Jio 5G NR Macro gNodeB
Combined CU and DU (CCDU) with Massive MIMO Radio Unit (MRU)

Maximizing Site Capacity with Increased Coverage using Beamforming

Part of Jio’s complete End-to-End 5G-product offering
Low Cost, Power Efficient and a Compact Massive MIMO Radio with a Combined Centralized and Distributed Unit

5G is about connecting things everywhere while enabling new use cases. A 5G Radio Access Network (RAN) uses 5G radio FDD frequencies to provide wireless connectivity to devices to deliver these incredible applications. 5G use cases will deliver new revenue streams for CSPs and new connectivity opportunities for subscribers. In order to deliver these use cases, the Radio Access Network consists of antennas, radios, baseband (RAN Compute), and RAN software to enable incredible speeds and mobility.

Jio offers its Macro gNodeB solution which acts as a 5G wireless base station that helps to communicate between the user equipment and the mobile network. It has a low cost, power efficient and a compact Release 15 compliant design. Jio 5G NR Macro gNodeB operates in Band-n78 (3300 MHz–3600 MHz frequency band). It consists of a massive MIMO (Multiple Input Multiple Output) Active Antenna Unit that supports 32 transmit and 32 Receive chains. It is the logical 5G radio node to ensure that operator’s 4G Towers deliver 2.3 GHz identical coverage with 3.5 GHz 5G NR. The baseline Macro gNodeB solution is designed to be a 32T32R Massive MIMO product. The product comes with advanced Beamforming and Multi-User MIMO algorithm to maximize the capacity at site. The frequency band for 5G gNodeB operation is 450 MHz to 7.125 GHz (sub 6GHz).

There are two sub-systems in Jio Macro gNodeB – Combined CU and DU (CCDU) and Massive MIMO Radio Unit (MRU). Jio CCDU is a single box solution and consist of CU and DU functionality together. CCDU hosts baseband functionality including Radio Resource Management (RRM), MAC Scheduler, RLC, MAC, HI-PHY and supports Ng interfaces to connect with 5G Core. It supports 7.2x architecture as defined by 3GPP.

Jio MRU is an Active Antenna Unit, and it connects to the CCDU through eCPRI interface. It consists of Low PHY, Digital front end and 32 Transceiver chains. Each chain has a transmitter, receiver and feedback path for DPD – linearizer. MRU has an integrated antenna with 128 AEs and can support gain up to 22.5 dBi.

The Macro gNodeB supports multi-user MIMO and beam forming such that a maximum 8 layers in DL and 4 layers in uplink can be achieved. It supports maximum throughput of 10 Gbps in DL and 1.25 Gbps in UL with 3 sector scenarios.

Jio 5G MRU
- First and only 5G Massive MIMO Radio designed and manufactured in India.
- O-RAN Front haul Compliant
- 32 Tx and 32 Rx totaling to 200 Watts of transmit power
- 2x Peak Cell Throughput compared to typical outdoor small cells due to Multi-User Multiplexing in same spectrum at same time

Jio 5G CCDU
- Single box, baseband unit solution to host entire 5G protocol stack for 3 nos. of Massive MIMO Cells
- Connects to the core network through 10G optical interface
- Mountable on Poles, Towers, Roof Tops, Walls with mechanical tilt bracket
- Typical Cell Radius : 250–350 meters due to narrow beams
- Connects to MRU through 25G Optical cable over eCPRI interface
- O-RAN Front haul Compliant
High Level Architecture

The Jio Macro gNodeB is based on the split architecture proposed by the 3GPP and ORAN consisting of the following three units:

1. The Massive MIMO Radio Unit (MRU) - 3 units for a tri-sectored site
2. The Distributed Unit (DU) - 1 unit for a tri-sectored site
3. The Centralized Unit (CU) - Virtualized at Data Centre

The 5G NR Macro gNodeB architecture supports three sector configurations for Massive MIMO Radio Unit (MRU). The CU and DU is combined as a single entity called as "Combined CU and DU (CCDU)". CCDU connects to the core network through 10 G optical interface at one end and connects to MRU through 25 G Optical cable over eCPRI interface.

**Jio 5G MRU - Key Specifications**

- 200W - Total Transmit power
- 32 Chains
- 6.25 watt per port
- ORAN compliant MRU
- Complete customized design in India
- 192 Antenna Elements, 64 Dual cross polarized (8 X 8) antenna elements

**Jio 5G CCDU - Key Specifications**

- Combined CU and DU
- Host L2, L3 and High PHY for 3 sectors
- Synchronization through GPS - Primary
- 3 X 25G optical interfaces through Ethernet Controller - Front haul Interface
- 22 dBi gain of Antenna for user plane
- Direct RF Sampling of ADC - concept is used (No IF stage at all)
- 750-Watt power consumption
- 1X 10G / 2 X 1G - Backhaul connections
- ORAN 7.2 X complaint DU
- Supports 8 layers
- Peak throughput of 3.6 Gbps per sector.
Key Features

Single box, baseband unit
Jio CCDU is a single box baseband solution to host entire 5G protocol stack for 3 nos. of Massive MIMO Cells.

Supports Multiple Deployment Options
The Jio MRU is mountable on Poles, Towers, Roof Tops, Walls with mechanical tilt bracket as per the deployment scenario.

O-RAN Front haul Compliant
The product follows a disaggregated approach to deploying mobile fronthaul and midhaul networks built entirely on cloud native principles.

High Cell Throughput
The Jio MRU provides 2x Peak Cell Throughput compared to typical outdoor small cells due to Multi-User Multiplexing in same spectrum at same time.

Transmit power of 200W
The solution has 32 transmit and 32 Receive chains totaling to 200 Watts of transmit power. This maximize coverage and data throughputs.

High Data Capacity
The Macro gNodeB supports multi-user MIMO and beam forming such that a maximum 8 layers in DL and 4 layers in uplink can be achieved. It supports maximum throughput of 10Gbps in DL and 1.25Gbps in UL with 3 sector scenarios.

High Active Users and Data Radio Bearer Support
The product supports 16RRC Connected Users and 32 Data Radio Bearers.

Native Voice over NR and VoNR Support
Build to support Voice and Video Calling natively on 5G NR from Day 1. Having VoNR and VoNR as the baseline features are quite revolutionary for the 5G NR market that started mostly with NSA mode and recently moving to SA mode.

EPS Fallback for Voice
Supports the mobility procedure where network triggers the UE to change Radio Access from 5G to 4G network.

Pre-Integrated with Automation and AI/ML platforms

✓ Network Management System: It helps in monitoring and managing the FCAPS data and provides a single pane of glass for the Network Operations Centre. Provisioning and de-provisioning of the node in the NMS is fully automated and bulk-provisioning is supported. Similarly, the commissioning of the ODSC at the site becomes also very simple. The ODSC supports a zero touch, plug-and-play integration process wherein, once the node is powered-up, all procedures such as the assignment of IP Address and connectivity to the EMS and the core network are carried out automatically. The ODSC starts radiating with desired configuration within a couple of minutes.

✓ SON Platform: Jio 5G ODSC supports self-organising network (SON) features such as Auto PCI, Automatic Neighbour Relation (ANR), Auto adjustment of transmit power based on the interference, etc. This means there is no human intervention required for routine operational tasks such as neighbour list management and special optimization tasks. It is based on the inter-play of a distributed SON (DSON) and centralized SON (CSON) components that leverages NMS databases.

✓ vProbe Solution: Protocol Events as well as periodic RF measurements for every connected user are streamed to a vProbe Solution that ingests all the traces and applies geolocation algorithms to approximate the position of the users.

✓ Radio Intelligent Controllers (RIC) and xApps: A scalable and extensible RIC framework ingests geolocated trace data from vProbes and counters/alarms (from the NMS) and run intelligent algorithms to optimize the configuration parameters in near real time.

✓ Jio Cognitive Platform: Jio’s in-house AI driven low code platform for end-to-end lifecycle network management.
Differentiators

1. Pre-Integrated with Automation and AI/ML Platforms
2. O-RAN Compliant, the architecture supports multiple split options
3. Future Ready as aligned to 3GPP Standards
4. Power Efficient design.
5. Made in India and designed for the dense network like India
6. Software Defined Radio implementations using high performance and fully programmable platform
7. Product Lifecycle is Amalgamation of multiple engineering disciplines
8. Fully Complaint to 5G NR FAPI protocol for L2-L1 interface
9. Supports Voice and Video over NR

Hardware Specifications - MRU

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Freq (GHz)</td>
<td>3.3 -3.67 GHz (3GPP n78)</td>
</tr>
<tr>
<td>IBW (MHz)</td>
<td>370</td>
</tr>
<tr>
<td>OBW (MHz)</td>
<td>100</td>
</tr>
<tr>
<td>RF Output (W)</td>
<td>200</td>
</tr>
<tr>
<td>No. of Carriers</td>
<td>1C</td>
</tr>
<tr>
<td>Antenna Elements</td>
<td>128</td>
</tr>
<tr>
<td>Layers (DL/UL) Per Carrier</td>
<td>8/4</td>
</tr>
<tr>
<td>Antenna Gain (dBi)</td>
<td>22.5</td>
</tr>
<tr>
<td>Vertical Beam steering range</td>
<td>6 deg</td>
</tr>
<tr>
<td>Rx Sensitivity (dBm) as per TS 38.104</td>
<td>-97.2</td>
</tr>
<tr>
<td>Power Supply</td>
<td>-48 V DC</td>
</tr>
<tr>
<td>Fronthaul (FH)</td>
<td>eCPRI (O-RAN 7-2x)</td>
</tr>
<tr>
<td>Number of 25G FH Interfaces</td>
<td>1</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>&lt;22</td>
</tr>
<tr>
<td>Power Consumption@ 200W</td>
<td>~745 peak / ~510 Avg</td>
</tr>
<tr>
<td>Ingress Protection</td>
<td>IP-65</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>0 to 55 degC</td>
</tr>
</tbody>
</table>
### Software Specifications – CCDU

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CU/DU split or integrated</td>
<td>Integrated CU DU</td>
</tr>
<tr>
<td>5G Cell Capacity</td>
<td>3 Cell x100MHz x 8L (TDD)</td>
</tr>
<tr>
<td>BBU Level Throughput Processing</td>
<td>3.5 Gbps</td>
</tr>
<tr>
<td>RRC Connected User</td>
<td>600 per RU</td>
</tr>
<tr>
<td>Front Haul Interface with MRU</td>
<td>O-RAN Compliant FH Split (7-2x)</td>
</tr>
<tr>
<td># eCPRI ports</td>
<td>3 x 25G SFP28 Ports</td>
</tr>
<tr>
<td># Backhaul Port</td>
<td>2x10G optical ports</td>
</tr>
<tr>
<td># Synchronization</td>
<td>GPS</td>
</tr>
<tr>
<td>Max Power Consumption (W)</td>
<td>350</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>&lt;5Kg</td>
</tr>
<tr>
<td>Dimension (W x D x H mm)</td>
<td>439 x 494 x 87.86</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>0 to 55 degC</td>
</tr>
</tbody>
</table>

*Copyright © 2022, Reliance and/or its affiliates. All rights reserved. This document is provided for information purposes only, and the contents hereof are subject to change without notice. This document is not warranted to be error-free, nor subject to any other warranties or conditions, whether expressed orally or implied in law, including implied warranties and conditions of merchantability or fitness for a particular purpose. We specifically disclaim any liability with respect to this document, and no contractual obligations are formed either directly or indirectly by this document. This document may not be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without our prior written permission. Jio is registered trademarks of Reliance and/or its affiliates. Other names may be trademarks of their respective owners.*
Connect with us

https://www.jio.com/platforms

https://www.linkedin.com/company/jpl-5g-solutions/c