – Remote-Request – Remote request with follow-up • One-way delay measurements • Bulk message support to calculate minimum delay, maximum delay, and average delay • Pre-defined health indicators to validate the request and response messages.
Remote Reset	• Message types: – Remote Reset Request – Reset indication • Pre-defined health indicators to validate the request and response messages
Event Indication	• Event types: – Fault Indication – Notification Indication – Synchronization Request
Wireshark decoder	• Wireshark decoder for all eCPRI message types

Technical Specifications (cont'd)

Parameter	Description
Next Generation Fronthaul Interface (NGFI)	
Emulate RoE	Support control plane and data plane, like to configure the P counter, and Q counter, TLV for RoE OAM messages

Bit Rate

Rate		Word Length (Bytes)	Rate		Word Length (Bytes)
Rate 1	1x	1	Rate 6	10x	10
Rate 2	2x	2	Rate 7	16x	16
Rate 3	4x	4	Rate 8	20x	20
Rate 4	5x	5	Rate 9	24x	24
Rate 5	8x	8	Rate 10	48x	48

ETSI TS 138 211 V15.2.0 (2018-07)	
5G NR Frame and Sub-Frame Structure	Sub Carrier Spacing 15KHz, 30KHz, 60KHz, 120KHz

5G NR

Slot Configurations

μ	N^{slot}_{symbol}	$N^{frame\mu}_{slot}$	$N^{subframe\mu}_{slot}$
0	14	10	1
1	14	20	2
2	14	40	4
3	14	80	8

5G Fronthaul Supported Platforms and Modules

Recommend Spirent FX3 and MX3 Test Modules and TestCenter Virtual (refer to Customer Support Center for latest supported hardware).

Ordering Information

Product Number	Description
BPK-1376	O-RAN O-DU Emulation Base Package
BPK-1364	ECPRI Base Package
BPK-1385	O-RAN O-RU Emulation Base Package
BPK-1155A	IEEE 1588V2 Network-Based Timing & Synchronization Base Package
BPK-1363	NGFI BASE PACKAGE

About Spirent Communications
Spirent Communications (LSE: SPT) is a global leader with deep expertise and decades of experience in testing, assurance, analytics and security, serving developers, service providers, and enterprise networks. We help bring clarity to increasingly complex technological and business challenges. Spirent's customers have made a promise to their customers to deliver superior performance. Spirent assures that those promises are fulfilled. For more information visit: **www.spirent.com**

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