ABI RESEARCH COMPETITIVE RANKING

MOBILE ANTENNA VENDORS

Rosenberger

OVERALL: 70.1 | INNOVATION: 69.2 | IMPLEMENTATION: 71.0 | RANK: 4

OVERALL COMPETITIVE RANKINGS

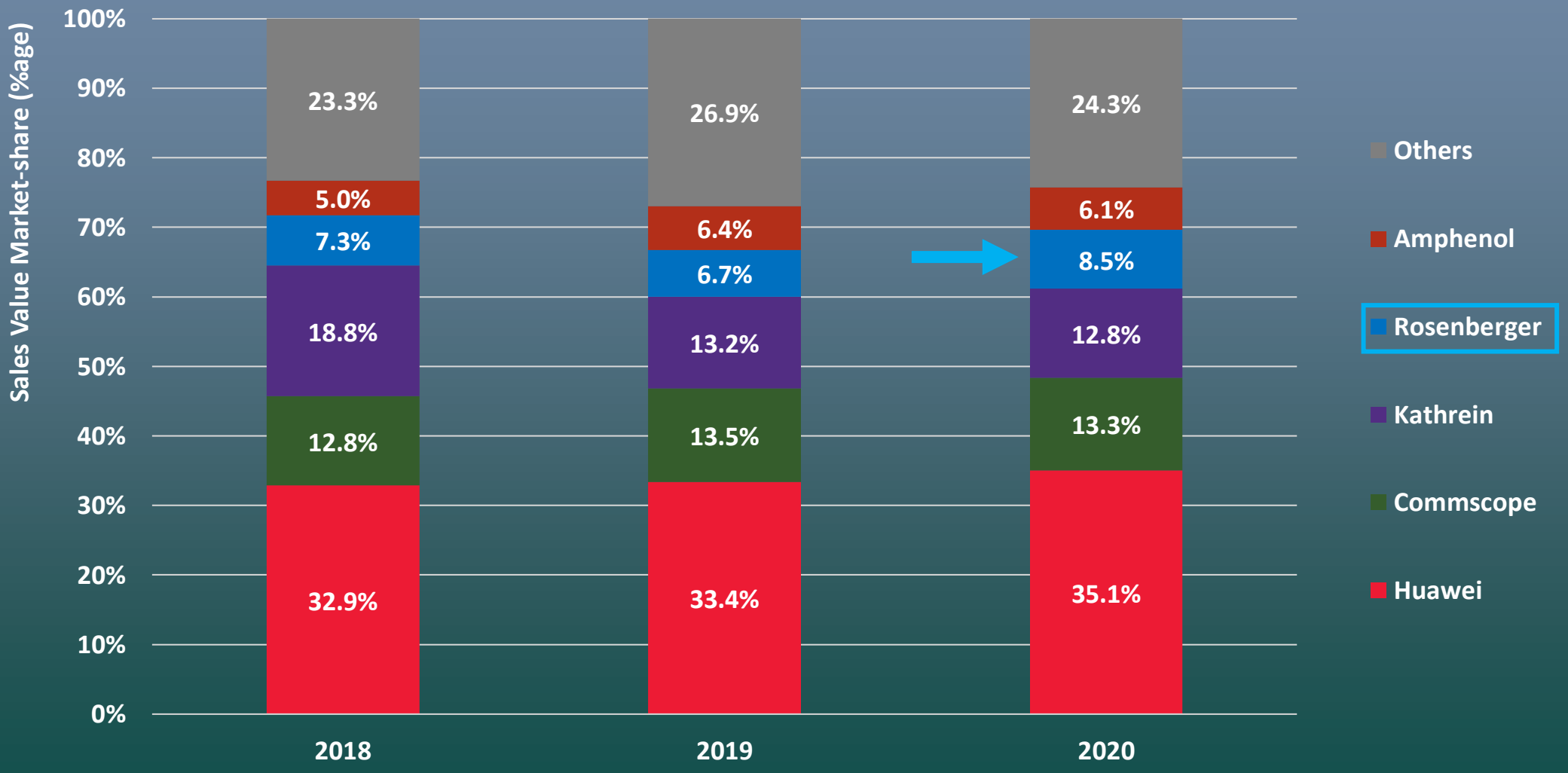
LEADERS		
HUAWEI	1	85.0
COMMSCOPE®	2	76.2

MAINSTREAM		
KATHREIN	3	73.9
Rosenberger	4	70.1
Amphenol ANTENNA SOLUTIONS	5	62.7

FOLLOWERS		
RFS RADIO FREQUENCY SYSTEMS	6	59.5
Comba	7	58.1
ACE Technologies	8	56.8
MOBI 摩比	9	50.1
DENGYO	10	47.3
TONGYU COMMUNICATION	11	44.0
HENGXIN TECHNOLOGY 亨鑫科技	12	38.3

MARKET SHARE RANKING

PASSIVE BASE STATION ANTENNA REVENUE, WORLD MARKETS, 2018 TO 2020



2020 MARKET SHARE & VENDOR RANKING

In 2020, the total market for the passive base station antenna amounted to US$3.37 billion. This represents a decrease of approximately 13% year-on-year, when compared to US$3.87 billion in 2019. The passive base station antenna market faced disruption in 2020 with the increased emphasis on active antenna for the 5G mobile network and the impact from COVID-19 pandemic.

Market-share Analysis

In 2020, Huawei remained number one in the market share ranking with CommScope in 2nd place. While Kathrein holds 3rd place, Rosenberger has increased its market-share to close the gap with the top 3 vendors and is secure in its 4th place. Amphenol overtook Ace Technologies to take 5th place.

Only Huawei and Rosenberger has managed to increase their percentage market-share by more than 1% in 2020.

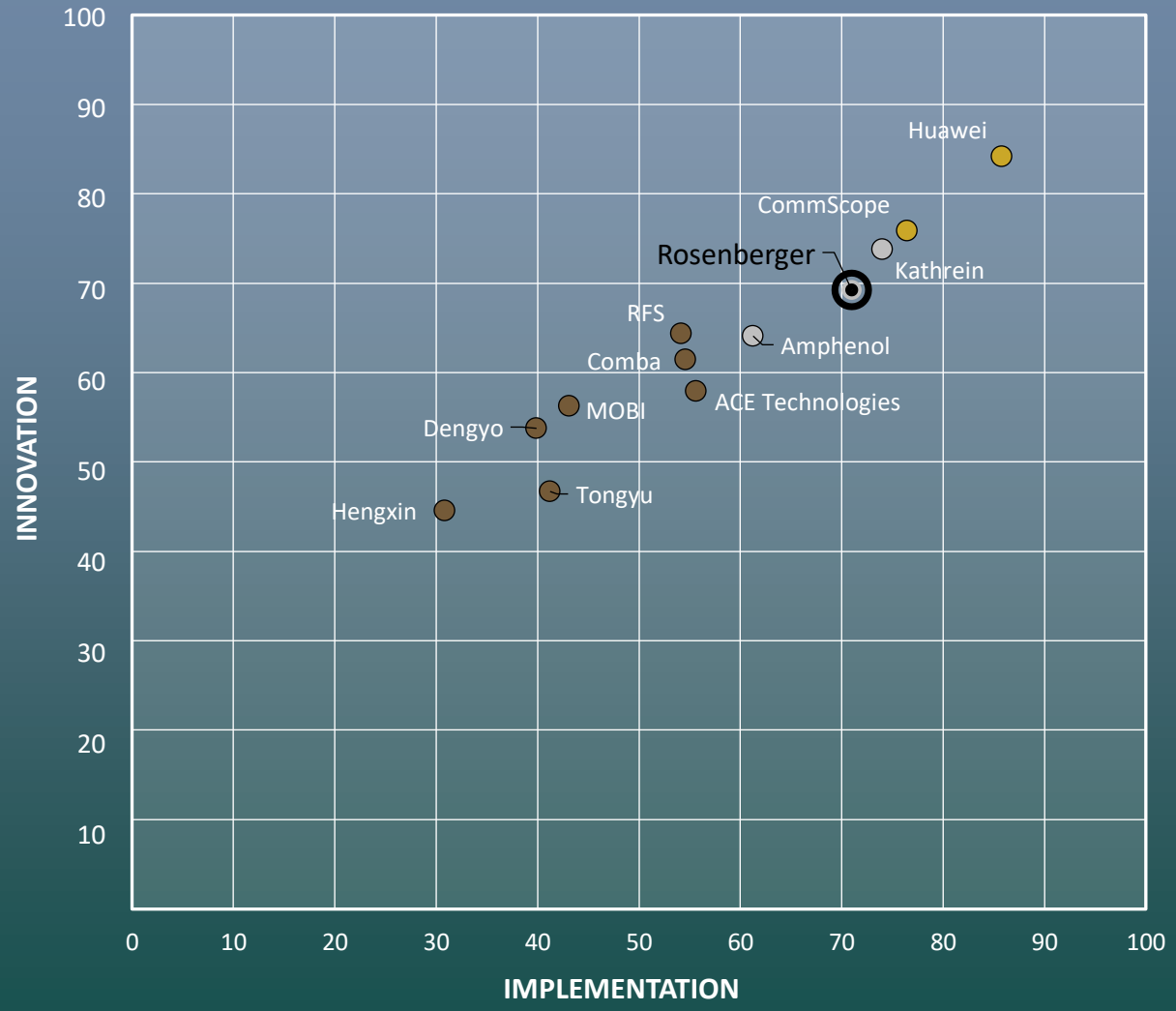
Vendor Matrix

The **Vendor Matrix**, which evaluates the **Innovation** and **Implementation** capabilities of the vendors, based on the 2020 data has undergone a recalibration. This recalibration is intended to capture the momentum towards 5G mobile infrastructure readiness. The top four vendors in the Vendor Matrix rankings were Huawei, CommScope, Kathrein and Rosenberger. Rosenberger's score for the Vendor Matrix has improved as they expanded their antenna portfolio and increased their market-share.

Rosenberger

Innovation & Implementation Vendor Matrix

ROSENBERGER ranks in 4th place in the **Innovation** vs **Implementation** Vendor Matrix Assessment



INNOVATION

Rosenberger

INNOVATION SCORE: 69.2

Rosenberger was founded in 1958 in Germany. The company currently employs around 11,300 employees worldwide, with about 2,300 employees in its headquarters in Fridolfing, Germany. Rosenberger has also been awarded the BAYERNS Best 50 by the German state of Bavaria which accredit the company's future viability. Rosenberger's innovation score comes in at 83.3 for 2020.

Multi-band Capabilities: 19.5/30

Multi-band capabilities is one of the important criteria for innovation score, Rosenberger scored a good 19.5 points out of 30. The company's multi-band antennas run from a single band up to penta-deca bands configurations providing frequency coverage from the 600 MHz to 3.8 GHz. These antennas are also equipped with field-exchangeable RET systems which help with adjusting the tilt angle of the antenna without climbing up the tower.

Ultrawide-band Capabilities: 22.0/30

In terms of ultrawide-band capabilities, Rosenberger scored a high 22.0 points out of 30. Rosenberger's ultrawide-band antennas come in various hexa-band and nona-band covering for example the 1,427-2,690 MHz. At the same time, improvement is in the roadmap for these products to cater to varying demands by mobile operators. For example, expanding the ultrawide band capability into more products for the low band.

Essential IP & R&D: 17.3/25

Rosenberger scored a good 17.3 points out of 25 for essential IP & R&D. The company has embarked and seen results from their R&D. For example, the company introduced it patented technology to achieve superior azimuth pattern performance and beam isolation. This is important as it improves the performance of the antenna. Other innovations such as reduction in the width of the base station antenna and improving the performance through introduction of new design elements for its antenna products. Globally, Rosenberger has 10 R&D centers with 5 located in Asia Pacific.

Antenna Configuration & Maintenance: 10.4/15

Wind load is perennial concern and challenge for mobile operators. Rosenberger has also innovated in this field to reduce the amount of wind load faced by an antenna by up to 50%. This is achieved by improving on the design of the antenna's radome with aerodynamics considerations. In addition, Rosenberger has introduced its patented end cap design to delay the separation point between the wind flow and the antenna.

IMPLEMENTATION

Rosenberger

IMPLEMENTATION SCORE: 71.0

Overall Antenna Sales Market Share: 30.0/45

In 2020, Rosenberger ranked 4th in ABI Research's Market Share Ranking 2020 with 8.5%. This is an increase of more than 1% from 2019, which made it one of only two antenna vendors to increase their market-share by more than 1% in 2020. This has resulted in Rosenberger scoring a high 30.0 points for its overall antenna sales market share for 2020.

Antenna Sales Regional Geographical Penetration: 15.8/20

Rosenberger scored a 15.8 points out of 20 for this criteria. The company is well established in Asia Pacific region and have footprint in Middle East, Africa, Europe, and the Americas. Rosenberger has also been expanding its market outreach to emerging markets in 2020 as compared to 2019.

Rosenberger has a global outreach for its antenna business and a sizable amount of it is from the Asia Pacific region, Europe, and the Middle East. The company has also extended its reach into the Latin American market with the aid of its offices in Brazil and Chile. As of 2020, The Rosenberger Group operates globally with 22 manufacturing locations and 10 R&D centers with sales offices in more than 70 different countries.

Major Antenna Customer Contract Wins: 11.3/15

Rosenberger has won new customers in the emerging markets with its well-balanced performance to cost products. The company also supplies its base station antenna products to some of the largest mobile operators by subscribers or by annual revenue globally.

In the Asia Pacific region, for example, Rosenberger has showcased multiple solutions for different deployment scenarios. For example, the requirement is different for city and non-city in terms of capacity, cost, and physical site constraints. The company has also deployed antenna solutions for FDD-LTE at various frequencies (850 MHz, 1.8 GHz, 2.3 GHz) to improve the overall system capacity.

IMPLEMENTATION

Rosenberger

IMPLEMENTATION SCORE: 71.0

Financial & Organizational Health: 3.3/5

Rosenberger antenna product line, is part of the larger Rosenberger Group with an annual revenue of approximately USD 1.47 billion (1.2 billion Euro) in 2019. The Group has also expanded its production capacity with 4 new plants in Germany, Mexico and India in 2019. In addition, Rosenberger has been a stable and increasing revenue from its antenna product line over the years. Rosenberger is therefore expected to be in a good financial position with a score of 3.3 points out of 5.

Vendor's Antenna Portfolio: 10.6/15

Rosenberger has an extensive product portfolio for base station antennas which includes multi-port, multi-band, multi-beam, TDD+FDD hybrid antennas. For example, its multi-port solution ranges from 2 to 30 port count and can support all sub 2.7 GHz bands in a single antenna. In 2020, Rosenberger further expanded its antenna portfolio to provide support for the 5G frequency bands (e.g., 3.5 GHz band and the 600 MHz band). The portfolio allows Rosenberger to meet the global demands for LTE, LTE-Advanced, and 5G technologies. Rosenberger has also innovated on solution such as the Active + Passive platform to provide flexibility to mobile operators for their 5G rollout. As such, the company obtained a good 10.6 points out of 15.

CRITERIA AND METHODOLOGY

VENDOR MATRIX

Methodology: After individual scores are established for innovation and implementation, an overall company score is established using the Root Mean Square (RMS) method:

$$Score = \sqrt{\frac{innovation^2 + implementation^2}{2}}$$

The resulting overall scores are then ranked and used for percentile comparisons.

The RMS method, in comparison with a straight summation or average of individual innovation and implementation values, rewards companies for standout performance.

For example, using this method, a company with an innovation score of 9 and an implementation score of 1 would score considerably higher than a company with a score of 5 in both areas, despite the mean score being the same. ABI Research believes this is most suitable as the goal of these matrices is to highlight those companies that stand out from the others.

In 2020, the "Active Antenna Capability" criterion has been removed to ensure the focus of the report will be primarily on the passive base station antenna. The "Active Antenna Capability" weighted at 20 points is redistributed with 10 points for "Essential Intellectual Property" and R&D, and 5 points each to "Ultra-Wideband Capabilities" and "Antenna Configurability and Maintenance" respectively.

RANKING CRITERIA

Leader: A company that receives a score of **75 or above** for their overall ranking

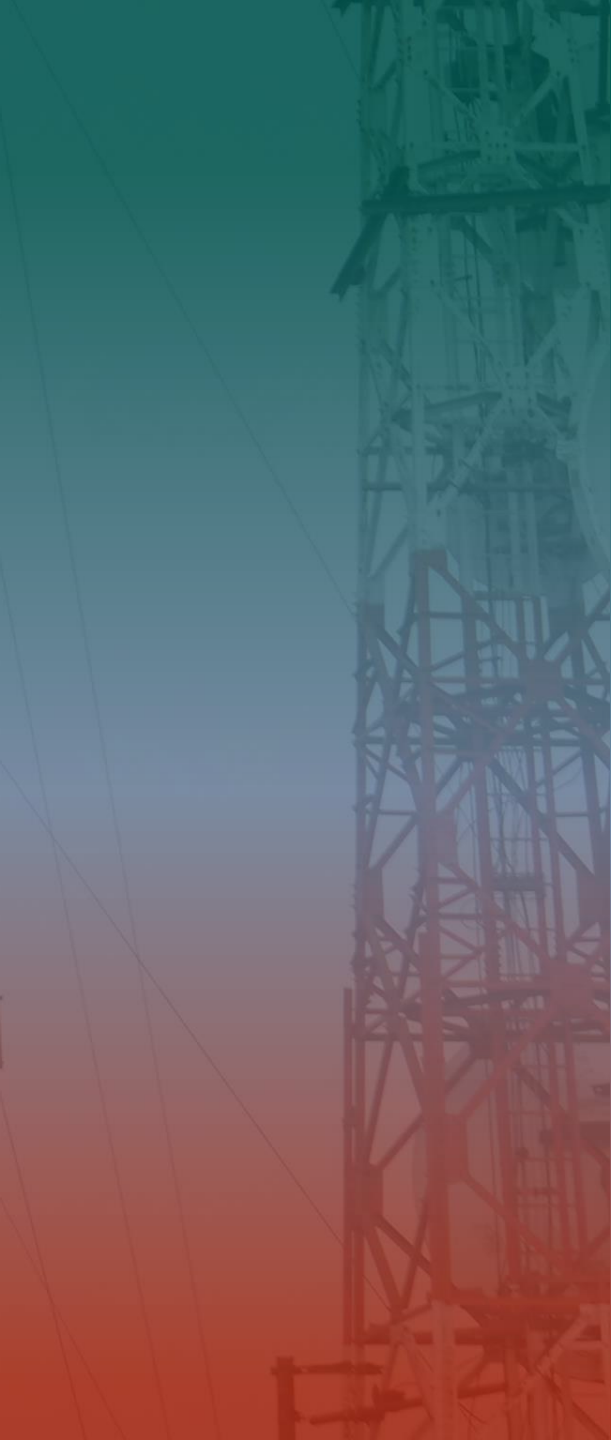
Mainstream: A company that receives scores **between 60 and 75** for their overall ranking

Follower: A company that receives a score of **60 or below** for their overall ranking

Innovation Leader: A company that receives a score of **75 or above** for their innovation ranking.

Implementation Leader: A company that receives a score of **75 or above** for their implementation ranking.

Note: The scores for the vendors have been recalibrated in 2021 published report to capture the momentum towards 5G mobile networks. Therefore, the chart has been "recentered" to be able to evaluate the future trajectories of antenna vendors as 5G matures and 4G becomes a decreasing part of the market.



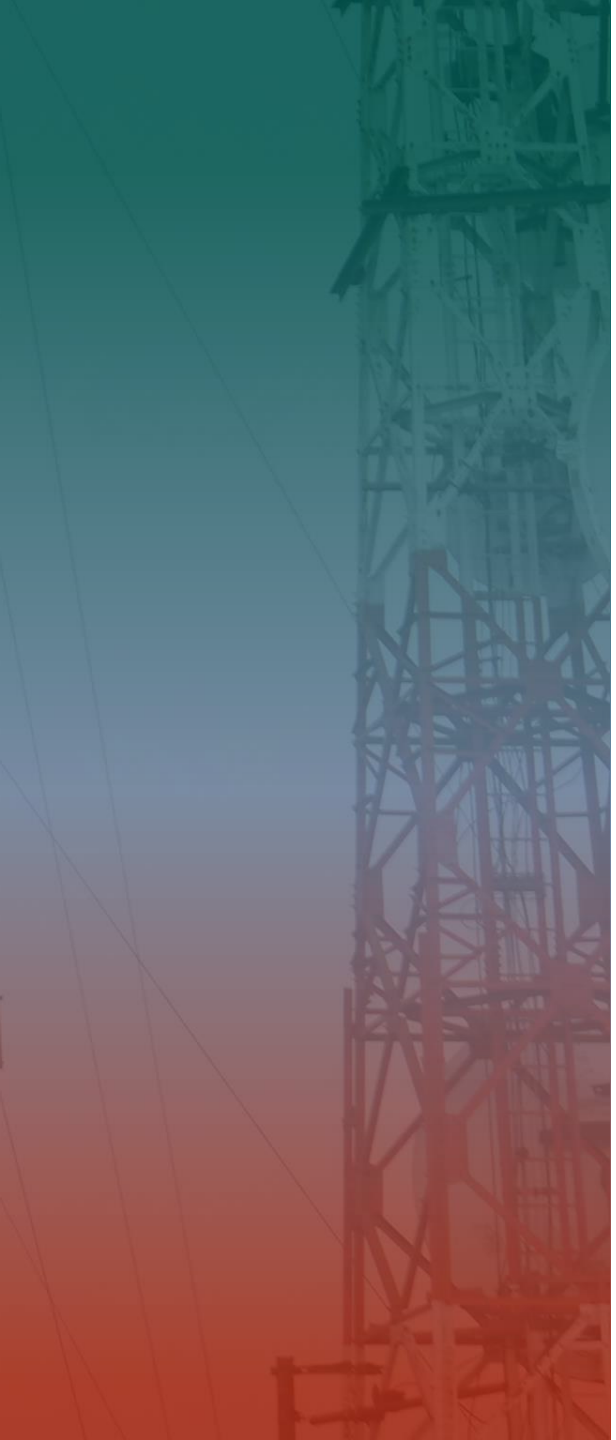
INNOVATION CRITERIA

Multi-Band Capabilities: Degree of support for multi-band capabilities, but also needs to deliver high gain and coverage. This criterion is given a weighting of 30 out of 100 points.

Ultra-Wideband Capabilities: How extensive is the vendor's antenna support for ultrawideband capabilities, while also supporting high gain and coverage? This criterion is given a weighting of 30 out of 100 points.

Essential Intellectual Property and R&D: Level of intellectual property, also factors in collaborative partnerships, and quality of the antenna design and manufacturing process. This also encapsulates innovations which the company released to improve on product performance. This criterion is given a weighting of 25 out of 100 points.

Antenna Configurability and Maintenance: Degree of maintenance, quality of materials and components to resist downtime of antenna, and simplicity of configuration, Self-Organizing Network (SON) and Remote Electrical Tilt (RET). This criterion is given a weighting of 15 out of 100 points.



IMPLEMENTATION CRITERIA

Overall Antenna Sales Market Share: The greater the market share in terms of revenue, the better the ranking. This criterion is given a weighting of 45 out of 100 points.

Antenna Sales Regional Geographical Penetration: Partly based on sales presence in each global region. Also, the more regions the vendor's clients are in, the better the ranking. This criterion is given a weighting of 20 out of 100 points.

Financial and Organizational Health: Based on the size of overall firm sales and operating margin. Tries to assess how robust the vendor is to shocks and to fund internal needs, such as R&D, regional distribution, channel expansion, etc. This criterion is given a weighting of 5 out of 100 points.

Major Antenna Customer Contract Wins: Weights based on significant clients. Major player decisions often reassure/guide small operators. Operators have a herding instinct. This criterion is given a weighting of 15 out of 100 points.

Vendor's Antenna Portfolio: Range of portfolio. Does the portfolio support all the protocols, have a wide range of spectrum bands, and competitive pricing? This criterion is given a weighting of 15 out of 100 points.

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