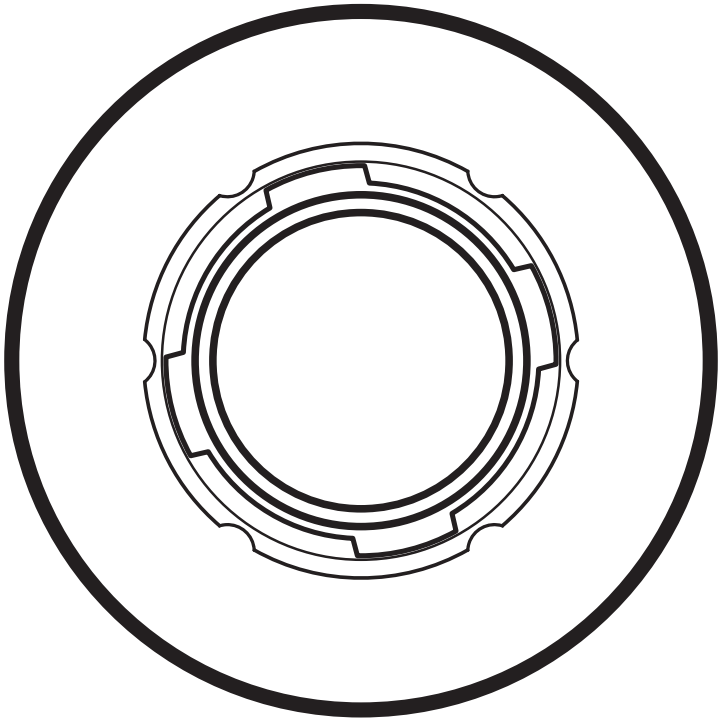


RF ELEMENTS®

Technology for fast, sustainable wireless.

Grow Smart. Reject Noise. Save Spectrum.

Wireless Broadband

High-speed internet evolved into a necessity in our modern world and lifestyle. The perpetual growth of the wireless industry is driven by an endless demand for more and more bandwidth worldwide. Wireless technology leveraging unlicensed frequency bands can deliver fiber speeds at a fraction of the cost and deployment time of fiber. It looks like a perfect match. But there is one major problem with spectrum availability:

THE PROBLEM: RF POLLUTION

The RF pollution problem is caused by an almost endless amount of RF noise created by today's poorly designed and deployed gear. Noise is usually the result of RF signals that travel too far, in unwanted directions, or with wrong signal timing. This massive amount of noise is a consequence of millions of radios deployed over the last decade with zero respect for sustainability.

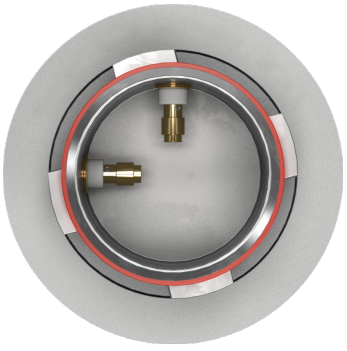
The party is wild and continues to this day - the whole industry still behaves very irresponsibly. WISPs are still deploying poorly designed, outdated gear in unsustainable ways, creating wireless networks that will never work as they should. Without a solution to the massive RF pollution problem, the Wireless Renaissance will never happen on the expected scale.

THE SOLUTION: RF ELEMENTS® TECHNOLOGY

RF elements® delivers technology for fast and massively scalable wireless networks. We address the issue of RF pollution, proper use of spectrum, and sustainable growth. Our unique approach to the problem makes RF elements® technology excel at rejecting the noise, eliminating RF loss, and enabling massive scalability of wireless networks.

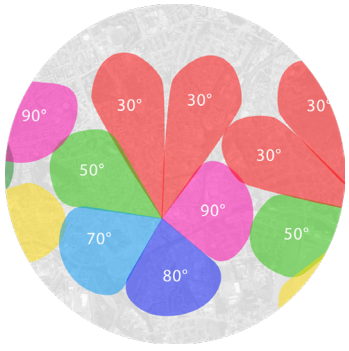
NOISE REJECTION

RF elements® horn antennas have no side lobes, which makes them immune to RF noise. Horns are the market leader in performance, cost, and spectrum efficiency.



ZERO LOSS

TwistPort™ is RF elements' proprietary waveguide connector with no RF cables and virtually zero loss. Installation of radio is ridiculously easy - just "twist and lock."



MASSIVE SCALABILITY

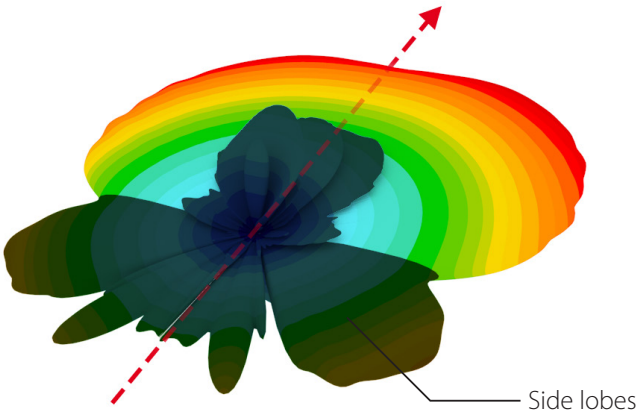
RF elements® products enable deployment of more sectors with higher density effectively multiplying the throughput of your network at no premium cost!

Noise Rejection

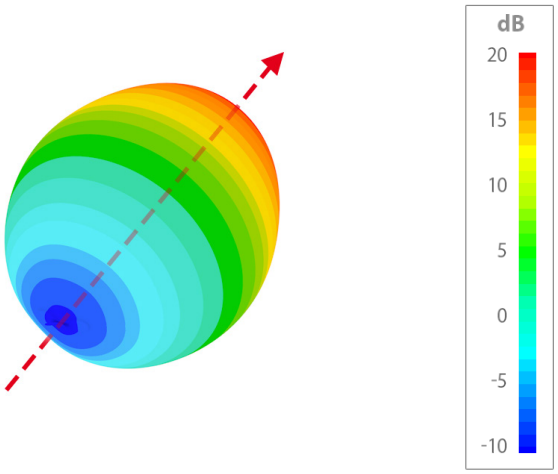
Our approach to the problem of RF pollution is logical and simple, yet truly unique. Instead of using complex and expensive methods, such as active filtering or GPS synchronization, we focus on the fundamentals of signal propagation to deal with excess noise. Instead of adding techniques to mask or filter its consequences, we remove the source of the problem, unlike our competitors. The approach of RF elements® dwells in cleaning the air, instead of inventing a better filter for a gas mask.

Our revolutionary antennas are based on Horn antenna technology re-invented for today's complex challenges. Our horns are the market leader in performance, cost, and spectrum efficiency. The noise rejecting features give our horns unique positioning and define a new class of wireless performance in a highly competitive market.

Competitor's Sector Antenna - radiation pattern

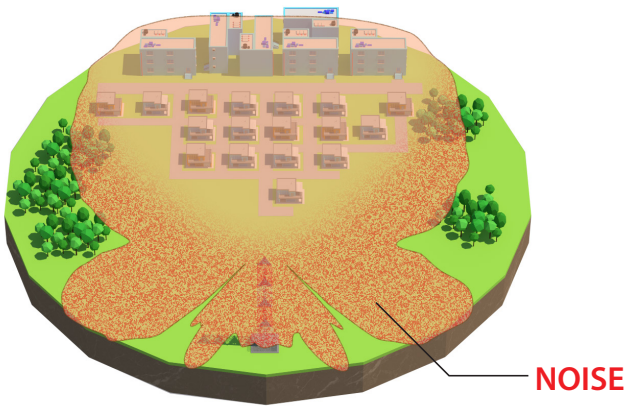


Symmetrical Horn TP Antenna - radiation pattern



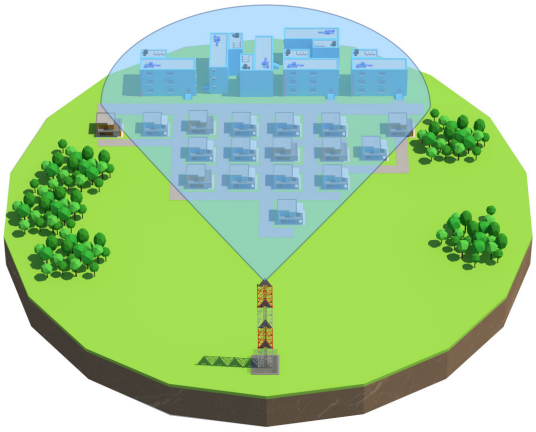
RF elements® Symmetrical Horn Antennas have no side lobes, they focus energy into one main beam. The problem of noise is directly related to antenna side lobes - an unavoidable feature in most competitive products. Symmetrical Horn TP Antennas behave differently, receiving no signal outside of their main beam.

Competitor's Sector Antenna



AP THROUGHPUT:

RF elements® Symmetrical Horn Antenna

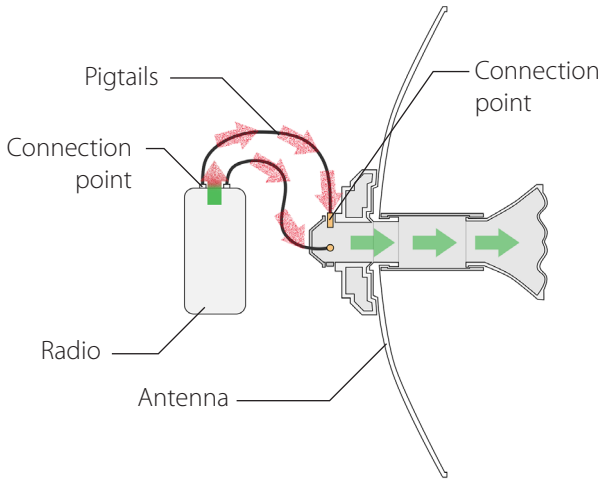


AP THROUGHPUT:

Zero Loss

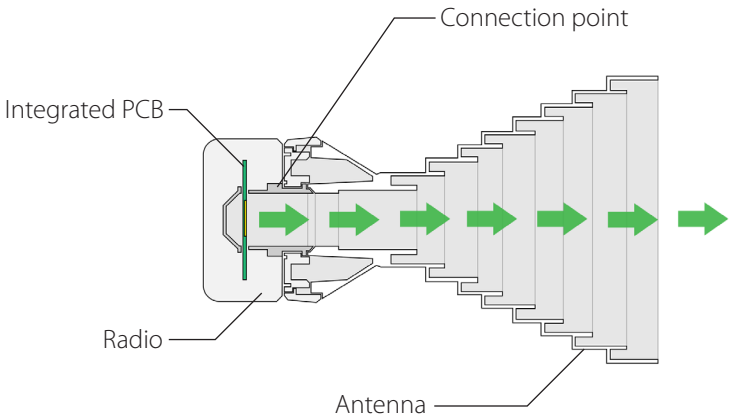
There are two key components to deal with to achieve superior wireless performance: Noise rejection and RF loss. The main cause of RF signal loss is the delivery of the signal from the radio to the antenna, and other system blocks. Typically, the signal travels via coaxial cable with connectors introducing loss due to the physics of transitions and cable loss. Our proprietary TwistPort™ waveguide connector has no cables or other coaxial components. It uses a waveguide to transport the RF signal from the radio to the antenna. Compared to the market standard, such as RP-SMA coaxial connectors, TwistPort™ is practically lossless. It is also remarkably durable and extremely easy to use. Connecting the radio is brilliantly simple - "twist and lock" - done with one hand!

Current industry standard



RF LOSS

RF elements® technology

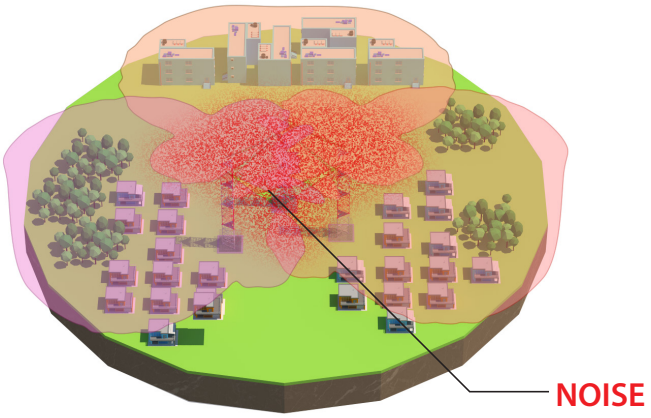


LOSSLESS

Massive Scalability

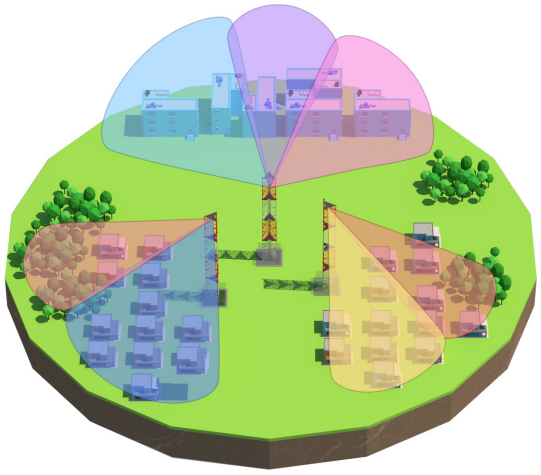
Increasing network granularity is impossible with common wireless equipment. Due to the low RF noise rejection and high loss distribution network, the common wireless equipment is incapable of delivering the performance matching todays' needs.
Solving the biggest problems - the RF noise and loss, we tap into a whole new paradigm of wireless networking. Deploying more sectors with higher customer density, WISPs can meet the increasing demands of customers on throughput. Increasing the granularity of the network is a real option at no premium - something WISPs have been dreaming about forever.

Competitor's Sector Antennas



NETWORK THROUGHPUT:

RF elements® Symmetrical Horn Antennas



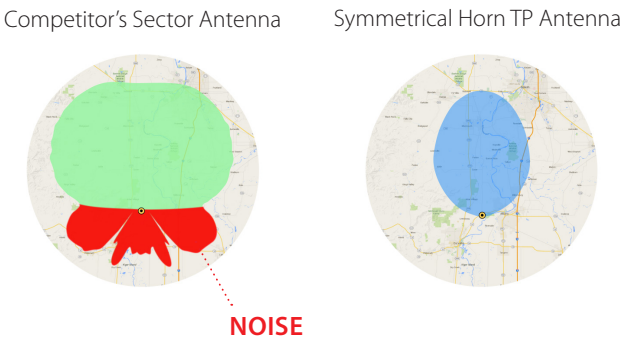
NETWORK THROUGHPUT:

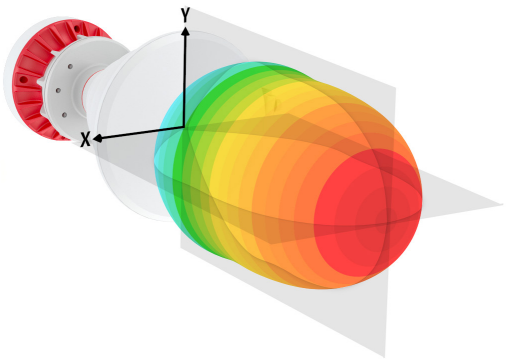
SYMMETRICAL HORN TP ANTENNAS

Symmetrical Horn TP Antennas are scalar horns with symmetrical radiation pattern and game-changing TwistPort™ (TP) connector. Deployed since 2014, they solve major weaknesses of mainstream sector antennas and provide excellent noise rejection, increased throughput, and network scalability. Approved by tens of thousands of installations all around the globe, RF elements® Symmetrical Horn TP Antennas are the new standard for fast and sustainable wireless.

Symmetrical Beam Pattern

Symmetrical Horn TP antennas have unique properties and shape of the main beam. Its cross-section is circular: the azimuth and elevation beamwidths are identical, so the null zone is covered much easier. The gain and the radiation pattern is stable over the whole bandwidth of operation.



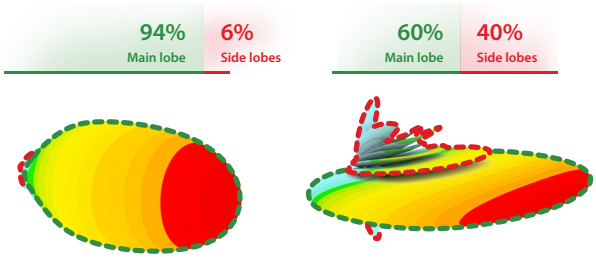


Excellent Noise Rejection

Symmetrical Horn TP Antennas have no side lobes, they focus energy into one main beam. The problem of noise is directly related to antenna side lobes - an unavoidable feature in most competitive products. Symmetrical Horn TP Antennas behave differently, receiving no signal outside of their main beam.

Zero Loss

Symmetrical Horn TP Antennas feature our industry-changing TwistPort™ connector, a quick-locking waveguide port. TwistPort™ is virtually lossless: there are no coaxial RF connectors or RF cables that would cause significant signal loss. Connecting radios can be done with one hand - "twist and lock."



Symmetrical Horn
BE = 94%

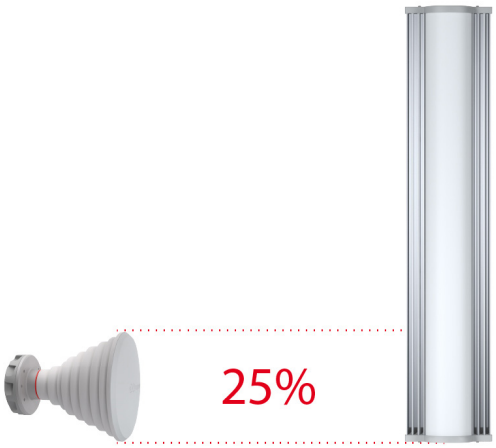
Patch Array
BE = 60%

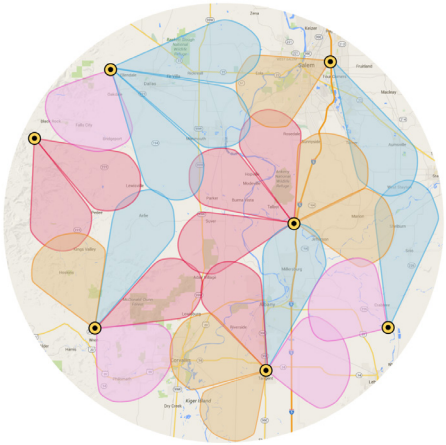
Beam Efficiency

A quantitative measure of side lobes is Beam Efficiency (BE). It is a ratio of energy in the main lobe to the total energy an antenna radiates. Thus, BE can have values from 0 - the worst case, to 100 - the best case. The higher the BE is the fewer side lobes an antenna has. Symmetrical Horns have BE between 90 to 94 %, being only 6 - 10 % short of perfection. Traditional patch array sectors have BE on the order of 60 %, making 40 % of the signal they transmit and receive noise. Symmetrical Horns are superior to traditional patch arrays in terms of noise rejection.

Compact Size

Symmetrical Horn TP Antennas are very compact, with only 20-25 % footprint of traditional sector antennas. This compact size saves tower rental fees, and makes it possible to install Symmetrical Horn TP Antennas in places where regular sectors would not be allowed due to their shape and size.



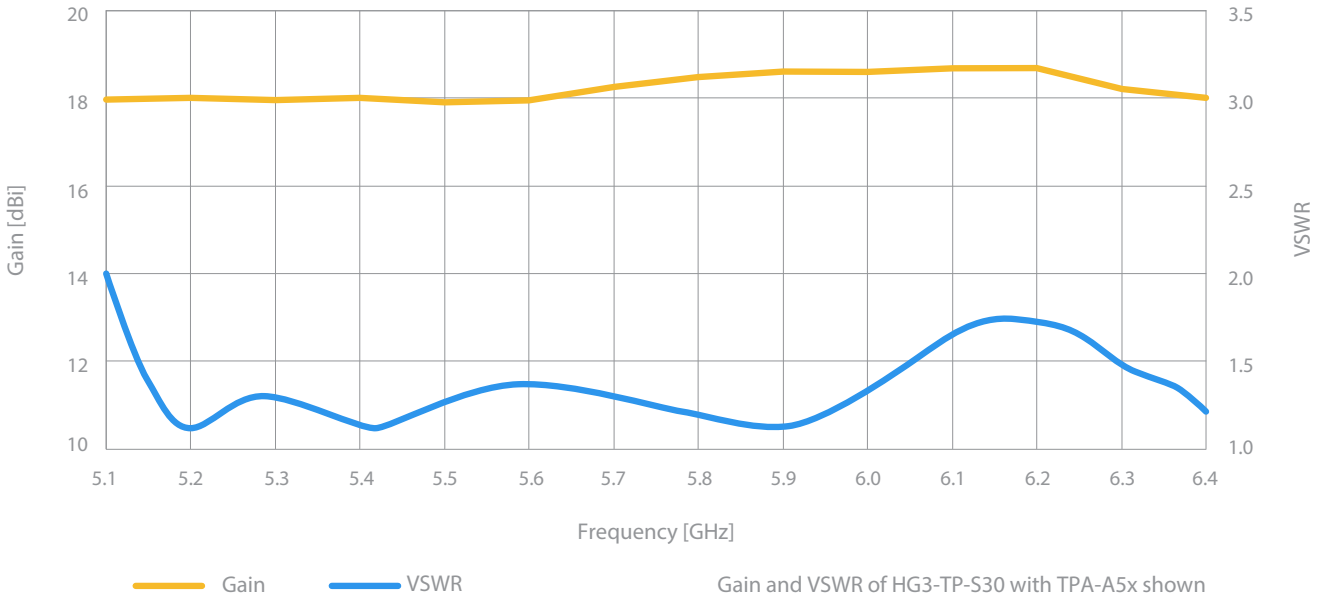


Breakthrough Scalability

Symmetrical Horn TP Antennas bring breakthrough scalability options to wireless networks. Excellent noise rejection and co-location characteristics allow for a higher density of sectors than traditional sector technology. Symmetrical Horn TP Antennas come with precise beamwidth angles ranging from 30 to 90 degrees, with 10-degree steps.

Excellent Gain Stability Across Spectrum

Symmetrical Horn TP Antennas cover an ultra-wideband spectrum: 5180-6400 MHz!



Gain and VSWR of HG3-TP-S30 with TPA-A5x shown

Models

5 GHz
6 GHz

30° Sector
Gain: 18.4 dBi
Beam Efficiency: 94 %
Product ID: HG3-TP-S30
MSRP: 149.00 USD

40° Sector
Gain: 16.2 dBi
Beam Efficiency: 93 %
Product ID: HG3-TP-S40
MSRP: 145.00 USD

50° Sector
Gain: 14.3 dBi
Beam Efficiency: 92 %
Product ID: HG3-TP-S50
MSRP: 140.00 USD

60° Sector
Gain: 13.2 dBi
Beam Efficiency: 90 %
Product ID: HG3-TP-S60
MSRP: 140.00 USD

70° Sector
Gain: 11.5 dBi
Beam Efficiency: 94 %
Product ID: HG3-TP-S70
MSRP: 140.00 USD

80° Sector
Gain: 10.4 dBi
Beam Efficiency: 94 %
Product ID: HG3-TP-S80
MSRP: 140.00 USD

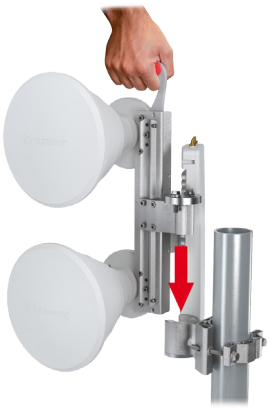
90° Sector
Gain: 9.6 dBi
Beam Efficiency: 92 %
Product ID: HG3-TP-S90
MSRP: 140.00 USD

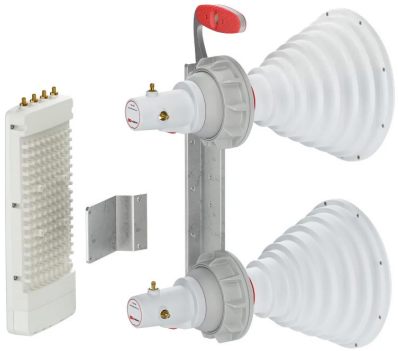
Twin Horn Bracket
Product ID: THB
MSRP: 90.00 USD

TWIN HORN BRACKET

Twin Horn Bracket allows you to install any two Symmetrical Horn antennas with exactly the same alignment. The bracket also accomodates mainstream 4x4 radios, such as Cambium ePMP™ 3000 or Mimosa® A5c. High density sectors or 4x4 deployments are now ingeniously simple.

Double the sector density to 4x4 MiMO setup by attaching two Symmetrical Horn antennas to the Twin Horn Bracket. The bracket ensures that they are aimed in the same direction without any special alignment tools. The Twin Horn Bracket comes with two default options for radio installation: **Cambium Networks™ ePMP™ 3000, ePMP™ 4600** and **Mimosa® A5c.**





Easy mounting

The bracket holds two horn antennas and the radio, allowing for easy assembly on the desk or bench and speeds up the climbers work significantly. The comfortable handle makes it easy to carry the bracket around or clip to a harness to haul up the tower. The completely new bracket allows for simple two step pole installation. First install the pole mount, then hang the assembled bracket. Align. Task completed.

Optional Radio Mount

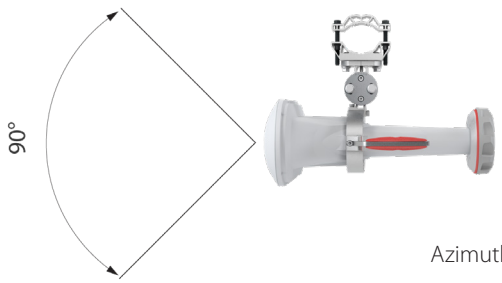
THB also provides integrated mounting option for 4x4 radios available on the market, such as Cambium™ ePMP™ 3000 and Mimosa® A5c. The radio and antennas are integrated on the same structure, enabling easy installation in the field. Radio mount is detachable, so the THB can be used with any 3rd party radio that is mounted separately.

ASYMMETRICAL HORN TP ANTENNAS

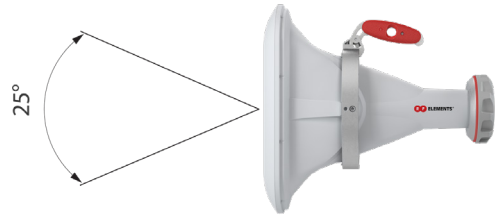
Asymmetrical Horn TP Antennas are scalar horns with an elliptical cross-section of the main beam and game-changing TwistPort™ (TP) connector. Complementing the successful range of Symmetrical Horn Antennas, they complete the toolbox of a modern WISP. Asymmetrical horns address major weaknesses of mainstream sector antenna technologies and provide an excellent noise rejection, network scalability, and increased throughput.

Parameter	30° Sector	60° Sector	90° Sector
Gain	20.5 dBi	17 dBi	16 dBi
Azimuth Beamwidth (-6dB)	H 30° / V 30°	H 60° / V 60°	H 90° / V 90°
Elevation Beamwidth (-6dB)	H 20° / V 20°	H 25° / V 25°	H 25° / V 25°
Frequency Range	5180 - 6000 MHz	5180 - 6000 MHz	5180 - 6000 MHz
Beam Efficiency	95 %	95 %	90 %
Product ID	AH2030-TP	AH60-TP	AH90-TP
MSRP	360.00 USD	360.00 USD	360.00 USD

FEATURES



Azimuth



Elevation

Asymmetrical Beam Performance

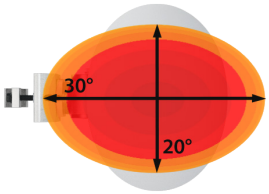
Asymmetrical Horn TP Antennas have unique properties and beam shape. The cross-section of the beam is elliptical - elevation beamwidth is narrower than azimuth beamwidth. The asymmetry of the antenna body results in higher gain compared to the Symmetrical Horn Antennas of the same azimuth beamwidth. The additional gain and elliptical beam shape are useful for rural deployments with customers spread out far and wide.

*AH90-TP displayed

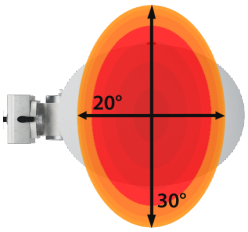
BeamSwitch™ Feature

Optional Mounting Solution

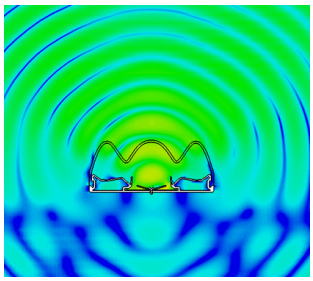
The 30-degree beamwidth Asymmetrical Horn comes with BeamSwitch™ feature. Swapping the position of the handle and bracket, the Asymmetrical Horn has 20 degrees azimuth and 30 degrees elevation beamwidth. BeamSwitch™ enables wider application range of the Asymmetrical Horn and helps you respond to the changing requirements on the go.



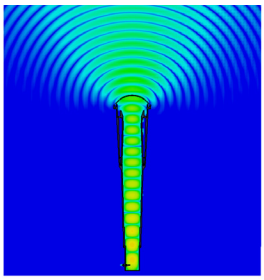
30° Azimuth Beamwidth



20° Azimuth Beamwidth



Mainstream patch array sector



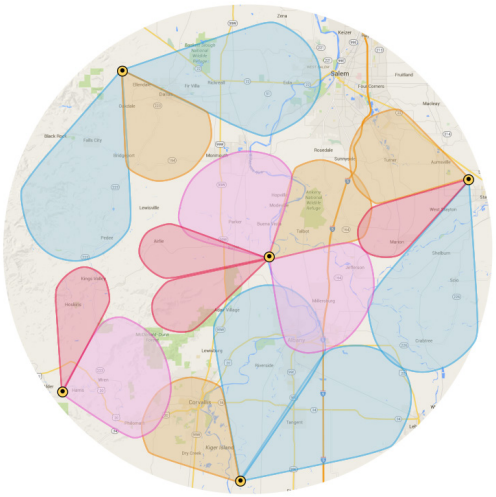
Asymmetrical Horn TP antenna

Excellent Noise Rejection

Asymmetrical Horn TP Antennas have zero side lobes. They focus the energy into a single main beam. As a result, radio collects and transmits significantly less noise compared to mainstream sector antennas based on patch arrays. The issue with noise is a direct result of antenna side lobes. Asymmetrical Horn TP Antennas behave differently. They are practically "deaf" outside the main beam.

Breakthrough Scalability Expanded

RF elements® Horn TP Antennas enable breakthrough scalability of wireless networks. Unique beam performance and co-location properties permit a greater density of sectors than traditional sector technology. Asymmetrical Horn TP Antennas expand the toolbox of any WISP, completing the pool of Symmetrical Horns and UltraHorn™. The asymmetrical radiation pattern is ideal for rural deployments and flat to mildly hilly landscapes.



Zero Loss

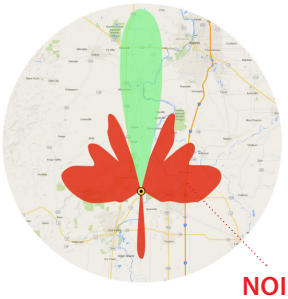
Asymmetrical Horn TP Antennas feature our industry-changing TwistPort™, a quick-locking waveguide connector. TwistPort™ is virtually lossless - radios based on our reference design have no coaxial connectors or cables that would cause signal loss. Connecting a radio is brilliantly simple, "twist and lock" done with one hand!

ULTRAHORN™ TP

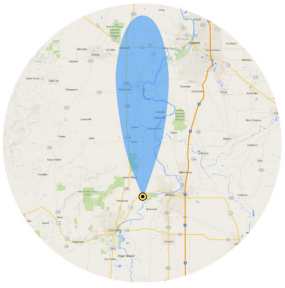
UltraHorn™ TP is a high-gain scalar horn antenna. It offers all the benefits of a scalar horn - superb noise rejection, lossless radio connection, and symmetrical beam with no side lobes. The unique properties make UltraHorn™ excellent long-distance link antenna for high noise environments. With 99 % Beam Efficiency, UltraHorn™ is the best antenna in terms of noise rejection on the WISP market.

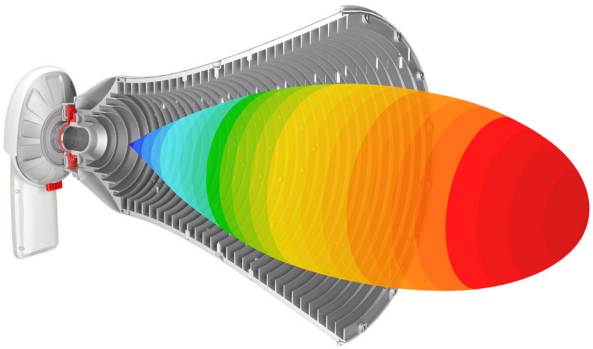
5 GHz
6 GHz

Competitor's PtP Antenna



UltraHorn™ TP



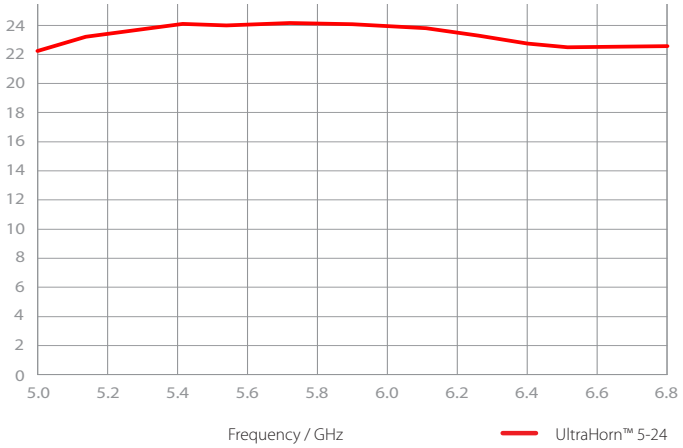


Ultimate Noise Rejection

UltraHorn™ TP Antenna does not have side lobes which enables noise rejection. Sidelobe radiation is a direct cause of the noise: radios transmit and receive interference to/from an unwanted direction at the same time. Side lobes of most mainstream antennas are enormous, at times almost half the gain of the main lobe having a huge impact on overall performance. UltraHorn™ TP Antennas receive a negligible amount of noise enabling flawless performance in noisy environments.

Unique beam without side lobes

UltraHorn™ TP Antenna is exceptionally directional: it focuses all of the signal energy into a single main beam without any side lobes. Frequency stability of the radiation pattern of UltraHorn™ TP Antenna ensures unprecedented performance of long-distance links in the high noise environment. Optimal beamwidth makes aiming naturally simple compared to the competitive antennas.

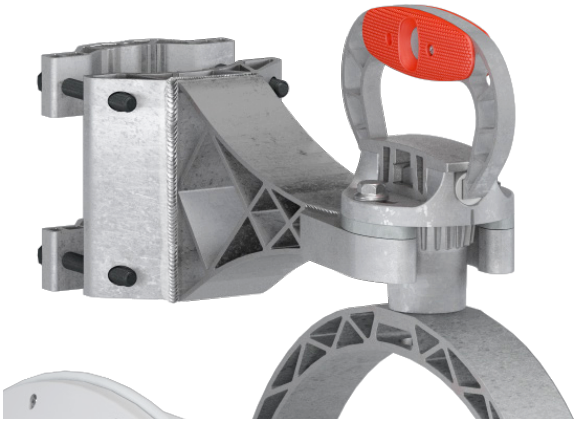


Zero Loss

UltraHorn™ TP Antenna features industry-changing TwistPort™, our quick-locking waveguide connector. Lack of coaxial connectors and cables makes TwistPort™ virtually lossless. The connection of radio is brilliantly simple, "twist and lock" done with one hand!

High Gain

UltraHorn™ TP Antenna comes with surprisingly high gain of 24 dBi. Combined with narrow beamwidth and no sidelobes, UltraHorn™ TP Antennas deliver amazing performance compared even to competitive products with a higher gain.



No Accessories Needed

UltraHorn™ TP Antenna is a complete solution - no need to spend more money on radomes or shrouds. No expenses for additional shielding which is anyway ineffective, nor burdening the tower. UltraHorn™ TP Antenna has everything, simply buy appropriate TwistPort™ Adaptor for your radio and mount. That's it!

Innovative Mounting System

UltraHorn™ TP Antenna features our innovative mounting system that makes antenna installation an easy task. The mount is a part of the package. Install the bracket on the tower first and then slide on the antenna. Adjustment for precise aiming is quick and easy as well.

Parameter	UltraHorn™ TP 5-24
Gain	24 dBi
Azimuth/Elevation Beamwidth -6 dB	H 16° / V 15°
Frequency Range	5180 - 6775 MHz
Front-to-back Ratio	40 dB
Beam Efficiency	99 %
Product ID	UH-TP-5-24
MSRP	499.00 USD

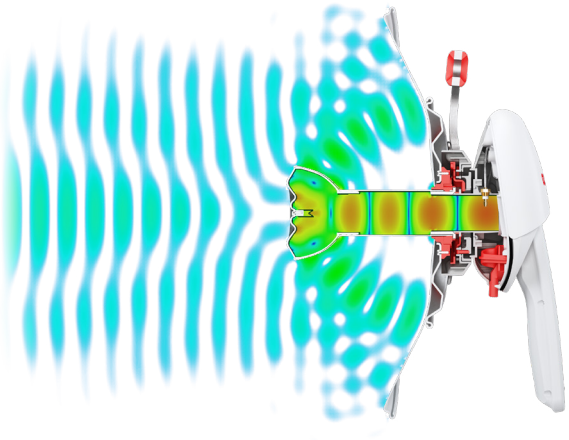
ULTRADISH™ TP ANTENNAS

UltraDish™ TP Antennas are high gain parabolic dish antennas for 5 GHz and 6 GHz unlicensed networks. Highly directional UltraDish™ Antennas have suppressed side lobes for ultimate performance. Great stability of the radiation pattern and gain ensure flawless point to point or CPE connection. UltraDish™ TP Antennas feature our proprietary TwistPort™ - practically lossless waveguide connector that is extremely easy to work with. UltraDish™ TP Antennas are built from high quality materials and the mounting system provides high attachment reliability and wind resistance.

5 GHz

6 GHz

Parameter	UltraDish™ TP 21	UltraDish™ TP 24	UltraDish™ TP 27
Gain	21.2 dBi	24.4 dBi	27.5 dBi
Azimuth Beamwidth -6dB	H 14° / V 13°	H 12° / V 11°	H 10° / V 9°
Elevation Beamwidth - 6db	H 13° / V 14°	H 11° / V 12°	H 9° / V 10°
Frequency Range	5180 - 6775 MHz	5180 - 6775 MHz	5180 - 6775 MHz
Front-to-Back Ratio	28 dB	35 dB	37 dB
Beam Efficiency	30 %	40 %	61 %
Product ID	UD-TP-21	UD-TP-24	UD-TP-27
MSRP **(2-PACK)**	220.00 USD	260.00 USD	345.00 USD



Suppressed Sidelobes

UltraDish™ TP Antennas have suppressed side lobe radiation reducing the interference and enabling installation in areas with high noise levels. The gain of UltraDish™ TP Antennas is achieved by focusing the signal delivered via the TwistPort™ connector.

Zero Loss

TwistPort™ connector is virtually lossless: there are no coaxial connectors or cables that can cause significant loss. Compared to widely used coaxial cables and connectors, the loss of TwistPort™ is almost unmeasurable.

Radome Cover

High quality radome protects the UltraDish™ TP 27 from weather elements and decreases the wind load of the antenna. Radome is made of high-quality UV-resistant plastic and stainless steel. A drain hole on the bottom ensures any condensed water will leak out.

Radome Cover for UltraDish™ TP 27
Product ID: RC27-10PACK
Compatible Antenna: UD-TP-27
MSRP (10-PACK): 780.00 USD

Innovative Mounting System

UltraDish™ TP Antennas feature an innovative mounting system. The mount is separate from the antenna which makes the installation simple and quick. First, install the bracket on the pole and then slide the UltraDish™ TP Antenna onto it. Adjustment is also easy and quick.

TPA TWISTPORT™ ADAPTORS

TwistPort™ Adaptors make the most popular connectorized radios compatible with any TwistPort™ antenna. TwistPort™ Adaptors allow easy integration with Ubiquiti Networks® MikroTik™ RouterBOARDs™, Cambium Networks™, and Mimosa® radios.

Attachment and installation of a radio is easy:

1. Slide it into the connector interface of the TwistPort™ adaptor and push down until you hear a 'click'.
2. Insert the adaptor into antenna TwistPort™.
3. Rotate clockwise until you hear a 'click' - and the radio is installed.

1.

2.

3.

TPA Models

TwistPort™ Adaptor for PAF
Product ID: TPA-PAF
Compatible radios: UBNT™ Rocket® Prism 5AC, Rocket® Prism 5AC Gen2, airFiber® 5X, airFiber® 5X-HD, LTU™ Rocket
MSRP: 55.00 USD

TwistPort™ Adaptor for IsoStation™
Product ID: TP-ADAP-IS
Compatible radios: UBNT® PrismStation™ 5AC, IsoStation™ 5AC, IsoStation™ M5
MSRP: 20.00 USD

TwistPort™ Adaptor for Rocket AC
Product ID: TPA-R5AC
Compatible radios: UBNT® Rocket® 5AC-Lite
MSRP: 35.00 USD

TwistPort™ Adaptor for Rocket M5
Product ID: TPA-RM5
Compatible radios: UBNT® Rocket® M5
MSRP: 35.00 USD

TwistPort™ Adaptor for ePMP-A
Product ID: TPA-ePMP
Compatible radios: Cambium Networks™ ePMP™ 1000 AP, ePMP™ 1000 CSM, ePMP™ 3000L AP, ePMP™ Force 300 CSM, 5 GHz PMP 450b CSM, PMP 450 MicroPop
MSRP: 40.00 USD

TwistPort™ Adaptor for ePMP-B
Product ID: TP-ADAP-e2K
Compatible radios: Cambium Networks™ ePMP™ 2000 AP, ePMP™ Force 400C, ePMP™ Force 4600C, ePMP™ 4600L, ePMP™ 4500L
MSRP: 50.00 USD

TwistPort™ Adaptor RBP
Product ID: TPA-RBP
Compatible radios: MikroTik™ RouterBoard™ Series 4, 7, 9, M11
MSRP: 40.00 USD

TwistPort™ Adaptor RBC
Product ID: TPA-RBC
Compatible radios: MikroTik™ RouterBoard™ Series 4, 7, 9, M11
MSRP: 60.00 USD

TwistPort™ Adaptor for Mimosa Waveguide
Product ID: TPA-AMU-V2
Compatible radios: Mimosa® C5x, B5x, C6x
MSRP: 33.00 USD

TwistPort™ Adaptor for A5x
Product ID: TPA-A5x
Compatible radios: Mimosa® A5x
MSRP: 49.00 USD

TwistPort™ Adaptor for C5x
Product ID: TPA-C5x
Compatible radios: Mimosa® C5x
MSRP: 30.00 USD

TwistPort™ Adaptor for C5c
Product ID: TP-ADAP-C5c
Compatible radios: Mimosa® C5c
MSRP: 35.00 USD

TwistPort™ Adaptor SMA
Product ID: TPA-SMA
MSRP: 45.00 USD

HORN ANTENNAS CARRIER CLASS

ASYMMETRICAL HORN

Asymmetrical Horn CC Antennas are scalar horns with elliptical cross-section of the main beam and they are equipped with N-female connectors. Complementing the successful range of Symmetrical Horn Antennas, they complete the toolbox of a modern WISP. Asymmetrical Horns address major weaknesses of mainstream sector antenna technologies and provide an excellent noise rejection, network stability, and increased throughput.

Parameter	20° Sector	30° Sector	60° Sector	90° Sector
Gain	20.5 dBi	20.5 dBi	17 dBi	16 dBi
Azimuth Beamwidth (-6dB)	H 20° / V 20°	H 30° / V 30°	H 60° / V 60°	H 90° / V 90°
Elevation Beamwidth (-6dB)	H 30° / V 30°	H 20° / V 20°	H 25° / V 25°	H 25° / V 25°
Frequency Range	5180 - 6000 MHz	5180 - 6000 MHz	5180 - 6000 MHz	5180 - 6000 MHz
Beam Efficiency	95 %	95 %	95 %	90 %
Product ID	AH20-CC	AH30-CC	AH60-CC	AH90-CC

Models

20° Asymmetrical Horn
Gain: 20.5 dBi
Product ID: AH20-CC
MSRP: 420.00 USD

30° Asymmetrical Horn
Gain: 20.5 dBi
Product ID: AH30-CC
MSRP: 420.00 USD

60° Asymmetrical Horn
Gain: 17 dBi
Product ID: AH60-CC
MSRP: 420.00 USD

90° Asymmetrical Horn
Gain: 16 dBi
Product ID: AH90-CC
MSRP: 420.00 USD

SYMMETRICAL HORN

Symmetrical Horn CC is a scalar horn with equal beamwidth in azimuth and elevation equipped with N-female connectors. Since 2014, our horns address major weaknesses of mainstream sector antenna technologies and provide excellent noise rejection, network scalability, and throughput improvement. RF elements® Symmetrical Horn Carrier Class Antennas are the new standard for fast and sustainable wireless.

Models

5 GHz
6 GHz

30° Sector
Gain: 18.4 dBi
Beam Efficiency: 94 %
Product ID: HG3-CC-S30
MSRP: 255.00 USD

40° Sector
Gain: 16.2 dBi
Beam Efficiency: 94 %
Product ID: HG3-CC-S40
MSRP: 255.00 USD

50° Sector
Gain: 14.3 dBi
Beam Efficiency: 92 %
Product ID: HG3-CC-S50
MSRP: 255.00 USD

60° Sector
Gain: 13.2 dBi
Beam Efficiency: 90 %
Product ID: HG3-CC-S60
MSRP: 255.00 USD

70° Sector
Gain: 11.5 dBi
Beam Efficiency: 94 %
Product ID: HG3-CC-S70
MSRP: 255.00 USD

80° Sector
Gain: 10.4 dBi
Beam Efficiency: 94 %
Product ID: HG3-CC-S80
MSRP: 255.00 USD

90° Sector
Gain: 9.6 dBi
Beam Efficiency: 92 %
Product ID: HG3-CC-S90
MSRP: 255.00 USD

ULTRAHORN™

UltraHorn™ CC is a highly directional horn antenna with high gain. UltraHorn™ offers superb noise rejection due to symmetrical beam with no side lobes. These unique features make UltraHorn™ CC ideal for long-distance links and high noise environment. UltraHorn™ delivers excellent performance as a narrow sector antenna as well. Top performance of UltraHorn™ allows for precise network planning and dense co-location in very challenging RF conditions.

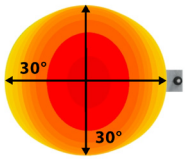
5 GHz
6 GHz

Parameter	UltraHorn™ CC 5-24
Gain	24 dBi
Azimuth/Elevation BeamWidth -6 dB	H 16° / V 15°
Frequency Range	5180 - 6775 MHz
Beam Efficiency	99 %
Product ID	UH-CC-5-24
MSRP	549.00 USD

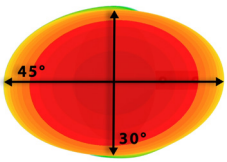
STARTER ANTENNAS

STARTERHORN™ 30° USMA & STARTERHORN™ 45° USMA

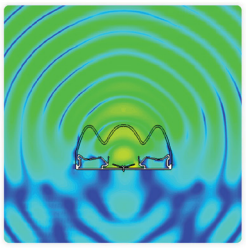
STH-30-USMA and STH-A45-USMA are scalar horn antennas with symmetrical and asymmetrical radiation pattern respectively and RP-SMA interface for easy connectivity. The StarterHorn™ antennas are a convenient entry-level option for customers new to horn antenna technology with low initial investment and attractive pricing.

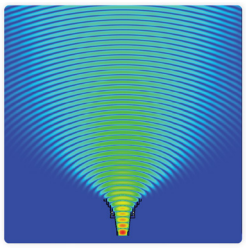


STH-30-USMA



STH-45-USMA





Radiation Pattern Options

STH-30-USMA offers a symmetrical radiation pattern with the same beamwidth in azimuth and elevation planes for any landscape type and dense customer density areas. STH-A45-USMA has a radiation pattern wide in the azimuth and narrower in the elevation plane for cases when customers are more spread out and the landscape is not overly mountainous.

Parameter	30° Sector	45° Sector
Gain	18 dBi	17 dBi
Azimuth Beamwidth -6 dB	H 30° / V 30°	H 44° / V 45°
Elevation Beamwidth -6 dB	H 30° / V 30°	H 30° / V 29°
Frequency Range	5150 - 5950 MHz	5150 - 6400 MHz
Beam Efficiency	92 %	90 %
Front-to-Back Ratio	33 dB	30 dB
Product ID	STH-30-USMA	STH-A45-USMA
MSRP	99.00 USD	122.00 USD

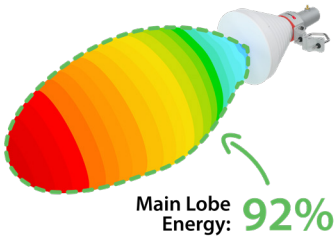
5 GHz
6 GHz

Excellent Noise Immunity

Noise in unlicensed 5 GHz wireless networks is caused by the side lobes of widely used traditional patch array antennas. The StarterHorn™ 30° USMA and StarterHorn™ A45° USMA have zero side lobes, ensuring efficient use of the spectrum. As a result, your wireless network does not suffer from high interference.

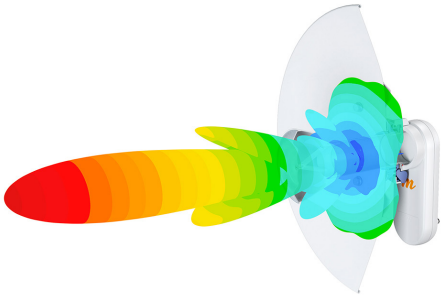
High Beam Efficiency

Beam Efficiency (BE) is a side lobes measure with values from 0 to 100 %. The higher the BE, the less side lobes an antenna has. StarterHorn™ antennas have BE of 92 and 90 %, suppressing vast majority of interference and providing game-changing throughput increase. For reference, BE of widely used patch array sector antennas rarely exceeds 58 %!



STARTERDISH™ UM ANTENNAS

StarterDish™ UM are parabolic dish antennas with high directivity designed for CPE deployment scenarios in 5 GHz unlicensed networks. The StarterDish™ UM is a convenient and affordable antenna series providing wide range of footprint, gain, and connectivity options.



Beam Performance

StarterDish™ UM antennas are designed for the best possible performance having minimized side lobes, enabling their deployment as CPE antennas in high interference environment.

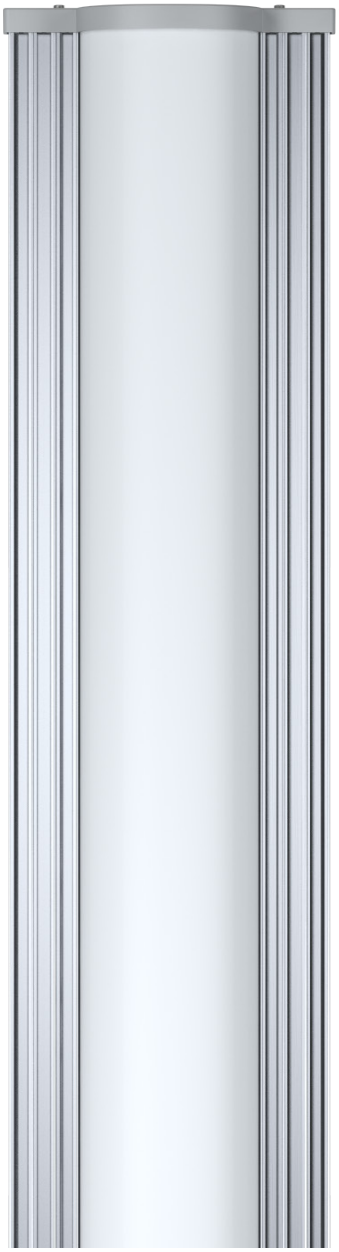
Flexible Radio Connectivity

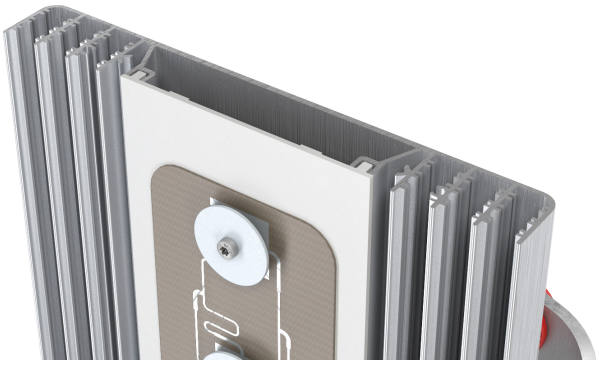
The StarterDish™ UM antennas provide connection to Ubiquiti Networks and Mimosa Networks waveguide radios out of the box. Separately sold StarterAdapter™ enables connectivity with any radio with coaxial interface. This adapter provides a pair of RP-SMA connectors and is not part of the StarterDish™ UM package.

Parameter	StarterDish™ 21 UM	StarterDish™ 24 UM	StarterDish™ 27 UM	Adapter SMA
Gain	21 dBi	24 dB	27 dBi	
Azimuth Beamwidth -6 dB	H 15° / V 15°	H 12° / V 12°	H 8° / V 8°	
Elevation Beamwidth -6 dB	H 15° / V 15°	H 12° / V 12°	H 8° / V 8°	
Frequency Range	5150 - 5950 MHz	5150 - 6400 MHz	5150 - 6400 MHz	
Front-to-Back Ratio	24 dB	27 dB	33 dB	
Beam Efficiency	28 %	34 %	42 %	
Product ID	STD-21-UM-5PACK	STD-24-UM-5PACK	STD-27-UM-5PACK	STA-SMA
MSRP	345.00 USD	400.00 USD	525.00 USD	20.00 USD
		5 GHz 6 GHz	5 GHz 6 GHz	

ARRAY SECTOR ANTENNAS

The new Array Sector series are superior patch array antennas optimized for excellent performance in sectorial coverage and dense cluster applications. The Array Sector radiation pattern is optimized for balanced chain performance, frequency stability, and minimum side lobes in the azimuth plane thanks to the patented BackShield™ technology.



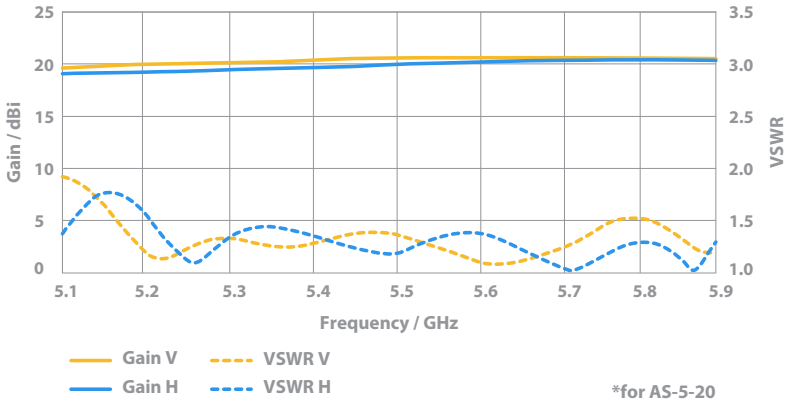


BackShield™ for Cluster Deployments

Array Sector Antennas have integrated BackShield™ - patented frequency-selective surfaces attenuating azimuthal side lobes and back radiation significantly improving the co-location capability of Array Sector Antennas.

Stable Gain Across The Band

The gain of Array Sector antennas remains very stable across an ultra-wide range of frequencies 5150-5850 MHz (for AS-5-20) and VSWR values are excellent across the whole useful spectrum for maximum power delivered from a radio to the antenna.



*for AS-5-20

Parameter	Array Sector 5-20	Array Sector 2-14	Array Sector 2-17	Array Sector 3-17 HV	Array Sector 3-17 DS	Array Sector 3-18 DS
Gain	20 dBi	14 dBi	14 dBi	17.4 dBi	17 dBi	18 dBi
Azimuth Beamwidth -6 dB	H 100° / V 100°	H 112° / V 112°	H 115° / V 109°	H 118° / V 118°	116° *	90° *
Elevation Beamwidth -6 dB	H 4.5° / V 4.5°	H 21° / V 21°	H 10° / V 10°	H 9° / V 9°	9.2° *	9.2° *
Beam Efficiency	69 %	88%	87%	87 %	81 %	74 %
Front-to-Back Ratio	30 dB	21 db	21 dB	30 dB	35 dB	35 dB
Product ID	AS-5-20	AS-2-14	AS-2-17	AS-3-17HV	AS-3-17DS	AS-3-18DS
MSRP	210.00 USD	182.00 USD	210.00 USD	280.00 USD	315.00 USD	315.00 USD

*Both polarizations

ENCLOSURES

STATIONBOX® ALU

StationBox ALU is an ideal outdoor enclosure for various wireless platforms and access point radios. It is a versatile platform that enabling easy and lasting wireless solutions.

Product ID: SBX-ALU-6N1E
MSRP: 39.00 USD

Built To Last

StationBox® ALU is made exclusively of high grade materials: die cast aluminum, UV resistant paint, and stainless steel die-cast hardware. The enclosure also features a number of nifty little details, such as captive screws that do not fall out when loosened.

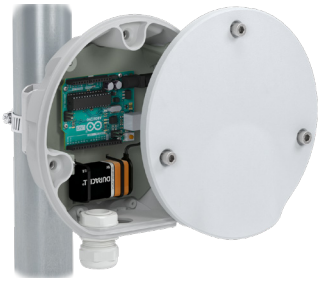
Easy Installation

The mounting system on StationBox® ALU allows easy and quick installation on a pole or a wall. The mounting bracket is made of plastic to minimize mechanical vibration from the pole to the enclosure and electronics.

STATIONBOX® ALU-MINI

Compact outdoor enclosure for wireless platforms, access points, and all things IoT. StationBox ALU-Mini is a rugged enclosure for uncompromising performance and electronics protection with a versatile mounting system.

Product ID: SBX-AM
MSRP: 59.00 USD



Versatile Outdoor Enclosure

StationBox® ALU-Mini is a compact outdoor enclosure for wireless platforms, access points, and all things IoT. StationBox® ALU-Mini is a customizable solution for wide range of applications whenever a reliable and durable enclosure is necessary.

IP55 Aluminium Enclosure

StationBox® ALU-Mini is IP55 cast aluminium enclosure. Increasing the rating to IP66 can be achieved by sealing the drain holes. SBX ALU-Mini provides outstanding weather resistance.

Compatibility of TwistPort™ Adaptors with 3rd party radios

CAMBIUM NETWORKS™


TPA-ePMP


ePMP™ 3000L AP, Force 300 CSM


ePMP™ 1000 AP, 1000 CSM


5 GHz PMP 450b CSM, 450 Micropop


TP-ADAP-e2K


ePMP™ 2000 AP


ePMP™ Force 400C, 4600C


ePMP™ 4600L, 4500L

UBIQUITI NETWORKS®


TPA-PAF


Rocket® Prism 5AC, Gen2


airFiber® 5X, HD


LTU™ Rocket


TPA-RM5

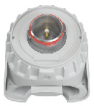

Rocket® M5


TP-ADAP-IS


PrismStation™ 5AC


IsoStation™ 5AC


IsoStation™ M5


TPA-R5AC


Rocket® 5AC Lite

MIMOSA® BY AIRSPAN


TP-ADAP-C5c


Mimosa® C5c


TPA-C5x


Mimosa® C5x


TPA-A5x


Mimosa® A5x


TPA-AMU-V2


Mimosa® C5x, B5x, C6x

MIKROTIK™


TPA-RBC


TPA-RBP


RouterBoard™ M11


RouterBoard™ 9 Series


RouterBoard™ 7 Series


RouterBoard™ 4 Series

CONNECTORIZED RADIOS


TPA-SMA

coaxial connectorized radios

All TwistPort™ Adaptors arecompatible with every TP antenna

Symmetrical Horn TP Gen2


HG3-TP-S90


HG3-TP-S80


HG3-TP-S70


HG3-TP-S60


HG3-TP-S50


HG3-TP-S40


HG3-TP-S30

Asymmetrical Horn TP


AH90-TP


AH60-TP


AH2030-TP

UltraDish™


UD-TP-21


UD-TP-24


UD-TP-27

UltraHorn™


UH-TP-5-24

WIRELESS 101

RF can be a bitch sometimes, so we've prepared some useful stuff for you!

1. WHAT IS THE MAXIMUM DISTANCE OF A LINK WITH A HORN ANTENNA?

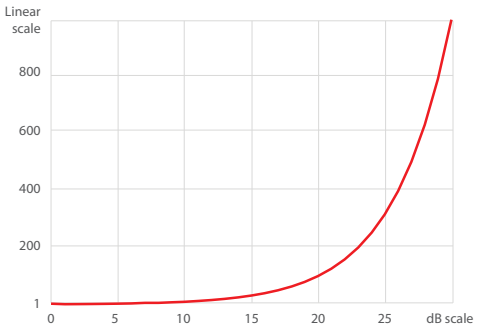
This depends on multiple factors such as Tx power of the radio, gain of the CPE antenna, noise floor, frequency, and so on. We have created an online Link calculator to make it easy for you: **www.rfelements.com/calc**

2. DECIBELS.. NOW WAIT A SECOND

Decibel

The decibel (dB) is a commonly used logarithmic unit and represents a ratio of a certain physical quantity. In the world of RF, a few logarithmic units are used to describe antenna performance, radio, and noise background.

A frequent misconception is that dB is linear. Most things in our life are measured in a linear scale - time, distance, amount, money (unless you are Warren Buffet), etc. Another misconception is that 0 dB means there is no quantity to be measured. This is also incorrect. 0 dB means the strength of the measured quantity is equal to its reference, non-zero value. An increment of 3 dB equals 2x the reference value. An increment of 6 dB equals 4x the reference value and so on.*



dBi

Gain represents the ability of an antenna to radiate electromagnetic energy in a specific direction. The typical unit to represent gain is dBi (where "i" means isotropic). dBi represents the ratio of energy radiated by an antenna compared to an isotropic antenna in a given direction. An isotropic antenna is an ideal antenna that radiates equally in every direction. Although it is a theoretical concept, it is useful as a reference for real-world antennas. Again, note that the gain of 0 dBi does not mean that no energy is radiated. It means that the radiated energy is equal to what an isotropic antenna would radiate. Negative gain means this energy is lower than the reference value used.

For example:

18dBi antenna = 64x stronger than an isotropic antenna

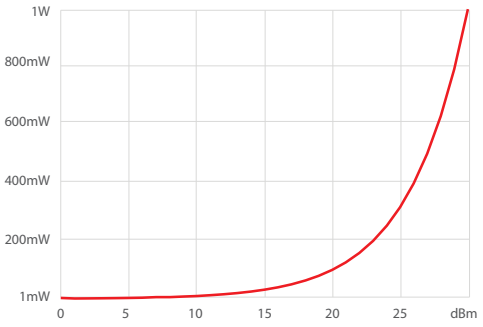
(6x3dB = 2x 2x 2x 2x 2x 2x stronger = 2^6x stronger = 64x)

Likewise, a 30 dBi antenna has "12 dBi more gain" than an 18 dBi one. This does not mean that it is +66.6 % stronger (as our linear perception of the world would suggest). It is actually 16x stronger(!).

dBm

The output power of RF radios is often represented in a logarithmic scale as a ratio of power in linear scale relative to 1 mW (milliwatt).

An output power of 0 dBm is equal to 1 mW, not 0 mW!



Attenuation

Propagation of electromagnetic wave can be affected by many factors. An obvious problem is an obstacle between the transmitter and the receiver. Also high humidity significantly influences electromagnetic waves. It absorbs (attenuates) the energy wave carries and as the wave arrives at the receiver. The wave strength is lower than it would be in lower humidity conditions. The decrease of strength can be also represented on a logarithmic scale.

Why decibels?

Using decibels for analysis of a radio link is convenient for two reasons mainly. First, it is easier to combine different physical quantities (such as those mentioned above) in mathematical equations, because instead of multiplying and dividing the numbers (in linear scale), you can add and subtract decibels (logarithmic scale).

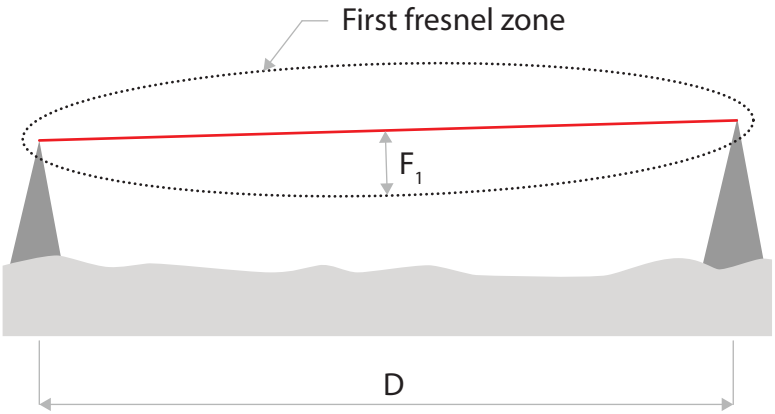
Second, using a logarithmic scale (decibels) simplifies the mathematics necessary for calculations. Instead of using huge numbers as would be the case in a linear scale, the logarithmic scale results in easier and simpler operations and it also makes small numbers more visible in the graphs.

3. FRESNEL ZONE

The first Fresnel zone is a pill shaped region between the transmitter and the receiver that should be kept free of obstacles. If buildings or trees obstruct more than 20 % of this zone it can have a noticeable impact on signal strength.
You can easily calculate the Fresnel zone for a link using the following formula:

$$F_1 = \frac{1}{2}\sqrt{\frac{cD}{f}}$$

where F1 = the Fresnel zone radius, c = speed of light [m/s], D = distance between the two endpoints [m], and f = frequency [Hz].



4. CHANNELS & FREQUENCIES IN 5GHz SPECTRUM

Channel number	Frequency [MHz]	Europe (ETSI)	North America (FCC)	Japan
36	5180	Indoors	OK	OK
40	5200	Indoors	OK	OK
44	5220	Indoors	OK	OK
48	5240	Indoors	OK	OK
52	5260	Indoors / DFS / TPC	DFS	DFS / TPC
56	5280	Indoors / DFS / TPC	DFS	DFS / TPC
60	5300	Indoors / DFS / TPC	DFS	DFS / TPC
64	5320	Indoors / DFS / TPC	DFS	DFS / TPC
100	5500	DFS / TPC	DFS	DFS / TPC
104	5520	DFS / TPC	DFS	DFS / TPC
108	5540	DFS / TPC	DFS	DFS / TPC
112	5560	DFS / TPC	DFS	DFS / TPC
116	5580	DFS / TPC	DFS	DFS / TPC
120	5600	DFS / TPC	No Access	DFS / TPC
124	5620	DFS / TPC	No Access	DFS / TPC
128	5640	DFS / TPC	No Access	DFS / TPC
132	5660	DFS / TPC	DFS	DFS / TPC
136	5680	DFS / TPC	DFS	DFS / TPC
140	5700	DFS / TPC	DFS	DFS / TPC
149	5745	SRD	OK	No Access
153	5765	SRD	OK	No Access
157	5785	SRD	OK	No Access
161	5805	SRD	OK	No Access
165	5825	SRD	OK	No Access

Note 1: There are additional regional variations for countries including Australia, Brazil, China, Israel, Korea, Singapore, South Africa, Turkey, etc. Additionally Japan has access to some channels below 5180 MHz.

Note 2: DFS = Dynamic Frequency Selection; TPC = Transmit Power Control; SRD = Short Range Devices 25 mW max power.

5. MCS INDEX: 802.11n

Spatial streams	HT MCS Index	Modulation	20MHz	40MHz
1	0	BPSK 1/2	7.2	15
1	1	QPSK 1/2	14.4	30
1	2	QPSK 3/4	21.7	45
1	3	16-QAM 1/2	28.9	60
1	4	16-QAM 3/4	43.3	90
1	5	64-QAM 2/3	57.8	120
1	6	64-QAM 3/4	65	135
1	7	64-QAM 5/6	72.2	150
2	8	BPSK 1/2	14.4	30
2	9	QPSK 1/2	28.9	60
2	10	QPSK 3/4	43.3	90
2	11	16-QAM 1/2	57.8	120
2	12	16-QAM 3/4	86.7	180
2	13	64-QAM 2/3	115.6	240
2	14	64-QAM 3/4	130.3	270
2	15	64-QAM 5/6	144.4	300
3	16	BPSK 1/2	21.7	45
3	17	QPSK 1/2	43.3	90
3	18	QPSK 3/4	65	135
3	19	16-QAM 1/2	86.7	180
3	20	16-QAM 3/4	130	270
3	21	64-QAM 2/3	173.3	360
3	22	64-QAM 3/4	195	405
3	23	64-QAM 5/6	216.7	450
4	24	BPSK 1/2	28.9	60
4	25	QPSK 1/2	57.8	120
4	26	QPSK 3/4	86.7	180
4	27	16-QAM 1/2	115.6	240
4	28	16-QAM 3/4	173.3	360
4	29	64-QAM 2/3	231.1	480
4	30	64-QAM 3/4	260	540
4	31	64-QAM 5/6	288.9	600

Note: Speeds are calculated for Data Rate GI = 400ns. All speeds are in Mbps.

6. MCS INDEX: 802.11ac

Spatial streams	HT MCS Index	Modulation	20MHz	40MHz	80MHz	160MHz
1	0	BPSK 1/2	7.2	15	32.5	65
1	1	QPSK 1/2	14.4	30	65	130
1	2	QPSK 3/4	21.7	45	97.5	195
1	3	16-QAM 1/2	28.9	60	130	260
1	4	16-QAM 3/4	43.3	90	195	390
1	5	64-QAM 2/3	57.8	120	260	520
1	6	64-QAM 3/4	65	135	292.5	585
1	7	64-QAM 5/6	72.2	150	325	650
1	8	256-QAM 3/4	86.7	180	390	780
1	9	256-QAM 5/6	n/a	200	433.3	866.7
2	0	BPSK 1/2	14.4	30	65	130
2	1	QPSK 1/2	28.9	60	130	260
2	2	QPSK 3/4	43.3	90	195	390
2	3	16-QAM 1/2	57.8	120	260	520
2	4	16-QAM 3/4	86.7	180	390	780
2	5	64-QAM 2/3	115.6	240	520	1040
2	6	64-QAM 3/4	130.3	270	585	1170
2	7	64-QAM 5/6	144.4	300	650	1300
2	8	256-QAM 3/4	173.3	360	780	1560
2	9	256-QAM 5/6	n/a	400	866.8	1733.3
3	0	BPSK 1/2	21.7	45	97.5	195
3	1	QPSK 1/2	43.3	90	195	390
3	2	QPSK 3/4	65	135	292.5	585
3	3	16-QAM 1/2	86.7	180	390	780
3	4	16-QAM 3/4	130	270	585	1170
3	5	64-QAM 2/3	173.3	360	780	1560
3	6	64-QAM 3/4	195	405	n/a	1755
3	7	64-QAM 5/6	216.7	450	975	1950
3	8	256-QAM 3/4	260	540	1170	2340
3	9	256-QAM 5/6	288.9	600	1300	n/a
4	0	BPSK 1/2	28.9	60	130	260
4	1	QPSK 1/2	57.8	120	260	520
4	2	QPSK 3/4	86.7	180	390	780
4	3	16-QAM 1/2	115.6	240	520	1040
4	4	16-QAM 3/4	173.3	360	780	1560
4	5	64-QAM 2/3	231.1	480	1040	2080
4	6	64-QAM 3/4	260	540	1170	2340
4	7	64-QAM 5/6	288.9	600	1300	2600
4	8	256-QAM 3/4	346.7	720	1560	3120
4	9	256-QAM 5/6	n/a	800	1733.3	3466.7

Note: Speeds are calculated for Data Rate GI = 400ns. All speeds are in Mbps.

7. MCS INDEX: 802.11ax

Spatial streams	HT MCS Index	Modulation	20MHz	40MHz	80MHz	160MHz
1	0	BPSK 1/2	8.6	17.2	36	72.1
1	1	QPSK 1/2	17.2	34.4	72.1	144.1
1	2	QPSK 3/4	25.8	51.6	108.1	216.2
1	3	16-QAM 1/2	34.4	68.8	144.1	288.2
1	4	16-QAM 3/4	51.6	103.2	216.2	432.4
1	5	64-QAM 2/3	68.8	137.6	288.2	576.5
1	6	64-QAM 3/4	77.4	154.9	324.3	648.5
1	7	64-QAM 5/6	86	172.1	360.3	720.6
1	8	256-QAM 3/4	103.2	206.5	432.4	864.7
1	9	256-QAM 5/6	114.7	229.4	480.4	960.8
1	10	1024-QAM 3/4	129	258.1	540.4	1080.9
1	11	1024-QAM 5/6	143.4	286.8	600.5	1201
1	-	4096-QAM 3/4	154.8	309.6	619.2	1238.4
1	-	4096-QAM 5/6	172.1	344.2	688.4	1376.8
2	0	BPSK 1/2	17.2	34.4	72.1	144.1
2	1	QPSK 1/2	34.4	68.8	144.1	288.2
2	2	QPSK 3/4	51.6	103.2	216.2	432.4
2	3	16-QAM 1/2	68.8	137.6	288.2	576.5
2	4	16-QAM 3/4	103.2	206.5	432.4	864.7
2	5	64-QAM 2/3	137.6	275.3	576.5	1152.9
2	6	64-QAM 3/4	154.9	309.7	648.5	1297.1
2	7	64-QAM 5/6	172.1	344.1	720.6	1441.2
2	8	256-QAM 3/4	206.5	412.9	864.7	1729.4
2	9	256-QAM 5/6	229.4	458.8	960.8	1921.6
2	10	1024-QAM 3/4	258.1	516.2	1080.9	2161.8
2	11	1024-QAM 5/6	286.8	573.5	1201	2402
2	-	4096-QAM 3/4	309.6	619.2	1238.4	2476.8
2	-	4096-QAM 5/6	344.2	688.4	1376.8	2753.6
3	0	BPSK 1/2	25.8	51.6	108.1	216.2
3	1	QPSK 1/2	51.6	103.2	216.2	432.4
3	2	QPSK 3/4	77.4	154.9	324.3	648.5
3	3	16-QAM 1/2	103.2	206.5	432.4	864.7
3	4	16-QAM 3/4	154.9	309.7	648.5	1297.1
3	5	64-QAM 2/3	206.5	412.9	864.7	1729.4
3	6	64-QAM 3/4	232.3	464.6	972.8	1945.6
3	7	64-QAM 5/6	258.1	516.2	1080.9	2161.8
3	8	256-QAM 3/4	309.7	619.4	1297.1	2594.1
3	9	256-QAM 5/6	344.1	688.2	1441.2	2882.4

Note: Speeds are calculated for Data Rate GI = 800ns. All speeds are in Mbps. 4096 QAM is currently supported only by proprietary solutions, not the 802.11 ax standard. Numbers under the channel width values are expressed in Megabit (Mb).

7. MCS INDEX: 802.11ax

Spatial streams	HT MCS Index	Modulation	20MHz	40MHz	80MHz	160MHz
3	10	1024-QAM 3/4	387.1	774.3	1621.3	3242.6
3	11	1024-QAM 5/6	430.1	860.3	1801.5	3602.9
3	-	4096-QAM 3/4	464.4	928.8	1857.6	3715.2
3	-	4096-QAM 5/6	516.3	1032.6	2065.2	4130.4
4	0	BPSK 1/2	34.4	68.8	144.1	288.2
4	1	QPSK 1/2	68.8	137.6	288.2	576.5
4	2	QPSK 3/4	103.2	206.5	432.4	864.7
4	3	16-QAM 1/2	137.6	275.3	576.5	1152.9
4	4	16-QAM 3/4	206.5	412.9	864.7	1729.4
4	5	64-QAM 2/3	275.3	550.6	1152.9	2305.9
4	6	64-QAM 3/4	309.7	619.4	1297.1	2594.1
4	7	64-QAM 5/6	344.1	688.2	1441.2	2882.4
4	8	256-QAM 3/4	412.9	825.9	1729.4	3458.8
4	9	256-QAM 5/6	458.8	917.6	1921.6	3843.1
4	10	1024-QAM 3/4	516.2	1032.4	2161.8	4323.5
4	11	1024-QAM 5/6	573.5	1147.1	2402	4803.9
4	-	4096-QAM 3/4	619.2	1238.4	2476.8	4953.6
4	-	4096-QAM 5/6	688.4	1376.8	2753.6	5507.2

Note: Speeds are calculated for Data Rate GI = 800ns. All speeds are in Mbps. 4096 QAM is currently supported only by proprietary solutions, not the 802.11 ax standard. Numbers under the channel width values are expressed in Megabit (Mb).

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