

Microwave Backhaul: Competitive Landscape Assessment

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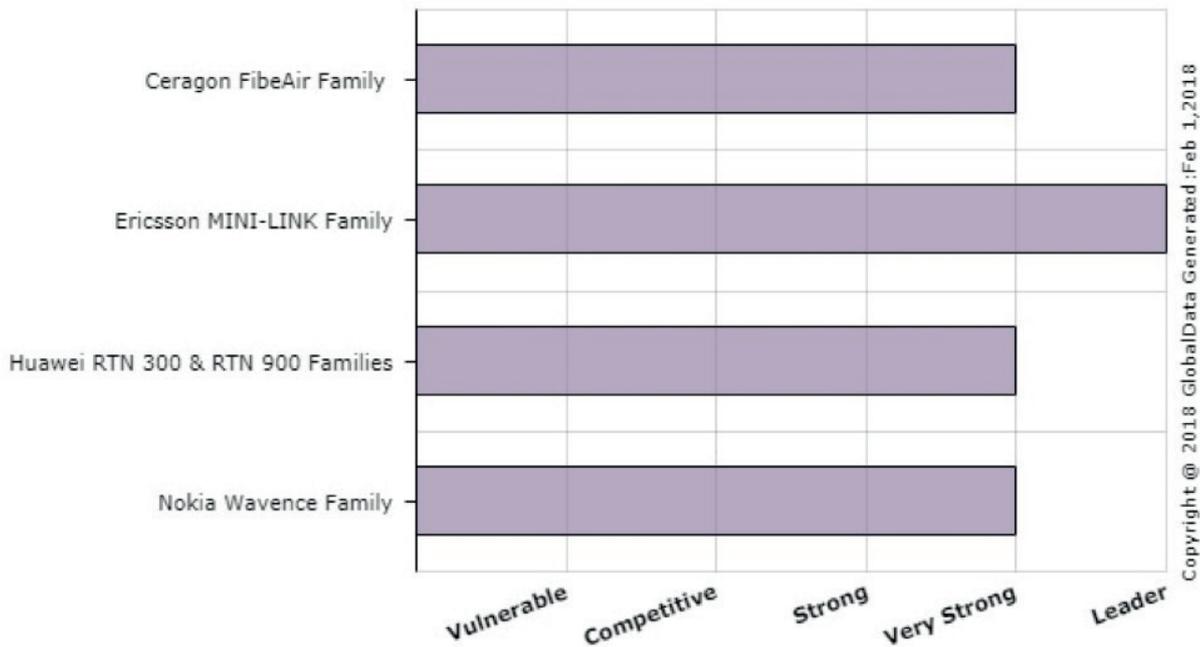
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COMPETITIVE LANDSCAPE ASSESSMENT - MICROWAVE BACKHAUL

REPORT SUMMARY

The microwave backhaul vendor landscape contracted a bit in late 2017 with the acquisition of DragonWave by a stealth-mode startup. And solutions that bond microwave with E-band links, novel last year, are now undifferentiating table stakes.

PRODUCT CLASS SCORECARD



MARKET OVERVIEW

Product Class	Microwave Backhaul
Market Definition	<p>To connect mobile base stations to the rest of the network, operators generally prefer fiber as a high-capacity, reliable medium. However, for a variety of reasons, deploying fiber to the cell site is not always cost-effective. In these cases, a common alternative has been the use of wireless connections, most often using microwave spectrum (i.e., radio signals in the traditional microwave spectrum between 6 and 42 GHz). The prospect of small-cell deployment has prompted many vendors to address the challenges of outdoor small-cell backhaul with wireless solutions, including traditional microwave backhaul and millimeter wave connections using either 60 GHz spectrum (also known as V-band) or 70 and 80 GHz spectrum, known as E-band. At the same time, E-band is also used increasingly for macrocell backhaul.</p>
Rated Competitors	<ul style="list-style-type: none"> • Ceragon • Ericsson • Huawei • Nokia
Additional Competitors	<ul style="list-style-type: none"> • Aviat Networks • Intracom Telecom • NEC • SIAE • ZTE
Changes Since Last Update	<ul style="list-style-type: none"> • In October, DragonWave was acquired by startup Transform-X, which hasn't yet publicly described its plans for the assets. • In Q4 2017, Ceragon made available two new short-haul products: the high-power, all-outdoor FibeAir IP-20C-HP and the FibeAir IP-20F split-mount edge node. • In Q4 2017, Ericsson made available a second E-band product, the MINI-LINK 6363-80, and two new long-haul products: the MINI-LINK LH SuperCompact and the split-mount MINI-LINK LH Split.

MARKET ASSESSMENT

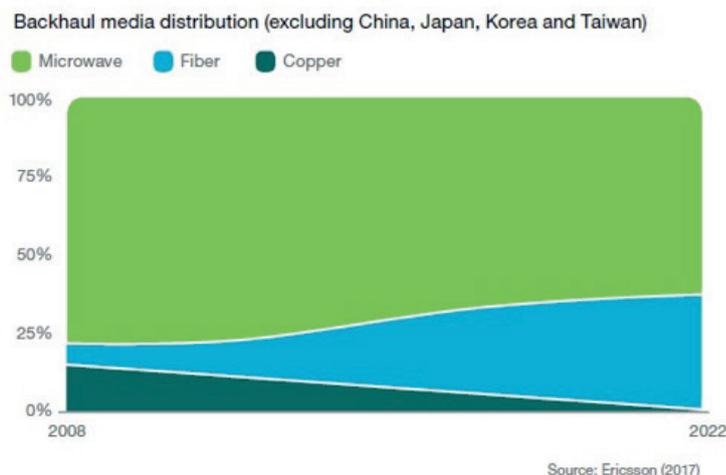
Ericsson is a leader in the microwave backhaul market. Its short-haul portfolio is highly competitive in general, but it has become more so as the market for E-band solutions has developed. Ericsson offers multiple E-band options, including high capacity and small form factors; it was also earlier than some rivals to introduce solutions for bonding E-band with traditional microwave, and it has demonstrated significant traction in the E-band market in the past 18 months. New long-haul gear doesn't move the needle much in terms of performance claims but add to one of the vendor's key strengths: a broad portfolio, not only of microwave products but also of supplemental offerings that can be used to sell end-to-end solutions.

Ceragon is very strong in the market. It continues to claim market-leading short-haul capacity, a very important metric. And it continues to expand the number of products that support its differentiating Advanced Frequency Reuse feature, offering efficiency, deployment flexibility and potential cost-savings. It hasn't been quite as strong in the burgeoning area of E-band, where its capacity claims don't stand out as much, and where it was slower than some rivals to introduce solutions that bond E-band with microwave. In general, the vendor does best when targeting operators that prefer best-in-breed solutions rather than the end-to-end solutions offered by its biggest rivals.

Huawei is very strong in the market. Perhaps its greatest strengths lie in its ability to offer broad end-to-end solutions that include in-house cell-site routers, optical gear and more. These in-house capabilities also allow for greater levels of integration, to increase efficiency - e.g., integrated routing functions or a common antenna for aggregated microwave/E-band links. But Huawei's portfolio doesn't stand out as much in terms of capacity claims or compact form factors. And rivals - especially those with new products this year - could take aim at the age of Huawei's products, one area in which Huawei's portfolio does stand out from those of its top peers.

Nokia is very strong in the market. In some respects, the company is still striving for greater momentum after having absorbed Alcatel-Lucent's portfolio and looked for ways to fully leverage the resulting breadth of assets. (The decline of DragonWave was another, albeit mild, impediment, as Nokia had resold DragonWave's products for years.) That utilization has certainly begun, as evidenced by the vendor's integration of Alcatel-Lucent's considerable IP/MPLS technology - a powerful set of assets. It has kept pace with E-band and E-band bonding trends. And it's showing the will and ability to create meaningful product-level differentiators, such as the self-configuring antenna interface modules that promise easier deployment and inventory management for operators. Still, Nokia's portfolio remains thin compared to most peers, and its capacity claims don't stand out, leaving room for it to pursue a more competitive position.

MARKET DRIVERS



- **Sluggish Operator Spending:** For years, wireless backhaul vendors, in general, have been decrying weak operator spending and the challenges of maintaining healthy margins in the face of pricing pressure, which has prompted restructurings, workforce reductions and diversification into adjacent markets, such as enterprise verticals and government entities. Ericsson estimates microwave ebbing from more than 75% of all mobile backhaul connections in 2008 to about 65% in 2022 (excluding China, Japan, Korea and Taiwan).
- **M&A:** The acquisition of DragonWave by startup Transform-X in Q4 2017 removed a player from the game, slightly easing competitive pressure and giving rivals a chance to convert DragonWave's customer base (which they've already begun).
- **5G Messaging:** Microwave backhaul vendors have already begun marketing their gear by arguing that operators need to prepare their networks for 5G migration. Most often this argument focuses on the higher capacities expected with 5G, though some vendors also cite other characteristics of their gear that align with 5G, such as low-latency or software-defined networking (SDN). Though 5G needs more time to be commercialized, vendors can argue that transport networks must be upgraded first so they don't bottleneck 5G when it arrives.
- **Regional Variance:** Some of the geographies with the highest proportions of microwave backhaul relative to fiber or other media are India, where microwave constitutes around 80% of backhaul links, as well as the Middle East, sub-Saharan Africa and Latin America, according to Ericsson. North America and China have some of the lowest percentages of microwave backhaul (roughly 20% and 5%, respectively). However, in no region is microwave's share of total backhaul links expected to grow in the next few years.
- **E-band Macrocell Backhaul:** Backhaul solutions using E-band millimeter-wave spectrum (70-80 GHz) saw a surge of activity in 2016 after Ericsson and NEC introduced solutions that allow E-band links to be aggregated with traditional microwave links. These solutions add capacity by using wide swaths of spectrum that are easily available in many countries because they are lightly licensed or unlicensed. Ericsson, for example, saw shipments of E-band gear nearly quadruple in 2016. However, this gear represented just 15% of Ericsson's short-haul radio shipments that year and an even smaller portion when long-haul products are included.
- **Small-Cell Use Case Alternatives:** Following a disappointing wait for large-scale outdoor small-cell deployments requiring wireless backhaul and (a shakeout of some small-cell backhaul players, small-cell backhaul vendors continue to pursue alternate use cases for these technologies, such as enterprise verticals. Some, such as Siklu, have even marketed their millimeter-wave gear as "5G" solutions, emulating mmWave-based fixed-wireless access gear being trialed in the U.S. and labelled "5G."

Buying Criteria

- **Short-Haul Portfolio:** Though "short-haul" is distinguished from "long-haul" by each vendor's marketing messages rather than hard-and-fast category requirements, short-haul microwave radio products are the most important part of any vendor's microwave backhaul portfolios. Vendors that promise high capacity in small form factors have the best competitive position.
- **E-Band Solutions:** Solutions that make use of 70 and 80 GHz millimeter wave have become increasingly popular in mobile backhaul in recent quarters, especially solutions that bond E-band links with traditional microwave. Solutions that promise higher capacity in smaller form factors have a competitive edge.
- **Long-Haul Portfolio:** Though not as prevalent as short-haul products, long-haul gear still represents an essential aspect of microwave backhaul portfolios and deployments. As with short-haul gear, vendors that promise high capacity in small form factors have the best competitive position.
- **Portfolio Breadth:** Vendors with broader portfolios of macrocell and small-cell backhaul products can make operators comfortable with flexible options and are better suited to meet the diverse needs of a global market. In addition, vendors that supplement their backhaul radio portfolios with other

elements - such as cell-site routers, wireline access or optical products - to offer more comprehensive end-to-end solutions can appeal to some segments of the market.

Vendor Recommendations

- **Ericsson, Huawei, Nokia & ZTE:** Argue that network slicing (a) works better and more cohesively in single-vendor end-to-end network solutions and (b) is better understood by end-to-end network suppliers than by microwave specialists like Aviat and Ceragon.
- **Ceragon, Ericsson, Huawei & ZTE:** Follow Nokia's lead in promoting its self-configuring UBT-Twin; consistently make deployment ease a significant part of both product design and messaging. In some cases, this can be more compelling than capacity claims.
- **Huawei:** Counter Ericsson's claims to offer both unsurpassed E-band capacity (with the 10-Gbps MINI-LINK 6352) and the smallest E-band form factor (the 3-L MINI-LINK 6363-80) by pointing out that Huawei's RTN 380 offers both benefits in the same product: 10 Gbps capacity in a 5-L box, for a larger capacity-per-liter than either Ericsson product.

Buyer Recommendations

- **5G Fronthaul:** Engage with microwave vendors to drive innovation around fronthaul solutions for cloud RAN and massive MIMO needs. Fiber won't be deployable everywhere that 5G will increase fronthaul needs.
- **E-Band Learning Curve:** A steep rise in E-band deployment in some regions gives operators that haven't yet deployed E-band a chance to learn from other operators' experiences. But of course, it's important to remember how differences in climate may lead to different experiences with E-band from region to region.
- **Consider Latency:** In planning transport networks for 5G, it's important to consider the latency characteristics of these network solutions more so than before (including consideration of the use of Multi-Access Edge Computing), in order to align with 5G's increased latency requirements.

PRODUCT EVALUATIONS

ProductName	Ceragon FibeAir Family
CompetitivePerspective	
ProductScores	<ul style="list-style-type: none"> • Short-Haul Portfolio: Leader • E-Band Solutions: Very Strong • Long-Haul Portfolio: Very Strong • Portfolio Breadth: Strong
OverallScore	Very Strong

Strengths	<ul style="list-style-type: none"> • Short-Haul Capacity: Ceragon’s highest capacity short-haul product, the FibeAir IP-20N (or FibeAir IP-20A in North America) promises a maximum capacity of 13 Gbps, a higher claim than any of the other three vendors makes. Higher capacities can persuade vendors that their investments can scale with increasing traffic volumes. • Advanced Frequency Reuse: This feature - added first to Ceragon’s IP-20C in late 2016 and now supported by its long-haul product and four of its short-haul products - allows operators to use common frequencies in adjacent links, enabling smaller angles between such links. This reuse of spectrum could save operators on spectrum license costs (where adjacent links would normally require separate spectrum bands) and give them greater flexibility in deploying links. • Spectral Efficiency: Ceragon’s FibeAir IP-20C short-haul product claims 2.6 Gbps of capacity in 56 MHz, implying more than 46 Mbps per MHz of bandwidth; this is the highest spectral efficiency in the product category. Higher spectral efficiency - the ratio of total capacity to bandwidth utilized - connotes greater utilization of resources, translating into greater financial efficiency.
Limitations	<ul style="list-style-type: none"> • E-Band Capacity: Ceragon’s E-band product, the FibeAir IP-20E, promises a capacity of 2.5 Gbps, a lower figure than the other three vendors in this analysis report. Though rivals report their claims relative to higher bandwidth levels (with spectral efficiencies closely in line with Ceragon’s), the claim could give rivals an advantage. • Layer 3 Support: Ceragon has plans to add IP forwarding and SDN-controlled IP routing, but, at times, has also questioned the value of Layer 3 functionality in transport network elements, arguing that carrier Ethernet is more cost-effective. That stance could put the vendor at a disadvantage against rivals touting IP/MPLS functionality, such as Huawei and Nokia. • Supplemental Products: Ceragon is the only vendor in the class that doesn’t offer in-house cell-site routers, wireline access or optical products (the other four offer at least one of those three product types), opting instead to rely on other vendors for these products. Supplemental backhaul solutions can help vendors provide more comprehensive, or turnkey, offerings and allow for greater product integration, which promises more cost-effective design and simpler supplier relations.
ProductName	Ericsson MINI-LINK Family
CompetitivePerspective	
ProductScores	<ul style="list-style-type: none"> • Short-Haul Portfolio: Very Strong • E-Band Solutions: Leader • Long-Haul Portfolio: Strong • Portfolio Breadth: Leader
OverallScore	Leader

Strengths

- **E-band Options:** Ericsson's two E-band products -- the MINI-LINK 6352 and MINI-LINK 6363-80 -- offer, respectively, unsurpassed (though not unmatched) capacity of 10 Gbps and the smallest form factor among E-band products analyzed here. Especially since most rivals only offer one E-band product, Ericsson's ability to provide two options that each represent market-leading performance should satisfy a diverse set of operator priorities.
- **Portfolio Breadth/Diversity:** With 14 products spanning short-haul and long-haul applications as well as indoor, outdoor and split-mount architectures, Ericsson's wireless backhaul portfolio is broader than any rival. The fact that many of those products were introduced in the last two years (three in the last six months) also speaks to the vibrancy of the portfolio. In addition, multiple versions of its products (e.g., the compact version of its LH or the E-band version of the 6363) adds further diversity. Vendors with broad, diverse portfolios are better equipped to meet a range of market needs.
- **Fronthaul Solution:** Ericsson is the only one of the four vendors analyzed here to actively market a microwave (technically E-band millimeter wave) solution with fronthaul as its primary function: the Fronthaul 6392 product. As 5G and Cloud RAN trends pick up, wireless fronthaul solutions will find more demand. With a putatively fronthaul-optimized (CPRI-based) product, Ericsson has positioned itself well for this opportunity.

Limitations

- **Long-Haul Capacity:** Ericsson's MINI-LINK LH long-haul product claims a maximum capacity of up to 8 Gbps using XPIC, a claim that is surpassed by most of the other vendors in this analysis. Though vendors often report capacity without clarifying the assumptions undergirding their claims, competitors could use these basic capacity claims to entice operators and undermine the impact of Ericsson's new long-haul products.
- **Link Aggregation Support:** Ericsson says the MINI-LINK LH supports two eight-link aggregation groups, with up to four radio links per group but a total of eight aggregated links possible. This puts the vendor with Ceragon at the bottom of market claims. Higher-link aggregation capabilities - especially prized in long-haul networks - promise operators flexibility in the capacity and number of links per site.
- **Long-Haul Spectral Efficiency:** The MINI-LINK LH promises 689 Mbps in either 56 MHz (ETSI version) or 50 MHz (ANSI version). That implies about 11 to 12 Mbps per MHz - figures that sit near the bottom of market claims. Higher spectral efficiency - the ratio of total capacity to bandwidth utilized - connotes greater utilization of resources, translating into greater financial efficiency.

ProductName

Huawei RTN 300 & RTN 900 Families

CompetitivePerspective

ProductScores

- **Short-Haul Portfolio:** Strong
- **E-Band Solutions:** Very Strong
- **Long-Haul Portfolio:** Strong
- **Portfolio Breadth:** Leader

OverallScore

Very Strong

Strengths

- **E-Band Solutions:** Huawei's RTN 380 E-band product claims a capacity of 10 Gbps, an unsurpassed claim among E-band products. Two such products used together can enable 20-Gbps links in a single channel. In addition, the RTN 380H, a version of the RTN 380, allows E-band links to be bonded with traditional microwave links for hitless switching and protection; and an evolution of that Super Dual Band solution introduced in early 2017 allows that bonding using a single antenna, potentially saving costs. High capacity ensures operators that their infrastructure investments can keep up with ever-rising traffic volumes.
- **Supplemental Products:** Huawei offers a broad range of supplemental, non-radio backhaul products for end-to-end solutions that not all competitors can match. It offers multiple cell-site routers (the ATN 905 series and PTN 960, 950 and 910), a fixed access PON product (the MA5694S) and optical transport products (the OSN 1800, 3800, 6800, 8800 T16 and 9800 U16). Supplemental backhaul solutions can help vendors provide more comprehensive, or turnkey, offerings and allow for greater product integration, which promises more cost-effective design and simpler supplier relations.
- **Integrated Layer 3 Functions:** Huawei's RTN 900 series products contain integrated Layer 3 functions for dynamic routing and QoS traffic engineering, including Layer 3 traffic forwarding in the X2 interface, which promises lower latency and greater network efficiency. Though the current level of demand for Layer 3 functionality that is integrated in microwave backhaul radio products as opposed to separate boxes may be a debatable topic, Huawei's capabilities are rare among microwave specialist competitors and take advantage of its broad expertise beyond microwave radio.

Limitations

- **Short-Haul Capacity:** Huawei's short-haul products claim a maximum capacity of 2.4 Gbps (without bonded E-band links), a claim that is surpassed by all three of the other vendors assessed here. Though vendors tend to make capacity claims using a variety of underlying assumptions, these basic claims can be used to entice operators into a more detailed exploration of a vendor's solutions. In general higher capacities promise operators a greater ability to handle ever-increasing traffic volumes - especially relevant in the runup to 5G networks.
- **Form Factor & Mass:** The physical bulk of some of Huawei's products may be a concern for operators. The vendor's RTN 980, although not as widely deployed as Huawei's other products and typically positioned for aggregation sites, is by far the largest and heaviest of the short-haul products we examined. And Huawei's smallest E-band product, the 5 L RTN 380, is larger than the other three vendors' smallest E-band products. Heavy, bulky products can add labor costs to installation and raise real estate rental fees at deployment sites in addition to raising questions about the vendor's engineering prowess.
- **Product Age:** Huawei's portfolio has aged in some areas to an extent that competitors might exploit. Most of its short-haul products have been around since 2007, the newest debuting in 2015. And its newest E-band product (excluding its Super Dual Band solution, which combines existing gear) has been available since mid-2016, while all three rivals have introduced new or updated E-band gear in 2017. This could leave Huawei vulnerable to rival claims that it has been leapfrogged and isn't continuing to invest in innovation.

ProductName Nokia Wavence Family

CompetitivePerspective

ProductScores

- **Short-Haul Portfolio:** Strong
- **E-Band Solutions:** Very Strong
- **Long-Haul Portfolio:** Strong
- **Portfolio Breadth:** Very Strong

OverallScore Very Strong

Strengths

- **Routing Integration:** Nokia offers solutions that integrate in-house IP/MPLS routing and microwave radio functionality in the same physical unit. That integration offers potential space savings and simplified management without sacrificing functionality. Nokia's in-house IP routing capabilities stand up very well to rivals' best-of-breed routing partners. Combined with claims of Carrier SDN support and Nokia's QoS Engine -- which prioritizes traffic and dynamically routes it to the appropriate microwave channel - the result is a compelling intelligent-networking story.
- **Deployment Flexibility Features:** Nokia's UBT-Twin offers antenna interface modules, separate from the radio hardware, which provide generic support of different sub-bands, allowing auto-configuration and simplifying deployment, maintenance and inventory management.
- **In-House Supplemental Offerings:** Nokia has a much broader portfolio of in-house supplemental backhaul solutions than any of the competitors examined here, with the possible exception of Huawei. In addition to cell-site router offerings -- including the 7705 Service-Aware Router (SAR) and the 7210 SAS -- Nokia also offers multiple wireline access products and optical transport solutions. Supplemental backhaul solutions can help vendors provide more comprehensive, or turnkey, offerings and allow for greater product integration, which promises cost-effective design and simpler supplier relations. They can also give vendors another foot in the door with operators that can be leveraged to sell microwave backhaul solutions.

Limitations

- **Short-Haul Capacity:** Nokia's UBT-Twin claims a maximum capacity of 2.5 Gbps (without bonded E-band links), a claim surpassed by most of the other competitors listed in this report. Though vendors tend to make capacity claims using a variety of underlying assumptions, these basic claims can be used to entice operators into a more detailed exploration of a vendor's solutions. In general higher capacities promise operators a greater ability to handle ever-increasing traffic volumes - especially relevant in the runup to 5G networks.
- **Long-Haul Capacity:** Nokia's MPT-HL claims a maximum capacity of more than 1.4 Gbps, a claim that is exceeded by all three of the competitors in this analysis. Though vendors' capacity claims are often based on differing assumptions (and not all of the vendors have clarified the conditions undergirding their claims in this area), vendors can use these basic claims to entice operators and provoke more detailed discussions of their solutions' capabilities.
- **Backhaul Radio Portfolio Depth:** Nokia offers fewer macrocell backhaul radio products than the other competitors examined here. Its three dedicated short-haul products are dwarfed by rival portfolios with seven to 11 products. This limited depth gives operators fewer options, allowing rivals to claim greater flexibility in, and commitment to, addressing the diverse needs of a global market.

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