



Casey Hu
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“ Multi-RF Technology Mobile Vehicular Antennas

White Paper from M.gear US

www.mgearus.com

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1. Introduction

In today's dynamic and interconnected world, the demand for seamless and reliable mobile network coverage has become increasingly vital, particularly for field workers engaged in mission-critical operations. Whether it is ensuring safety protocols are adhered to, maximizing productivity, or facilitating effective communication in remote or hazardous environments, the reliance on mobile networks has become ubiquitous. Field workers operating in diverse sectors such as emergency services, utilities, construction, and transportation require uninterrupted connectivity to access real-time data, collaborate with team members, and respond swiftly to emergent situations. Consequently, the need for enhanced mobile network coverage has emerged as a paramount priority to support the efficiency, safety, and overall effectiveness of field operations.

M.gear has been dedicated to advancing wireless connectivity for over 40 years through the design and development of networking and telecommunication antennas that contribute to the advancement of our industries and society.

M.gear antennas leverage cutting-edge radio technologies and manufacturing expertise to develop tailored solutions for critical infrastructure industries such as power utilities, addressing the crucial requirement for reliable, high-performance mobile vehicular wireless connectivity and location tracking for field service workers and critical assets. M.gear is committed to enhancing these capabilities through meticulous design and advanced telecommunication solutions, ensuring utility providers have the dependable solutions they need to optimize grid operations, increase reliability, mitigate outages and wildfires, and provide greater field team safety.

With our proficiency in custom antenna design, wide choice of off-the-shelf antenna selections, optimization, and pre-certification, M.gear possesses the knowledge and proprietary designs necessary to deliver all your antenna and wireless connectivity requirements.

2. Abbreviations

BW	Bandwidth
DL	Downlink
EMC	Electromagnetic Compatibility
FDD	Frequency Division Duplex
gNB	Next-Generation Node B
GNSS	Global Navigation Satellite System
HARQ	Hybrid Automatic Repeat and Request
IEEE	Institute of Electrical and Electronics Engineers
IoT	Internet of Things
LTE	Long-Term Evolution
MIMO	Multiple-Input-Multiple-Output
MNO	Mobile Network Operator
OEM	Original Equipment Manufacturer
RSRP	Reference Signal Received Power
SNR	Signal-to-Noise Ratio
TDD	Time Division Duplex
UE	User Equipment
UL	Uplink
3GPP	Third-Generation Partnership Project

3. Mobile Vehicular Antennas – T-Bar and Jellyfish

There has been a huge shift in mobile communication in electric, gas and water utilities, transportation and public safety industries towards accelerating greater use of digital technologies for grid modernization and operational efficiency.

Due to the complexity of communication, and stretched space in the vehicle, M.gear has integrated multiple antenna technologies into small form factor with low wind resistance and designed with aesthetic and aerodynamic principles.

3.1 T-Bar 5-in-1 Antenna (5G FR 1 MIMO/Wi-Fi 6E MIMO/GNSS)

M.gear's T-Bar antennas, besides offering superior technical features, provide aesthetics and aerodynamics for vehicular use. They can also house 5G FR1, LTE, Wi-Fi 6e and GNSS/GPS communication and navigation antenna elements. Below are some key reasons for using T-Bar antennas on service vehicles:

- 1. Aesthetics:** The T-Bar antennas exhibit a sleek design and visual appeal. Utility companies opt for T-Bar antennas due to their appearance, which significantly enhances the overall vehicle aesthetics.
- 2. Aerodynamics:** The aerodynamic shape of T-Bar antennas can effectively mitigate drag forces, thereby augmenting vehicle aerodynamics and advancing fuel efficiency and performance metrics. Engineered with precision, M.gear T-Bar antennas are meticulously crafted to minimize air resistance.
- 3. Functionality:** T-Bar antennas serve as multifunctional hubs accommodating various communication and navigation modules. Incorporating antennas for GPS, cellular communication, and Wi-Fi within a singular housing ensures a streamlined and uncluttered vehicular façade, elevating operational functionality.
- 4. Reduced Vulnerability:** Traditional whip antennas are susceptible to external hazards such as low-hanging branches and automatic car wash systems. Conversely, the seamlessly integrated design of T-Bar antennas renders them less prone to such vulnerabilities, offering heightened durability and longevity.

5. Global Positioning System (GPS): Modern vehicles often integrate T-Bar antennas to host GPS receivers, optimizing signal reception by providing an unobstructed view of the sky. Housing the GPS antenna within the T-Bar enhances positioning accuracy and navigational precision.

6. Multifunctionality: The inherently adaptable T-Bar design enables the integration of diverse antennas without compromising the vehicle's aesthetic integrity. This inherent versatility streamlines the manufacturing process, facilitating the seamless incorporation of various communication and navigation features without cluttering the vehicle's exterior with multiple antennas.

The adoption of T-Bar antennas in vehicle design constitutes a significant development, merging visual design with functional and aerodynamic improvements. The consolidation of multiple communication and navigation antenna elements into a single housing not only provides private and public LTE and 5G network access and high-speed Wi-Fi connectivity but refines the vehicle's exterior and contributes to decreased aerodynamic drag and enhanced fuel economy. Additionally, the design's resistance to external damage extends the antennas' lifespan. The strategic placement of these antennas also maximizes signal reception, crucial for the effective operation of systems like GPS navigation.

3.2 Jellyfish 5-in-1 Antenna (5G MIMO/Wi-Fi 6E MIMO/GNSS)

The "Jellyfish 5-in-1 Antenna" by M.gear, engineered for vehicular and marine applications, boasts an array of features including GPS/GNSS, LTE, 5G FR1 MIMO, and Wi-Fi MIMO. While renowned for its sleek design and expansive bandwidth coverage, this antenna serves as a multifunctional hub accommodating communication and navigation equipment. Below are several compelling rationales for the adoption of Jellyfish antennas on vehicles:

- 1. GNSS (Global Navigation Satellite System):** This constituent serves as a pivotal element for GPS and analogous satellite navigation systems, facilitating precise determination of the vehicle's coordinates, velocity, and direction.
- 2. LTE and 5G FR1 MIMO:** These modules are integral to ensuring seamless mobile data connectivity. LTE and 5G (FR1) MIMO technologies significantly augment data transmission rates and signal robustness within the cellular network framework.
- 3. Wi-Fi MIMO Capability:** This feature endows the antenna system with the capacity for multiple-input and multiple-output functionality tailored for Wi-Fi connectivity. It serves to optimize the performance and extend the coverage of the vehicle's Wi-Fi network, especially in rugged operational environments.
- 4. Streamlined Design:** The consolidation of multiple antenna units into a singular compact structure, such as the 5-in-1 configuration, represents a pragmatic and visually appealing design paradigm for vehicular applications. The nomenclature "Jellyfish" likely denotes the overarching form or spatial arrangement of the antenna constituents.
- 5. Unified Integration:** The amalgamation of diverse communication technologies within a singular antenna apparatus holds the promise of streamlining installation processes and diminishing the external antenna count on the vehicle's surface.
- 6. Extensive Bandwidth Coverage:** The antenna system may be engineered to encompass a wide frequency spectrum, ensuring comprehensive support for various communication standards. This versatility guarantees compatibility across heterogeneous networks and technological frameworks.

7. Multifaceted Versatility: A multifunctional antenna structure confers adaptability across disparate applications, adeptly addressing the diverse communication requisites inherent to contemporary vehicular operations.

The integration of advanced technologies such as GNSS, LTE, 5G, and Wi-Fi 6e within a compact and versatile antenna design empowers vehicles with enhanced navigational precision, seamless data connectivity, and robust communication capabilities across diverse operational scenarios. This multifaceted approach not only optimizes performance but also simplifies installation and reduces external hardware, exemplifying a pivotal advancement in modern vehicle communication systems.

3.3 Detailed Technical Specifications

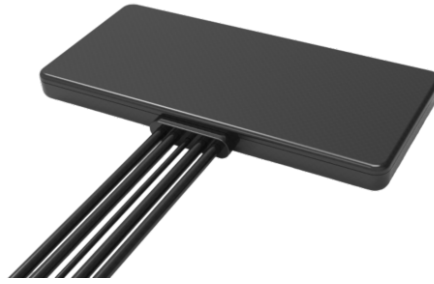


Figure 1 T-Bar Antenna Housing

The table below presents the combinations of technologies currently available in T-Bar antenna.

Table 1 Technology Combination Available on T-Bar Antenna

Combination	Combination Antenna Application (5-in-1)				
1	GNSS	5G FR1 MIMO-1	5G FR1 MIMO-2	Wi-Fi 6E MIMO-1	Wi-Fi 6E MIMO-2
2	GNSS	5G FR1 MIMO-1	5G FR1 MIMO-2	DSRC MIMO-1	DSRC MIMO-2
3	GNSS	5G FR1 MIMO-1	5G FR1 MIMO-2	Wi-Fi 6E	NA
4	GNSS	5G FR1 MIMO-1	5G FR1 MIMO-2	DSRC	NA
5	NA	5G FR1 MIMO-1	5G FR1 MIMO-2	Wi-Fi 6E MIMO-1	Wi-Fi 6E MIMO-2
6	GNSS	5G FR1 MIMO-1	5G FR1 MIMO-2	Wi-Fi 6E	DSRC

Table 2 Detailed Specifications for T-Bar Antenna

Electrical Specifications				
5G FR1 MIMO-1 Antenna Characteristics				
Frequency Range, MHz	617-960	1710-2690	3300-5000	5000-6000
VSWR	4.0 Max.	3.0 Max.	3.0 Max.	3.0 Max.
Peak Gain, dBi	3.2 Typ.	2.5 Typ.	5.0 Typ.	4.5 Typ.
Efficiency, %	50	40	60	60
Polarization	Linear			
Impedance	50Ω			

5G FR1 MIMO-2 Antenna Characteristics

Frequency Range, MHz	617-960	1710-2690	3300-5000	5000-6000
VSWR	4.0 Max.	3.0 Max.	3.0 Max.	3.0 Max.
Peak Gain, dBi	3.5 Typ.	2.3 Typ.	5.0 Typ.	4.5 Typ.
Efficiency, %	50	40	60	60
Polarization	Linear			
Impedance	50Ω			

Wi-Fi 6E MIMO-1 Antenna Characteristics

Frequency Range, MHz	2400-2500	5150-5850	5925-7125
VSWR	2.0 Max.	2.0 Max.	2.0 Max.
Peak Gain, dBi	3.0 Typ.	4.5 Typ.	4.0 Typ.
Efficiency, %	40	55	45
Polarization	Linear		
Impedance	50Ω		

Wi-Fi 6E MIMO-2 Antenna Characteristics

Frequency Range, MHz	2400-2500	5150-5850	5925-7125
VSWR	2.0 Max.	2.0 Max.	2.0 Max.
Peak Gain, dBi	3.0 Typ.	5.0 Typ.	4.5 Typ.
Efficiency, %	40	55	45
Polarization	Linear		
Impedance	50Ω		

GNSS Characteristics

Center Frequency, MHz	1561±3	1575.42±3	1602±4
VSWR	3.0 Max.		
Gain@ Zenith, dBi	4.0 Typ.	3.5 Typ.	3.0 Typ.
Efficiency, %	50	53	56
Impedance	50Ω		
Polarization	Linear		

GNSS LNA Properties

Frequency Range, MHz	1559-1608
Impedance	50Ω
Output Return Loss(S ₁₁), dB	10 Min.
Gain@ 3.0V, dB	29±3
Noise Figure@ 3.0V, dB	2.0 Typ.
DC Power Input, V	3.0
Power Consumption@ 3.0V, mA	9±2.5
ESD Withstand Voltage, KV	±8 contact; ±15 air

Mechanical Specifications

Environmental

Antenna Dimensions	(L)180×(W)84×(H)14.2 mm ³
Weight	358.0g
Mounting Function	Adhesive Mount
Operating Temperature	-40~ + 85°C
Housing Material & Color	PC-110U & Black
Cable	5G FR1 MIMO : CFD-200 Wi-Fi 6E MIMO : CFD-200 GNSS : RG-174
Connector	SMA / FAKRA or your specification
Waterproof	IPX7

Reliability Test

Cold Temperature	-40°C, 72hr
High Temperature	+85°C, 72hr
Composite Temperature/Humidity Cycling	-40~+85°C, 95%RH, 1 Cycle(8hr), 72hr
Thermal Shock	-40°C /30min → 5 min → +85°C /30min, 48hr



Figure 2: Jellyfish Antenna Housing

The table below presents the combinations of technologies currently available in Jellyfish antenna.

Table 3 Technology Combination Available on Jellyfish Antenna

Combination	Combination Antenna Application (5-in-1)				
1	GNSS	5G FR1 MIMO-1	5G FR1 MIMO-2	Wi-Fi 6E MIMO-1	Wi-Fi 6E MIMO-2
2	GNSS	5G FR1 MIMO-1	5G FR1 MIMO-2	DSRC MIMO-1	DSRC MIMO-2
3	GNSS	5G FR1 MIMO-1	5G FR1 MIMO-2	Wi-Fi 6E	DSRC
4	NA	5G FR1 MIMO-1	5G FR1 MIMO-2	Wi-Fi 6E MIMO-1	Wi-Fi 6E MIMO-2
5	GNSS	5G FR1 MIMO-1	5G FR1 MIMO-2	Wi-Fi 6E	NA
6	GNSS	5G FR1 MIMO-1	5G FR1 MIMO-2	DSRC	NA

Table 4 Detailed Specifications for Jellyfish Antenna

Electrical Specifications			
5G FR1 MIMO-1 Antenna Characteristics			
Frequency Range, MHz	617-960	1710-2700	3300-5850
VSWR	4.5 Max.	4.0 Max.	4.5 Max.
Peak Gain, dBi	1.5 Typ.	5.0 Typ.	7.0 Typ.
Efficiency, %	31	51	52
Polarization	Linear		
Impedance	50Ω		

5G FR1 MIMO-2 Antenna Characteristics

Frequency Range, MHz	617-960	1710-2700	3300-5850
VSWR	4.5 Max.	4.0 Max.	4.5 Max.
Peak Gain, dBi	2.0 Typ.	4.5 Typ.	6.5 Typ.
Efficiency, %	35	50	50
Polarization	Linear		
Impedance	50Ω		

Wi-Fi 6E MIMO-1 Antenna Characteristics

Frequency Range, MHz	2400-2500	4900-5850	5850-7150
VSWR	2.0 Max.	2.0 Max.	4.5 Max.
Peak Gain, dBi	5.5 Typ.	6.5 Typ.	6.5 Typ.
Efficiency, %	46	51	30
Polarization	Linear		
Impedance	50Ω		

GNSS Antenna Characteristics

Center Frequency, MHz	1561±2	1575.42±3	1602±4
VSWR	3.0 Max.		
Gain@ Zenith, dBi	1.5 Typ.	0.5 Typ.	2.5 Typ.
Efficiency, %	45	35	43
Polarization	Linear		
Impedance	50Ω		

GNSS LNA Properties

Frequency Range, MHz	1559-1606
Impedance	50Ω
Output Return Loss(S ₁₁), dB	10 Min.
Gain@ 3.3V, dB	29±3
Noise Figure@ 3.3V, dB	2.0 Typ.
DC Power Input, V	3.0
Power Consumption@ 3.3V, mA	9±2.5
ESD Withstand Voltage, KV	±8 contact; ±15 air

Mechanical Specifications

Environmental

Antenna Dimensions	$\Phi 143 \times 63.5\text{mm}^2$
Weight	740g
Mounting Function	Screw Mount
Operating Temperature	-40~ + 85°C
Housing Material & Color	PC+ABS & Black
Cable	5G FR1 MIMO : CFD-200 Wi-Fi 6E MIMO : CFD-200 GNSS : RG-174
Connector	SMA / FAKRA or your specification
Waterproof	IPX7
Reliability Test	
Cold Temperature	-40°C, 72hr
High Temperature	+85°C, 72hr
Composite Temperature/Humidity Cycling	-40~+85°C, 95%RH, 1 Cycle(8Hr), 48hr

3.4 Antenna Connection Diagrams

T-Bar Antenna

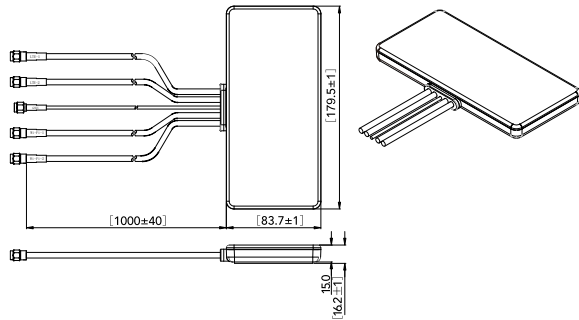


Figure3: T-Bar Wiring Diagram

In the picture above for T-Bar antenna, cables marked (in RED) as LTE-1, LTE-2, Wi-Fi-1, and Wi-Fi-2 (marked in Yellow) are used to connect LTE and Wi-Fi routers in 2X2 MIMO mode. The cable marked in BLUE is connected to GNSS/GPS receiver. This represents the Configuration 1 (per Table 1).

In other configurations, Wi-Fi marked cables can be used to connect DSRC in 2X2 MIMO mode or non-MIMO mode.

Jellyfish Antenna

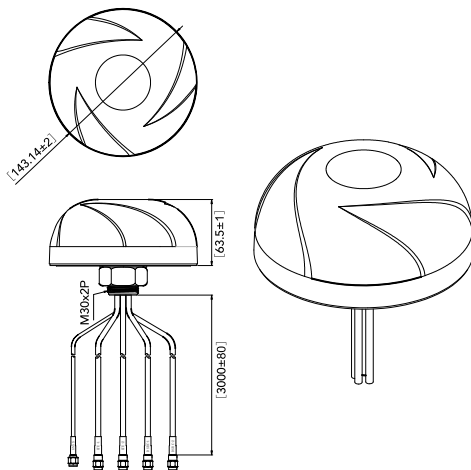


Figure 4: Jellyfish Wiring Diagram

As shown in the picture above, the cables are marked as GNSS (BLUE), LTE-1, LTE-2 (RED), Wi-Fi-1, and Wi-Fi-2 (YELLOW). They can be connected to LTE and Wi-Fi routers in 2X2 MIMO mode (MIMO-1 and MIMO-2). The cable marked GNSS should be connected to GPS/GNSS receiver. This represents Combination 1 (per Table 3) for the Jellyfish antenna.

In other configurations, Wi-Fi marked cables can be used to connect DSRC in 2X2 MIMO mode or non-MIMO mode.

3.5 T-Bar and Jellyfish Antenna Use Cases

Wide area, reliable vehicular, mobile data and voice coverage are essential for personal automobiles, fleet management, field service operations, public safety, freight, and public transportation. M.gear's T-Bar and Jellyfish antennas are reliable communications solutions for private and public cellular connectivity and navigation for freight transportation and electric utility field service operations as detailed in the following use cases.

Use Case

Long-haul Freight Transportation Efficiency and Safety with T-bar Antenna

Context

Long-haul trucking is essential for transporting goods over long distances. However, it faces significant challenges such as maintaining communication over remote areas, optimizing fuel efficiency, and ensuring driver safety.

Challenge

Operators must navigate through vast and sometimes uninhabited areas where communication signals are weak, which can impact the safety and operational efficiency of the fleet. Additionally, rising fuel costs necessitate improved vehicle aerodynamics to save on fuel consumption.

How M.gear's T-Bar Antenna Enhances Connectivity Performance

The M.gear T-Bar antenna is designed for long-range communication and improved vehicle aerodynamics. Its sleek and integrated design minimizes drag forces on the truck, potentially improving fuel efficiency. The antenna's capacity to house various communication technologies such as GPS, LTE or 5G, and Wi-Fi in a single unit, and combined with in-vehicle wireless modem or router, ensures a strong and consistent signal reception, which is crucial for safety and navigation in remote areas.

Benefits

1. Enhanced Signal Reception

The T-bar antenna enables stronger communication signals reception/transmission that improve the coordination between the fleet management center and the trucks, facilitating better route management and immediate response in case of

emergencies.

2. Improved Fuel Efficiency

The aerodynamic design of the T-Bar antenna reduces air resistance, which can lead to measurable fuel savings over long distances.

3. Reduced Vulnerability

The T-Bar antenna's design minimizes the risk of damage from environmental factors, leading to fewer repairs and maintenance.

4. GPS Accuracy

Housing GPS within the T-Bar antenna allows for an unobstructed signal, enhancing navigation precision and

aiding in efficient route planning to further conserve fuel.

5. Multifunctional Integration

By combining multiple communication technologies into one streamlined unit, the T-Bar reduces the need for multiple antennas, which can further enhance aerodynamics and signal quality.

By adopting the M.gear T-Bar antenna, trucking operators can not only improve the functionality and operational efficiency of their fleet but also tackle the challenges of safety and communication in remote transit, all while managing fuel expenses more effectively.

Optimized Connectivity for Freight Truck Operators with Jellyfish Antenna

Context

Urban logistics and last-mile delivery services require advanced technology to navigate complex environments and provide timely updates, especially as they adapt to the increasing pressures of e-commerce demands.

Challenge

With an intricate network of roads and constant changes due to traffic and regulations, urban delivery trucks require robust communication systems that can withstand dense urban conditions and deliver precise location and timing information.

How M.gear's Jellyfish Antenna Enhances Connectivity Performance

The Jellyfish 5-in-1 Antenna by M.gear supports GNSS for superior navigation, as well as LTE and 5G MIMO for high-speed data transfer and reliable connectivity. This is crucial for real-time tracking and communication in urban landscapes where signal interference from buildings is common. Its Wi-Fi MIMO capability enhances the coverage and performance of in-vehicle networks, aiding in logistics management.

Benefits

1. Precision Navigation

The Jellyfish antenna's enhanced GPS support enables accurate vehicle tracking and navigation, aiding drivers in finding the best routes and avoiding traffic delays.

2. Reliable Data Connectivity

The integration of LTE and 5G RF support, together with trucks' in-vehicle wireless modem or router, ensures that trucks are always connected, enabling better communication with dispatch and real-time updates.

3. Improved Wi-Fi Network

The Wi-Fi MIMO functionality

enhances in-vehicle network performance and cargo tracking, which is essential for IoT-enabled trucks and trailers.

4. Design Efficiency

The Jellyfish antenna's compact design combines multiple functionalities, reducing the number of external components and streamlining the vehicle's appearance.

5. Wide Coverage

Extensive bandwidth coverage ensures compatibility across different network standards, which is vital for trucks operating in various regions.

Improved Utility Field Service Operations with Jellyfish Antenna

Context

Electric utility field service teams face the daunting task of maintaining and restoring power during routine operations and in emergency situations, such as outages caused by natural disasters, wildfires, and infrastructure inspections.

Challenge

Utility field teams often work in areas with inconsistent cellular coverage, which can hinder communication and coordination efforts. Safety is paramount, and poor mobile voice signal quality can lead to miscommunication and delayed response during critical operations. Field teams require reliable communication tools to perform damage assessments, coordinate repairs, and conduct inspections, ensuring their safety and the effectiveness of their operations.

Solution with M.gear Jellyfish Antenna

The M.gear Jellyfish 5-in-1 Antenna is engineered to overcome the challenges of varying cellular coverage and to enhance signal quality for field service vehicles and the mobile workforce. Its capabilities in GPS/GNSS, LTE, 5G FR1 MIMO, and Wi-Fi MIMO provide a robust and reliable communication link essential for the mobile workforce. Connected to the vehicle's wireless router or modem, the Jellyfish antenna enhances connectivity for navigation, data transfer, and high-quality mobile data voice communications.

Benefits

1. Robust and Consistent Communication

Seamless integration of LTE and 5G technology in the Jellyfish antenna ensures teams stay connected, providing critical information flow during restoration efforts.

2. Accurate Location Tracking

GPS capabilities allow for precise tracking of field service vehicles, coordinating emergency responses and routine inspections, optimizing dispatch and routing during widespread outages.

3. Enhanced Data Access

Wi-Fi MIMO capability ensures that teams can access and share real-time data, from outage maps to repair schedules, directly from

the field via their connected laptops, tablets, and mobile handsets.

4. Efficient Mobile Workforce Management

Reliable connectivity supports mobile workforce applications, enabling real-time coordination and management of field crews.

5. Resilience in Emergencies

The robust design and extensive coverage ensure that communication is maintained even in areas affected by natural disasters.

6. Improved Safety Communication

High-quality mobile voice signals reduce the risk of miscommunication, ensuring field teams can coordinate safely and effectively.

Incorporating the M.gear Jellyfish antenna equips electric utility field service vehicles with the communication reliability necessary to maintain operational efficiency, improve safety, and provide high-quality service even under the most challenging conditions. This connectivity enhancement is a mission-critical investment for utilities looking to manage their field operations more effectively and respond to incidents with greater confidence in their underlying private wireless network and its role in mobile and field service communications.

Public Safety Communication and Coordination Enhanced by T-Bar Antenna

Context

Public safety vehicles are the first line of response in emergencies, and their efficiency can be a matter of life or death. To perform their duties effectively, police officers, paramedics, and firefighters depend on vehicles equipped with communication systems of unwavering reliability. These systems must facilitate seamless coordination with central dispatch and other emergency entities, allow for real-time navigation to avoid delays, and ensure the well-being of the emergency personnel and civilians alike. Whether it's a high-speed police pursuit, a time-sensitive race to the hospital, or a rapid deployment to a fire scene, the communications systems of these vehicles must perform flawlessly under pressure.

How M.gear's T-Bar Antenna Enhances Connectivity Performance

The M.gear T-Bar antenna is purpose-built to meet the demands of public safety vehicles. Its robust design integrates essential communication and navigational tools that withstand the rigors of emergency response scenarios. The antenna's ability to provide superior signal quality, coupled with its aerodynamic profile, ensures that emergency response teams remain connected, informed, and ready to act decisively with the confidence of having robust communications and networking capabilities.

Benefits

1. Reliable Signal Reception

The M.gear T-Bar antenna maintains clear channels for critical communication, even in environments that traditionally challenge signal strength.

2. Precision Navigation

Equipped with high-quality GPS, the T-Bar antenna boosts signal performance for in-vehicle connected devices, thus enabling responders to take the fastest routes, avoiding traffic and obstacles.

3. Aerodynamic Performance

The T-Bar antenna is designed to

reduce drag for faster response times and potential fuel savings, making it an important consideration for vehicles in constant use.

4. Rugged Durability

The T-Bar's resilient construction means it can endure the harsh conditions and physical demands of emergency response work.

5. Integrated Functionality

M.gear designed the T-Bar to simplify the vehicle's equipment by combining several communication technologies, allowing for a more streamlined operation.

The use of the M.gear T-Bar antenna in public safety vehicles ensures that communication systems are as dependable as the responders who use them, enabling a faster and more coordinated emergency response.

3.6 Performance Analysis

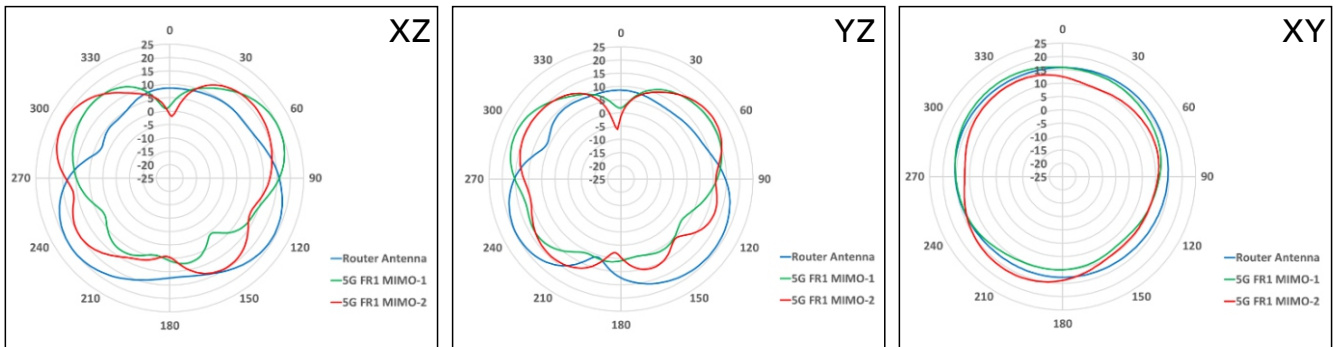
Here we compare the Jellyfish antenna with a standard stick antenna. The tests show a clear advantage with using a Jellyfish antenna.

3.7 Jellyfish / T-Bar vs. Standard Antenna Performance Comparison

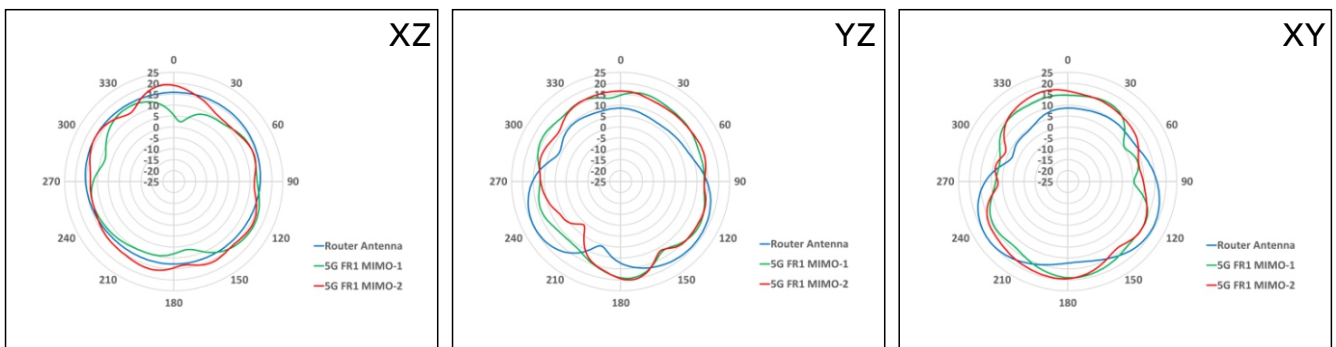
Item	Mid Jellyfish	T-Bar	Router Antenna
VSWR@ Band 8	< 2.5*	< 2.5*	< 3.5
Bandwidth	Multi-band*	Multi-band*	Narrow band
TRP testing results	20.1	20.1	20.5
IP	X7*	X7*	None
Radiation Field Pattern	Omni	Omni	Omni
MIMO	Yes*	Yes*	None

3.8 TRP Test 2D Patterns

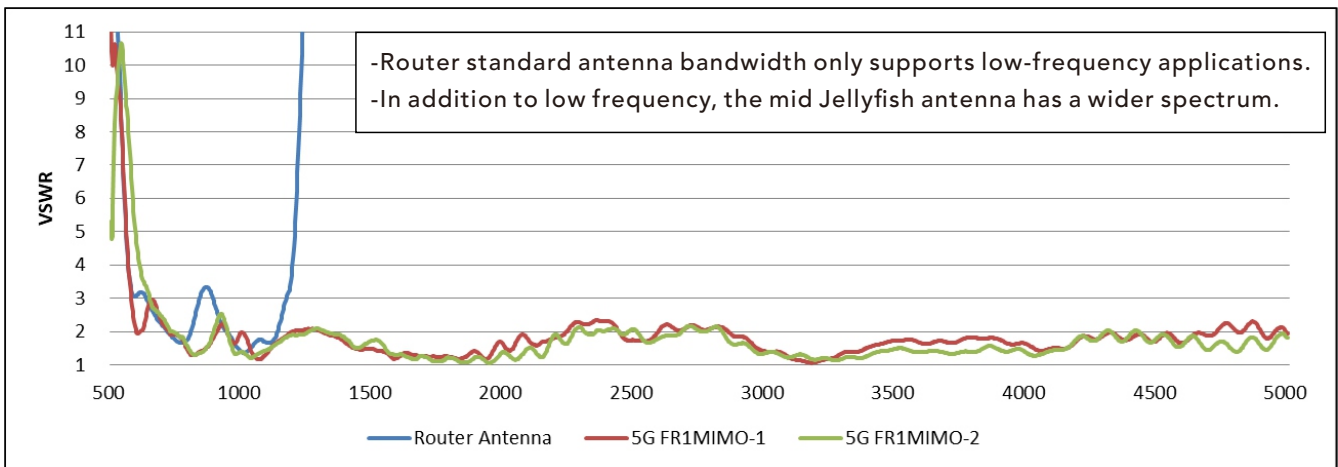
Jellyfish Pattern Drawings with Omni Pattern



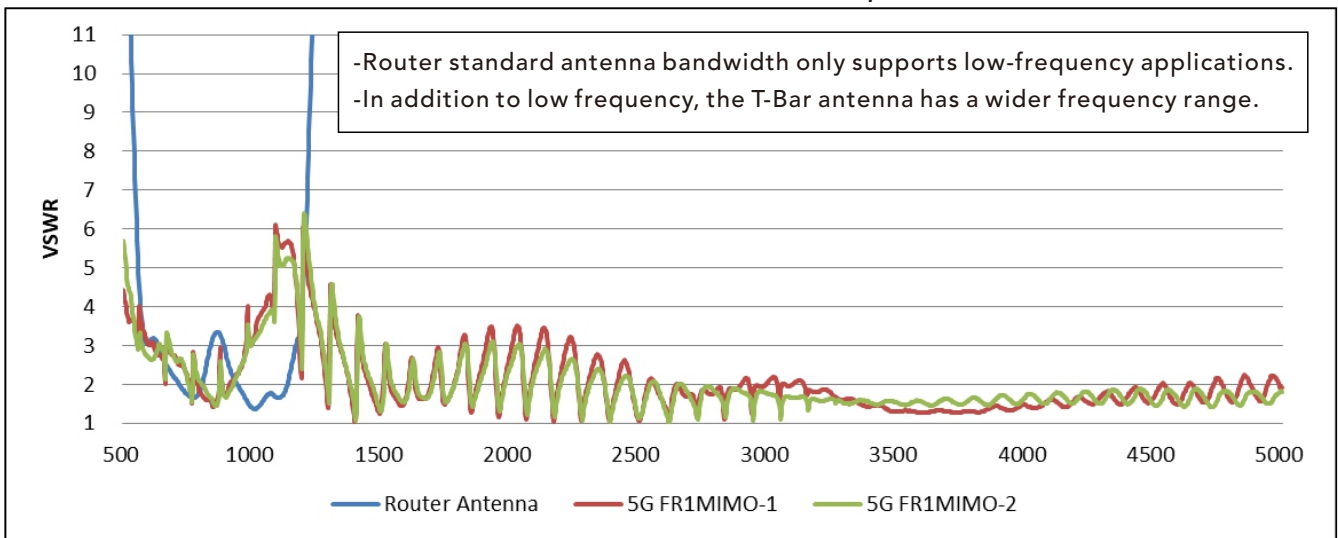
T-Bar Pattern Drawings with Omni Pattern



Jellyfish VSWR Measurements Comparison



T-Bar VSWR Measurements Comparison



4. Summary

M.gear's T-Bar and Jellyfish antennas incorporate advanced 5-in-1 technology, ensuring superior connectivity for vehicular applications across a spectrum of communication systems. These antennas are specifically designed to support 5G FR1 and LTE with MIMO (Multiple Input, Multiple Output) capabilities, enhancing the bandwidth and reliability of mobile communications, crucial for both private and public network users. The integration of MIMO technology for Wi-Fi extends robust and high-speed wireless access, facilitating the transfer of large data sets and uninterrupted access to cloud services for field mobile workforces. This is critical for in-field applications where real-time data exchange is imperative.

In addition to wireless communication improvements, both antenna designs include GPS/GNSS functionality, offering high-precision location tracking to support advanced navigation systems. This precision is vital for efficient fleet management, emergency response vehicles, and any in-vehicle networked devices requiring accurate positioning data.

Furthermore, these antennas accommodate AM/FM Radio reception, allowing for the reception of broadcast signals which can be essential for receiving traffic updates and emergency alerts.

The 5-in-1 antenna technologies housed within the aerodynamically designed T-Bar and Jellyfish antennas ensure a compact and efficient solution to vehicular connectivity needs. They streamline the installation process by reducing the number of separate antennas required, while also preserving the vehicle's external aesthetics and reducing aerodynamic drag.

M.gear's commitment to delivering robust, reliable, and consistent communication solutions is embodied in the design and engineering of their antennas, which are built to withstand harsh environmental conditions, thereby providing durability and performance. This comprehensive approach to vehicular antenna design ensures that M.gear's products meet the high demands of private LTE/5G networks, public cellular networks, GPS navigation, Wi-Fi access, and radio communication for a wide range of applications, including public safety, mobile workforce, and in-vehicle networking.

M.gear is your partner to deliver advanced antenna solutions for mobility.

Order Information

Model No.

T-Bar 5-in-1 Antenna (5G FR1 MIMO/Wi-Fi 6E MIMO/GNSS)


CVX Series MS-A2-5T0-A

Jellyfish 5-in-1 Antenna (5G MIMO/Wi-Fi 6E MIMO/GNSS)


CVX Series MS-A2-5Q2-A

5. Contact Information

Have questions or want to learn more about our antenna and wireless connectivity solutions? Contact us today and let our experts help you find the right solution for your unique needs.

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