OCP OPENEDGE BBU FOR 5G / IOT / EDGE PROPOSAL

HOWIE GRANAT – Director Business Development / Critical Power

February 2020
DEPENDABLE & EFFICIENT
Battery Backup Solutions for Critical Power Applications
CRITICAL POWER SOLUTIONS

Telecom

Data Storage

Energy Storage

UPS / Battery Backup
CRITICAL POWER PORTFOLIO
SMALL TO MEDIUM FORMAT, HIGH RELIABILITY

• Typical Applications
  – BBU (Battery Backup – Onboard)
  – PSU (Power Shelf Units – In Chassis)
  – BBU/PS (Battery Backup/Power Supply)
  – UPS Battery (System Component of UPS System)
• Over 20 programs in production today
  – Builds mostly in China, Malaysia & Mexico
• Voltages from 4V to 48V (Nominal)
• Power range 100 - 5kW (3kW in production today)
• Current production configurations from 1S1P to 14S6P (Larger configurations in development)
• Predominant construction – metal sleds & full metal enclosures
• Volume Ranges (Per SKU) – 2.5K to 50K+
TYPICAL VIRTUALIZED SYSTEM

*BATTERY BACKUP OPTIONS IN ALL EXCEPT THE NETWORK SWITCH

NETWORK SWITCH*

DATA SERVER

POWER SHELF/PSU

DATA STORAGE

UNINTERRUPTIBLE POWER SUPPLY (UPS)
OPENEDGE BBU

MARKET OPPORTUNITY AND DETAILS
### MARKET INSIGHTS FOR 5G / EDGE / IOT

$700 BILLION BY 2030 (ANNUAL TSP 5G REVENUE)

*(ERICSSON AND ARTHUR D. LITTLE REPORT)*

<table>
<thead>
<tr>
<th>Industry</th>
<th>MRKT %</th>
<th>CAGR %</th>
<th>Primary Application</th>
<th>Other Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare</td>
<td>21%</td>
<td>75%</td>
<td>Telemedicine</td>
<td>Hospitals</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>19%</td>
<td>76%</td>
<td>Automation, A/R</td>
<td>Robotics</td>
</tr>
<tr>
<td>Energy / Utilities</td>
<td>12%</td>
<td>67%</td>
<td>Power Generation</td>
<td>Smart Buildings</td>
</tr>
<tr>
<td>Automotive</td>
<td>12%</td>
<td>71%</td>
<td>Autonomous Cars</td>
<td>In-Car Entertain</td>
</tr>
<tr>
<td>Public Safety</td>
<td>10%</td>
<td>78%</td>
<td>Surveillance</td>
<td>Public Safety</td>
</tr>
<tr>
<td>Media / Entertain</td>
<td>10%</td>
<td>86%</td>
<td>Gaming</td>
<td>Advertising</td>
</tr>
<tr>
<td>Financial Services</td>
<td>5%</td>
<td>76%</td>
<td>Banking</td>
<td>Securities</td>
</tr>
<tr>
<td>Public Transport</td>
<td>5%</td>
<td>65%</td>
<td>Mass Transit</td>
<td>Goods Delivery</td>
</tr>
<tr>
<td>Retail</td>
<td>4%</td>
<td>76%</td>
<td>E-Commerce</td>
<td>Stores</td>
</tr>
<tr>
<td>Agriculture</td>
<td>2%</td>
<td>85%</td>
<td>Farming, Livestock</td>
<td>Fishing, Hunting</td>
</tr>
</tbody>
</table>
OPTIMIZED APPLICATIONS FOR BBU

FAR EDGE / MISSION CRITICAL / UNRELIABLE POWER

• Minimal Power infrastructure
• Minimal space availability
• Frequent power interruptions
  – Developing Nations
• Challenged Environments
  – Geophysical
  – Nautical
  – Weather
• Graceful Shutdown needs
  – Communication
  – System Auto-Reboot capability
• Multi-Prong deployments
  – Factories, Warehouses, Healthcare/Hospital
• Tower/Pole Mounted Applications
SYSTEM DETAILS

- Systems are physically 3U (5.25”) high 19” wide and designed with “sleds” that are 1U or 2U (1.75” or 3.5”) high x 8.5” wide and 17.5” deep
- There are effectively 6 sleds in the system, with 1 sled location for the twin (redundant) power supplies (PSU) and a rack management controller (RMC)
- The proposed BBU sled will be 8.45”w x 1.7”h x 17.5” deep
- If incorporated – the BBU will reside in the lower right sled location.
OPEN EDGE - CHASSIS

2 power connectors
(FCI 10078768-001LHLF)

1 guiding pin
(Ostracon D11402-200000-Z1)

1 signal connectors
(FCI 10130665-102LF)
OPEN EDGE MOCK-UP

- Enclosure Cover
- PCBA with Connectors
- Enclosure Front
- Enclosure Handle
- 6S6P Li-Ion Battery Assembly

THE CONNECTOR ON TOP WILL NOT BE INCLUDED ON THE MOCK_UP

Enclosure Base
## ELECTRICAL

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell Chemistry</td>
<td>NMC/NCA</td>
</tr>
<tr>
<td>Voltage (Nom/Max)</td>
<td>12.0V +/- 0.1V</td>
</tr>
<tr>
<td>Energy (Total/Usable)</td>
<td>260 / 220 Whr</td>
</tr>
<tr>
<td>Contin. Power / Current</td>
<td>1.6kW / 133A</td>
</tr>
<tr>
<td>Peak Power</td>
<td>TBD</td>
</tr>
<tr>
<td>Run Time</td>
<td>8 Minutes @ 1600W (Initial – 5 Years = 5 minutes)</td>
</tr>
<tr>
<td>Communication Protocol</td>
<td>SMBus</td>
</tr>
<tr>
<td>Cycle Life (@25°C)</td>
<td>750 @ 70% of Initial Capacity 5 Year Est’d Life</td>
</tr>
<tr>
<td>Scalability</td>
<td>N/A</td>
</tr>
<tr>
<td>BMS</td>
<td>Intelligent Microprocessor, Pre-charge, Cell Balancing, Over Voltage, Under Voltage, Over-current, Short circuit, Temperature Monitoring, Data Logging</td>
</tr>
</tbody>
</table>

## MECHANICAL

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (LxWxH) mm / (in)</td>
<td>427.5(D) x 215(W) x 44.45(H) mm (16.83 x 8.46 x 1.75 in)</td>
</tr>
<tr>
<td>Weight (kg / lbs)</td>
<td>TBD</td>
</tr>
<tr>
<td>Interface</td>
<td>Amphenol ICC (FCI) Airmax VS2 Power/Signal</td>
</tr>
<tr>
<td>Enclosure</td>
<td>Steel</td>
</tr>
<tr>
<td>Shipping Classification</td>
<td>UN3480, Class 9, UN38.3</td>
</tr>
<tr>
<td>Cooling</td>
<td>Fanless Design</td>
</tr>
<tr>
<td>Contact</td>
<td>Howie Granat – <a href="mailto:hgranat@inventuspower.com">hgranat@inventuspower.com</a></td>
</tr>
</tbody>
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## OPERATIONAL TEMPERATURE RANGE

<table>
<thead>
<tr>
<th>Condition</th>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charge</td>
<td>32°F to 113°F (0°C to 45°C)</td>
</tr>
<tr>
<td>Discharge</td>
<td>23°F to 140°F (-5°C to 60°C)</td>
</tr>
<tr>
<td>Storage</td>
<td>-4°F to 140°F (-20°C to 60°C)</td>
</tr>
</tbody>
</table>

## CERTIFICATIONS (Planned)

<table>
<thead>
<tr>
<th>Region</th>
<th>Certification</th>
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<tbody>
<tr>
<td>North America</td>
<td>UN38.3, UL1973</td>
</tr>
<tr>
<td>EMEA</td>
<td>IEC62619</td>
</tr>
<tr>
<td>Global</td>
<td>UL1642, RoHS, WEEE</td>
</tr>
</tbody>
</table>
TIMELINE

PROTOTYPE / PILOT / PRODUCTION

• July 2019
  – Preliminary Specifications presented to OCP community

• September 2019
  – Proto Zero / Physical mockup presented at OCP Regional Summit in Amsterdam
  – Preliminary Specifications presented to Open Network Foundation summit

• October 2019
  – Preliminary Quotes presented to Nokia/Asus/Wiwynn

• November 2019
  – Proto Zero / Physical mockup presented at Telecom Network Foundation in Amsterdam

• March 2020
  – OCP Global Summit – Request to have a working Proto-One to be able to power an OpenEDGE system (2-3 Units)

• September 2020
  – OCP Regional Summit – Prague – Proto-One to power an openEDGE system (3 Units)

• January 2021 – Agency Certifications in process – Pilot Builds

• Q2 2021 Production Ready
ADDITIONAL INFORMATION

• Nokia Airframe application for Smart City - Norway

• Wiwynn releases EP100 System

• Asus description of their OpenEDGE server offering
  – https://www.youtube.com/watch?v=40X7Vdl1Ko8

• Microsoft Nokia collaboration on 5G and IoT

• Nokia presentation of OpenEDGE Ecosystem to Open Network Foundation

• Ericsson report on 5G – Growth Business segments
  – ..\Open Compute\OpenEdge\the-5g-for-business-a-2030-compass-report-2019.pdf
LET’S DRIVE TOWARD THE EDGE!

FOR SPECIFIC PROJECTS – CONTACT US FOR MORE DETAILS AT HGRANAT@INVENTUSPOWER.COM