

# BreadCrumb® ES1

## Portable Wireless Mesh Network Node

The ES1 is an IP67 Kinetic Mesh network device intended for use in IIoT applications and light-duty vehicles. This portable mesh network node contains two transceivers with up to four external antenna ports and provides Ethernet and Wi-Fi access point interfaces to enable data, voice, and video applications with multiple mounting options.



### BreadCrumb ES1 Key Features

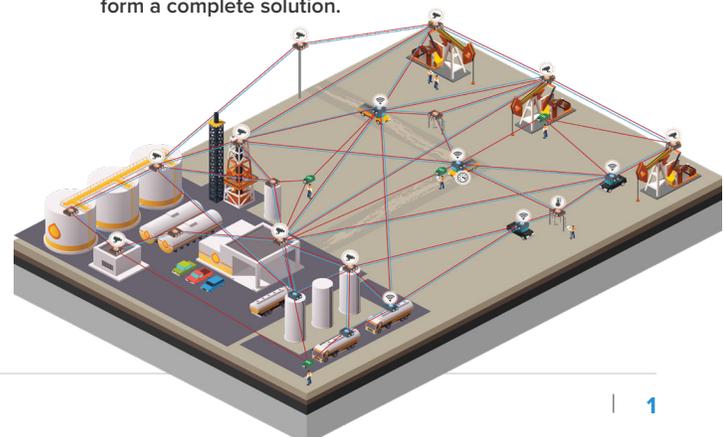
- Combines Kinetic Mesh backhaul, Wi-Fi access and layer 2 switching across interfaces in a single device
- Outdoor-rated:
  - o -40°C to +60°C (-40°F to 140°F) temperature range
  - o IP67
  - o Optional DIN rail mount kit for existing NEMA enclosures
- Rajant’s patented<sup>1</sup> InstaMesh® networking software, enables the network to quickly adapt to rapidly-deployed and quickly or constantly moving network elements
- 2.4 GHz, 4.9 GHz, and 5 GHz radio frequencies supporting a wide variety of applications and environments
- Lightweight, portable, and low power consumption
- Support for several strong cryptographic options used for data and MAC-address encryption and per-hop, per-packet authentication
- High bandwidth for data, voice, and video applications
- Scalability to hundreds of mobile, high-bandwidth nodes
- Integrated Wi-Fi Access Point service for compatibility with millions of commercial off-the-shelf (COTS) client devices such as laptops, tablets, smart phones, IP cameras, sensors, and other IP devices
- Self-configuring operation for fast and easy deployments
- Reliable and fast off-loading to Ethernet via multiple, simultaneous bridge-mode links through Automatic Protocol Tunneling (APT) feature
- Mesh Clustering to designate per-BreadCrumb sub-meshes that will only mesh with a user-specified series of nodes, useful applications include:
  - Enabling two BreadCrumbs to operate in a point-to-point (PTP) capacity on the same channel as other mesh nodes, eliminating the need to purchase a third-party PTP link for backhaul
  - Isolating one or more groups of BreadCrumbs to mesh with each other and not with other nodes outside the user-defined mesh cluster

### Utilizing ES1 BreadCrumbs to Your Advantage

The ES1 is Rajant’s mid-level BreadCrumb with the same features and reliability as our other BreadCrumbs intended for IIoT markets, including seaports, airports, oil & gas, utilities, solar, wind, smart cities, and public safety.

This commercial-grade network node not only offers reliability, performance and scalability but also security to support virtually any application, operating in outdoor environments that can utilize a less ruggedized solution. While the LX5 is recommended to build your core Rajant mesh infrastructure and the ruggedized LX5 and ME4 are recommended for the most severe environments, including deployment in extreme temperatures and on equipment with high shock and vibration, the ES1 is an excellent solution to expand coverage within your IIoT network.

**ES1 BreadCrumbs are designed to perform flawlessly in a variety of environments, such as Oil & Gas, and integrate seamlessly with all Rajant BreadCrumb models to form a complete solution.**



<sup>1</sup> U.S. Patent 8341289B2

| Model      | Description                                                                                  |
|------------|----------------------------------------------------------------------------------------------|
| ES1—2450CS | ES1 with (1) 2.4 GHz, 2x2 MIMO, 300 Mbps and (1) 4.9/5 GHz, 2x2 MIMO, 300 Mbps transceivers. |
| ES1—5050CS | ES1 with (2) 4.9/5 GHz, 2x2 MIMO, 300 Mbps transceivers.                                     |

| Wireless                            | 2.4 GHz                                                                                        | 4.9/5 GHz                                                                                                                         |
|-------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Antenna Connector                   | (2) Type N (female)                                                                            | (2) Type N (female)                                                                                                               |
| Frequency <sup>2</sup>              | 2402 – 2482 MHz                                                                                | 4940 – 4990 MHz<br>U-NII-1: 5150 – 5250 MHz<br>U-NII-2A: 5250 – 5350 MHz<br>U-NII-2C: 5470 – 5725 MHz<br>U-NII-3: 5725 – 5850 MHz |
| Modulation                          | DSSS, CCK, OFDM                                                                                | OFDM                                                                                                                              |
| Max. Physical Layer Data Rate       | 300 Mbps (throughput varies)                                                                   | 300 Mbps (throughput varies)                                                                                                      |
| Max. RF Transmit Power <sup>3</sup> | 29 dBm ± 2 dB                                                                                  | 29 dBm ± 2 dB                                                                                                                     |
| Receive Sensitivity                 | -99 dBm (@ 1 Mbps, 20 MHz channel bandwidth) to -71 dBm (@ 300 Mbps, 40 MHz channel bandwidth) | -94 dBm (@ 6 Mbps, 20 MHz channel bandwidth) to -69 dBm (@ 300 Mbps, 40 MHz channel bandwidth)                                    |

| Network & Security    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Network Functionality | VLAN and QoS support; Access Point; Bridge; Gateway; DHCP; NAT and Port Forwarding; Automatic Protocol Tunneling (APT).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Security              | <ul style="list-style-type: none"> <li>Multiple cryptographic options, including NSA Suite B algorithms (implementation not certified). For information on models with full Suite B certification, contact Rajant or your authorized Rajant partner.</li> <li>Separately configurable data and MAC address encryption via AES256-GCM, AES192-GCM, AES128-GCM, AES256-CTR, AES192-CTR, AES128-CTR, XSalsa20, XSalsa20/12, and XSalsa20/8.</li> <li>Configurable per-hop, per-packet authentication between BreadCrumbs via AES256-GMAC, AES192-GMAC, AES128-GMAC, HMAC-SHA512, HMAC-SHA384, HMAC-SHA256, HMAC-SHA224, HMAC-SHA1, and Poly-1305-AES.</li> <li>Supports IEEE 802.11i: AES-CCMP and TKIP encryption, WPA-Personal/Enterprise, WPA2-Personal/Enterprise, iPSK, 802.1x; 64/128-bit WEP; Access Control Lists; Compatible with Layer-2 and Layer-3 client/server and peer-to-peer security solutions; Compatible with Harris SecNet 54<sup>®</sup> encryption.</li> </ul> |

| Power                          |                                                    |
|--------------------------------|----------------------------------------------------|
| Input Voltage                  | 9 — 30 VDC Passive PoE                             |
| Power Consumption <sup>4</sup> | 2.8 W (average, idle); 15 W (maximum, peak) @ 24 V |

<sup>2</sup> Channel, frequency and bandwidth options vary based upon regional and local regulations and certifications.

<sup>3</sup> RF transmit power is governed by local regulations and varies by frequency.

<sup>4</sup> Power consumption depends on transceiver configuration.

| Input/Output                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ethernet</b>                | (1) 10/100/1000 Mbps IEEE 802.3, RJ-45, auto MDI/MDIX                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>USB</b>                     | USB port for firmware upgrades, and for GPS device add-on (through adapter cable)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>LED</b>                     | Status LED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Switch</b>                  | LED Configuration / Zeroize Keys and Restore Factory Defaults (through optional adapter cable)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Physical                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Dimensions</b>              | 155 mm x 149 mm x 41 mm (6.079" x 5.830" x 1.575")                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Weight</b>                  | 455 g ± 25 g (16 oz ± 0.9 oz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Temperature<sup>5</sup></b> | Ambient (operating): -40°C to 60°C (-40°F to 140°F)<br>System internal (operating): -40°C to 85°C (-40°F to 185°F)<br>Storage: -40°C to 85°C (-40°F to 185°F)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Enclosure<sup>6</sup></b>   | IP67                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Certification</b>           | FCC (US): ES1-5050CS, ES1-2450CS<br>IC (Canada): ES1-5050CS, ES1-2450CS<br>ICASA (South Africa): ES1-2450CS<br>CE mark (European Economic Area, Switzerland, and Turkey): ES1-5050CS, ES1-2450CS<br>AS/NZS 4268 (Australia): ES1-2450CS<br>IFT/NOM (Mexico): ES1-2450CS<br>Indonesia: ES1-2450CS<br>ANATEL (Brazil): ES1-2450CS<br>Saudi Arabia: ES1-2450CS, ES1-5050CS<br>Singapore: ES1-2450CS, ES1-5050CS<br>Guinea: ES1-2450CS<br>Ivory Coast: ES1-2450CS<br>Chile: ES1-2450CS, ES1-5050CS<br>South Korea: ES1-2450CS<br>Japan: ES1-2450CS<br>Senegal: ES1-2450CS<br><br>Electrostatic discharge (ESD) immunity testing compliant to EN 61000-4-2<br>Electrical fast transient (EFT) / burst immunity testing compliant to EN 61000-4-4<br>Surge immunity testing compliant to EN 61000-4-5 |
| <b>Warranty</b>                | 1 year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |



<sup>5</sup> Maximum ambient (operating) temperature may be positively or negatively influenced by power consumption, environmental and configuration factors such as but not limited to air flow, crypto encoding settings, transmit power settings and transmit duty cycle. To guarantee nominal operation of the device, both ambient (operating) and system internal (operating) temperature ranges must not be exceeded.

<sup>6</sup> Must be installed with the approved mating connectors. Ingress protection rating may be adversely affected due to exposure to direct sunlight for extended periods. Excessive shock and vibration, temperature extremes or fluctuations may void the manufacturer's warranty.