Hawk BreadCrumb®

Mobile Wireless Mesh Network Node

The Rajant Hawk BreadCrumb® is Rajant's new dual or triple transceiver, industrial-grade, high-performance BreadCrumb platform. The Hawk supports a maximum combined data rate of 5.3 Gbps and up to 6X enhanced throughput performance over existing BreadCrumbs. It offers 5G, multiple MIMO radio interfaces, high throughput, and enhanced security performance with up to 1024-QAM and 80 MHz channels.

Hawk BreadCrumb Platform Key Features

- Rajant's patented[1] InstaMesh® networking software enables the network to quickly adapt to rapidly-deployed and quickly or constantly moving network elements
- Multiple concurrent transceivers for high levels of network reliability, redundancy and diversity, and fewer problems due to interference, congestion, and equipment outages
- Up to 5.3 Gbps of physical layer data rate combined over two transceivers
- Multiple radio frequencies – 2.4 GHz, 4.9 GHz, 5 GHz, as well as military, licensed, public service, and other proprietary radio frequencies
- Multiple antenna-port configurations with 2x2 MIMO (multiple-input, multiple-output) 802.11n / 802.11ax and 4x4 MIMO 5G, substantially increasing the capacity of the system
- Support for several strong cryptographic options used for data and MAC-address encryption and per-hop, per-packet authentication
- Rugged and environmentally sealed enclosures
- High bandwidth for data, voice, and video applications
- Scalability to hundreds of mobile, high-bandwidth nodes
- Integrated 802.11n or 802.11ax Wi-Fi Access Point and client mode service for compatibility with millions of commercial off-the-shelf Wi-Fi client and access point devices such as laptops, tablets, smartphones, IP cameras, sensors, and other IP devices
- Self-forming and self-healing operation for fast and easy deployments
- Reliable and fast off-loading to Ethernet via multiple, simultaneous bridge-mode links through the Automatic Protocol Tunneling (APT) feature
- Secure connections to back-end networks using Rajant's APT and Remote Protocol Tunneling (RPT) features

Utilizing the Hawk Platform to Your Advantage

The Hawk is our high-performance BreadCrumb platform. Combined with Rajant's patented InstaMesh protocol, the Hawk is capable of integrating Kinetic Mesh wireless networks with other networks such as LTE/5G. The Hawk is part of Rajant's initiative to develop deeply integrated solutions that securely combine data from connected people, vehicles, machines, and sensors, with machine learning. This data combination unlocks the benefits of process optimization, digital twins, predictive analytics, condition-based maintenance, augmented reality, and virtual reality while improving worker safety. The Hawk is interoperable with all of our Breadcrumb models to expand market capabilities for industries like rail, shipping ports, military, mining, public safety, and heavy construction.

The Rajant FE1–2450G BreadCrumb networking device supports the 5G standard. In the FE1–2450G BreadCrumb platform, a 5G modem provides industrial-grade long-range, high-capacity, high-performance capabilities to support private and carrier-based video streaming and high bandwidth applications. Rajant introduced this platform to develop deeply integrated secure solutions that incorporate machine learning (ML).

InstaMesh and 5G capabilities combine to provide process optimization, digital twins, predictive analytics, condition based maintenance, augmented reality, and virtual reality while improving worker safety.

The Rajant FE1–2450G can interoperate with all Rajant BreadCrumb models to expand support for industrial and military markets.

[1] U.S. Patent 9,001,645

InstaMesh®

InstaMesh is the advanced, patented[1] protocol developed by Rajant that directs the continuous and instantaneous forwarding of wireless and wired connections. It enables complete network mobility, high throughput, and low latency with very low maintenance and administrative requirements. Operating at Layer 2 and not requiring a root node or LAN Controller, InstaMesh provides robust fault tolerance even if there is a connection or node outage. No matter how you configure your network, InstaMesh networking software always determines the most efficient pathway between any two points, even when those points are in motion.

Model	Description
FE1–2450 / FE1–2450A	Hawk with one 2.4 GHz, 2x2 MIMO, 300 Mbps and one 5 GHz, 2x2 MIMO, 866.7 Mbps transceivers. Up to 1.2 Gbps of data rate combined over two transceivers.
FE1–5050 / FE1–5050A	Hawk with two 5 GHz, 2x2 MIMO, 866.7 Mbps transceivers. Up to 1.7 Gbps of data rate combined over two transceivers.
FE1–2450G	Hawk with one LTE/5G NR Sub-6 4x4 MIMO, 3.5 Gbps downlink and 900 Mbps uplink, one 2.4 GHz, 2x2 MIMO, 573.5 Mbps and one 5 GHz, 2x2 MIMO, 1201 Mbps transceivers. Up to 5.3 Gbps of data rate combined over three transceivers.

Wireless	2.4 GHz (802.11ax)	4.9/5 GHz (802.11ax)	LTE/5G
Antenna Connector	(2) Type N (female)	(2) Type N (female)	(4) Type N (female)
Frequency[2]	2402 – 2482 MHz	4.9 GHz U-NII-1: 5150 – 5250 MHz U-NII-2A: 5250 – 5350 MHz U-NII-2C: 5470 – 5725 MHz U-NII-3: 5725 – 5850 MHz	5G RF Bands: 1-3, 5, 7, 8, 12-14, 18, 20, 25, 26, 28-30, 38, 40, 41, 48, 66, 70, 71, 75-79 4G LTE RF Bands: 1-5, 7, 8, 12-14, 17-20, 25-26, 28-30, 32, 34, 38-43, 46, 48, 66, 71, 106
Modulation	DSSS, OFDMA, with up to 1024-QAM	OFDM with up to 1024-QAM	OFDM with up to 256-QAM
Max. Physical Layer Data Rate	573.5 Mbps (throughput varies)	1201 Mbps (throughput varies)	5G: Downlink: 3.5 Gbps Uplink: 900 Mbps 4G LTE: Downlink: 2.9 Gbps Uplink: 200Mbps
Max. RF Transmit Power[3, 4]	30 dBm	30 dBm	26 dBm
Receive Sensitivity[5, 6]	-100 dBm (@ 1 Mbps, 20 MHz channel bandwidth) to -64 DBm (@ 573.5 Mbps, 40 MHz channel bandwidth)	-94 dBm (@ 6 Mbps, 20 MHz channel bandwidth) to -59 dBm (@ 1201 Mbps, 80 MHz channel bandwidth)	-106.9 dBm (5G Sub-6, band n76, 4 Rx)

[1] U.S. Patent 9,001,645
[2] Channel, frequency and bandwidth options vary based upon regional and local regulations and certifications.
[3] RF transmit power is governed by local regulations and varies by frequency.
[4] Transmit power tolerance is ± 2 dB
[5] Receive sensitivity tolerance is ± 2 dB
[6] Receive sensitivity criteria is less than 10% packet error rate (PER)

Wireless	2.4 GHz (802.11n)	5 GHz (802.11ac)
Antenna Connector	(2) Type N (female)	(2) Type N (female)
Frequency[2]	2402 – 2482 MHz	U-NII-1: 5150 – 5250 MHz U-NII-2A: 5250 – 5350 MHz U-NII-2C: 5470 – 5725 MHz U-NII-3: 5725 – 5850 MHz
Modulation	DSSS, CCK, OFDM with up to 64-QAM	OFDM with up to 256-QAM
Max. Physical Layer Data Rate	300 Mbps (throughput varies)	866.7 Mbps (throughput varies)
Max. RF Transmit Power[3, 4]	30 dBm	30 dBm
Receive Sensitivity[5, 6]	-100 dBm (@ 1 Mbps, 20 MHz channel bandwidth) to -76 dBm (@ 300 Mbps, 40 MHz channel bandwidth)	-94 dBm (@ 6 Mbps, 20 MHz channel bandwidth) to -68 dBm (@ 866.7 Mbps, 80 MHz channel bandwidth)

Power	
DC Power	20 — 60 VDC
PoE	IEEE 802.3at Type 2 / PoE+ or 38 — 60 VDC Passive PoE FE1–2450G: IEEE 802.3bt Type 4 / Active PoE or 38 — 60 VDC Passive PoE
Power Consumption[7]	TBD

Network & Security	
Network Functionality	VLAN and QoS support; Access Point; Bridge; Gateway; DHCP; NAT and Port Forwarding; Automatic Protocol Tunneling (APT).
Security	• 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. • 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. • 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. • 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.

[2] Channel, frequency and bandwidth options vary based upon regional and local regulations and certifications.
[3] RF transmit power is governed by local regulations and varies by frequency.
[4] Transmit power tolerance is ± 2 dB
[5] Receive sensitivity tolerance is ± 2 dB
[6] Receive sensitivity criteria is less than 10% packet error rate (PER)
[7] Power consumption depends on transceiver configuration.

Input/Output	
Ethernet	(2) M12 X-Code female connector, 10/100/1000 Mbps, IEEE 802.3, auto MDI/MDIX
USB	USB 2.0 Type A female host port for firmware upgrade, USB-based zeroize and GPS device add-on
LED	(2) Status LED
Switch	LED configuration / zeroize keys and restore factory defaults (reset) switch
PWR	M12 L-Code male connector for DC power
SIM	User-accessible SIM

Physical	
Dimensions	264.9 mm x 253.7 mm x 46.2 mm (10.43 in x 9.99 in x 1.82 in)
Weight[8]	Dual-transciever models: 2698 g ± 50 g (5 lbs 15.2 oz ± 1.8 oz) FE1–2450G: 2946 g (6 lbs 7.9 oz)
Temperature	Startup: -40 °C to +70 °C (-40 °F to 158 °F) Ambient (operating): -40 °C to +70 °C (-40 °F to 158 °F) Storage: -40 °C to +80 °C (-40 °F to 176 °F)
Enclosure	Designed for IP67 (6: Dust-tight, 7: Waterproof)
Certification	FCC (US): FE1–2450, FE1–2450A, FE1–5050, FE1–5050A, FE1–2450G (Pending) IC (Canada): FE1–2450, FE1–2450A, FE1–5050, FE1–5050A, FE1–2450G (Pending) AS/NZS 4268 (Australia): FE1–2450, FE1–2450A, FE1–5050, FE1–2450G (Pending) CE mark (European Economic Area, Switzerland and Turkey): FE1–2450, FE1–2450A, FE1–5050, FE1–5050A IFT/NOM (Mexico): FE1–2450 Peru: FE1–2450A Singapore: FE1–2450, FE1–2450A, FE1–5050, FE1–5050A ICASA (South Africa): FE1–2450, FE1–2450A, FE1–5050, FE1–5050A Philippines: FE1–2450 Chile: FE1–2450 Zambia: FE1–2450, FE1–5050 Indonesia: FE1–2450 Ivory Coast: FE1–2450 Japan: FE1–2450 Argentina: FE1–2450A Saudi Arabia: FE1–5050 EN 50155: FE1–2450G (Pending)
Warranty	1 year

[8] Weight depends on transceiver configuration

NOTE: This is a PRELIMINARY spec sheet due to pending test results.

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