

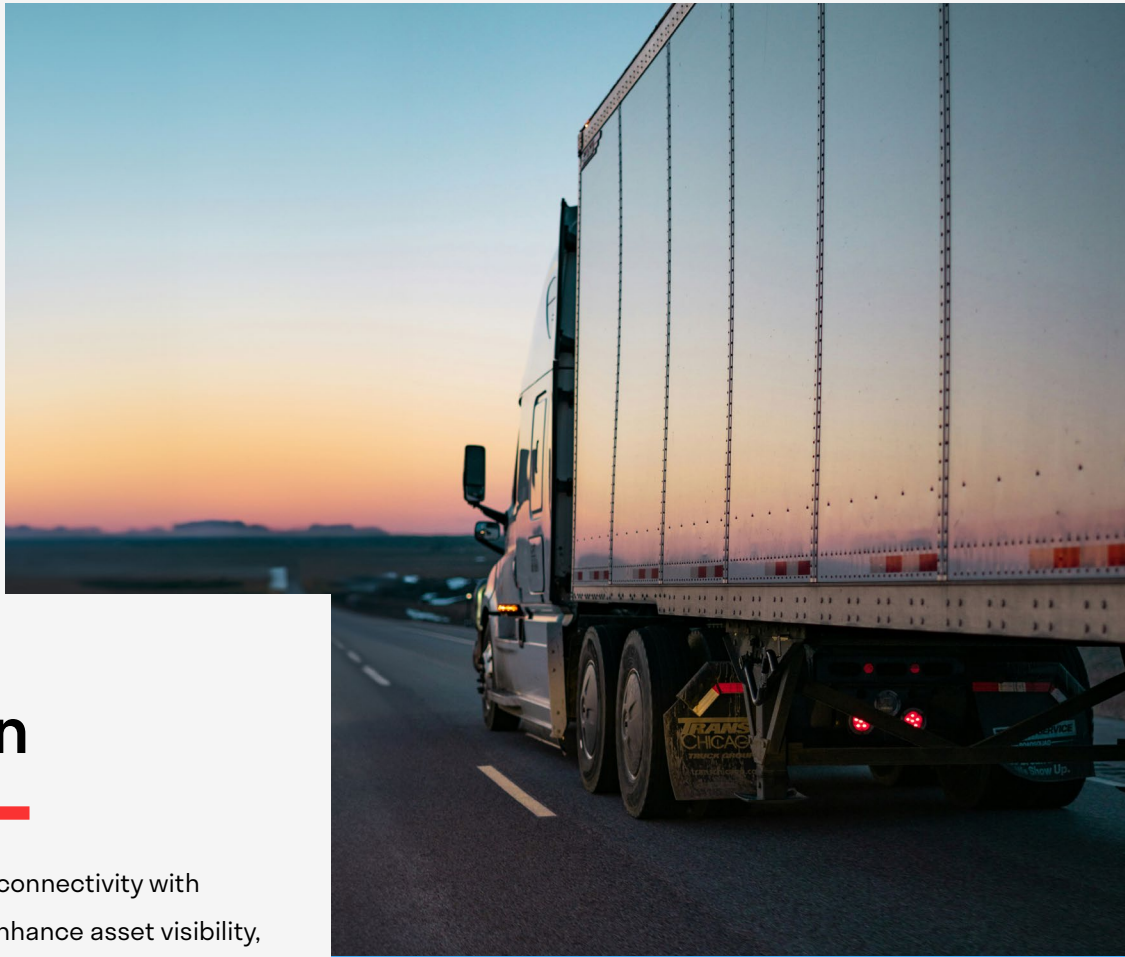
Telematics white paper

Commercial telematics: boosting safety, productivity and cost-efficiency



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Introduction

Commercial telematics blend connectivity with information technologies to enhance asset visibility, vehicle lifecycle management and road safety. The technology enables fleet managers and vehicle or asset owners to track and monitor the status of their vehicles, transforming efficiency by enabling predictive analytics, remote assistance and route optimization. Logistics and other organizations now depend on commercial telematics to enable informed decisions that save money, reduce emissions and enhance efficiency.

By combining vehicle and logistics systems (which monitor multiple aspects of vehicle or asset functions) with GPS and mobile connectivity, user organizations can generate a complete view of the asset's location, its health and performance. Everything from trucks to containers, to mining equipment and forklift trucks can be monitored, with data-driven insights communicated so decisions can be made regarding route optimization or when to schedule maintenance.

Commercial telematics have accessed richer data and become more valuable over the last few years by enabling far more than simply tracking the location of an asset or vehicle. Data including vibration, speed and temperature can be monitored alongside vehicle insights such as fuel consumption, hours of engine use and driver behavior. Enterprises can use these systems to optimize routes, reduce fuel consumption and emissions and save costs.

Further innovations in network performance via high-end 4G and 5G are adding video telematics to the portfolio of capabilities, and telematics will also be aided by technologies such as AI, deeper predictive analytics and increased automation. Rich information and insights handled by telematics will feed into assisted driving and operation of vehicles and assets.

Clear ROI demonstrated

The value of commercial telematics to organizations comes in several forms. The return on investment (ROI) comes in financial savings from route distance optimization, operator wages and minimized downtime, all of which can be readily calculated. Less clear but still substantial are savings in CO2 emission, which contributes to organizations' ESG and regulatory responsibilities, and in wasted maintenance, which saves time and aids efficiency.

This suite of benefits has helped maintain momentum for commercial telematics. Research firm ABI Research, for example, has projected that the worldwide commercial telematics market will surpass US\$84 billion in 2032.¹ Local delivery, government and construction organizations are among the highest adopters, with compounded annual growth rates (CAGR) of 14%, 13.5%, and 12.3% respectively between 2023 and 2032.

The firm has also published projections for the number of commercial telematics connections it expects to see in the period 2024-2030. It segments the market into trucking, non-trucking and trailer-based tracking and foresees significant growth, especially in the non-trucking sector which it expects to exceed 150 million connections in 2030.

FIGURE 1: COMMERCIAL TELEMATICS CONNECTIONS 2024-2030



Source: ABI Research (PT-3134)

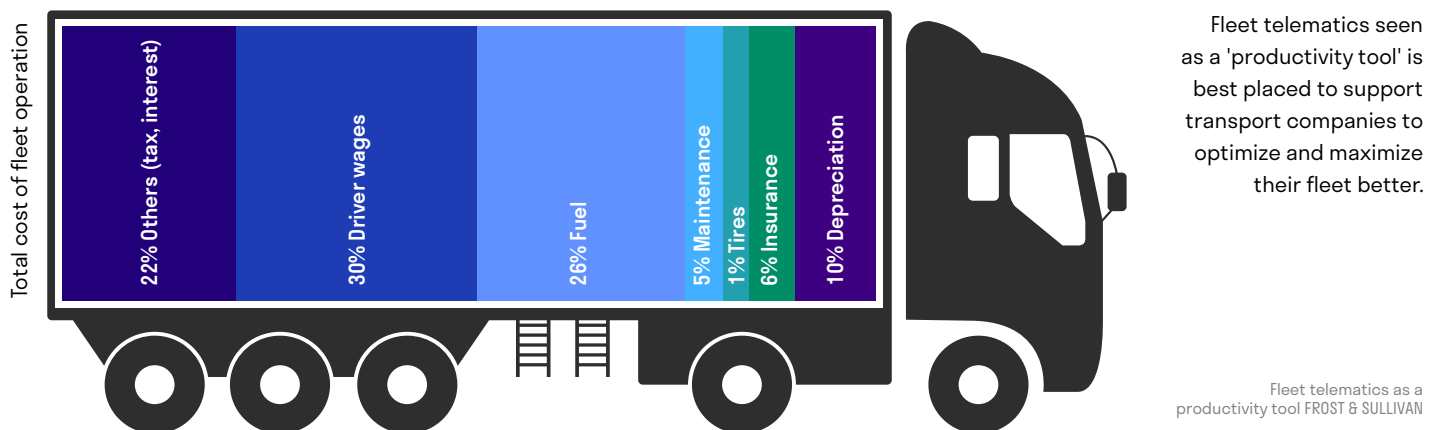
¹ <https://www.abiresearch.com/press/commercial-telematics-revenues-set-to-surpass-us84-billion-as-fleets-seek-more-real-time-visibility/>

Telematics keeps on trucking

The level of transparency that telematics solutions provide enables drivers and fleet managers to track critical infractions during a trip and over time. This information can help to increase accountability and encourage safer driving habits. It can also mitigate costs, as preventive maintenance and fuel consumption tracking capabilities can be adopted to improve vehicle lifecycle performance and reduce insurance costs, the firm says.

In trucking, the benefits are substantial. Analyst firm Frost & Sullivan has emphasized that fleet expenses typically center on driver wages and fuel costs². While driver wages account for about 30% of a fleet's expenses, fuel costs make up about 26% of fleet expenditure, the firm says. Telematics deliver significant savings on both of these and have the capacity to increase productivity by 10-15%, and reduce overtime by another 10-15%.

FIGURE 2: FLEET OPERATION COSTS AND TELEMATICS BENEFITS



Benefits after effective deployment of fleet management system:



² <https://www.frost.com/frost-perspectives/commercial-vehicle-sales-are-ailing-so-why-is-the-connected-truck-telematics-market-still-in-good-health/>



They also enable fleets to save about 20-25% on fuel expenses, on average, by promoting better driving practices. In addition, telematics can help fleets to shave 20-30 minutes off daily driving time.

For truck fleet operators these benefits are compelling, and Berg Insight has reported that the number of active fleet management systems deployed in commercial vehicle fleets in North America was 15.3 million in Q4 2022³. Growing at a CAGR of 12.6%, this number is expected to reach 27.6 million by 2027. In Latin America, the number of active fleet management systems is expected to grow at the same 12.6% CAGR from 5.3 million in Q4 2022 to reach 9.6 million in 2027.

There are now more than 30 players with installed bases of more than 100,000 active fleet management units in the Americas. At the end of 2022, the top 30 vendors together had nearly 15 million vehicles under management in the region and the top 10 alone represented 50% of the total installed base in the Americas.

The number of active fleet management systems deployed in commercial vehicle fleets in Europe was similar according to the firm, totalling 14.8 million at the end of 2022.⁴ Growing at a compound annual growth rate (CAGR) of 12.4%, this number is expected to reach 26.5 million by 2027. The top 38 vendors have today more than 100,000 active units in Europe.

³ <https://www.frost.com/frost-perspectives/commercial-vehicle-sales-are-ailing-so-why-is-the-connected-truck-telematics-market-still-in-good-health/>

⁴ <https://www.berginsight.com/the-installed-base-of-fleet-management-systems-in-europe-will-reach-265-million-by-2027>

Go further than fleet management

Commercial telematics aren't only for truck fleets. Although adoption of the technology has been led by vehicles with on-board diagnostics (OBD) ports, which provide a vital means to gather data from on-board systems, other moving assets, vehicles and equipment are increasingly adopting telematics systems. Items such as construction equipment, fuel tankers and leased machines such as excavators for mining are all deriving significant value from telematics.

The ability to know where assets are, how many hours they have been used for, whether they are being driven or used correctly or if maintenance is needed are essential data points for commercial equipment fleet operators. The value of knowing how many hours a machine engine has been on for or if it needs hydraulic fluid to be replenished can help owners create accurate bills and plan for predictive maintenance. In addition, knowing where the asset is can aid efficiency when it comes to collecting it at the end of a lease. Stolen equipment can also be tracked.

A further benefit is the ability to control vehicle functions remotely. Equipment that has not been paid for or is being used incorrectly can be disabled to prevent further use or avoidable damage. For these reasons and the productivity and efficiency benefits outlined for truck fleets, owners and operators of non-road-based equipment, vehicles and machinery are increasingly turning to telematics to gain benefits.

The global installed base of active construction equipment OEM telematics systems, for example, reached 6.2 million units in 2022, according to Berg Insight. Growing at a CAGR of 12%, the active installed base is forecast to reach 11 million units worldwide in 2027. This includes all construction equipment telematics systems marketed by construction equipment OEMs, either developed in-house or provided by the OE manufacturers in partnership with third-party telematics players.

The firm also estimates that the global installed base of active off-highway vehicle telematics systems reached 7.9 million units in 2022⁵. This includes connected units deployed on various off-highway vehicles across the construction, mining, agriculture and forestry sectors. Growing at a CAGR of 13.1%, the active installed base of off-highway vehicle telematics systems across all sectors is estimated to reach 14.6 million units worldwide in 2027.

⁵ <https://www.berginsight.com/the-installed-base-of-off-highway-vehicle-telematics-systems-to-reach-146-million-units-worldwide-by-2027>

Into the next phase of commercial telematics

Commercial telematics have focused on gathering data from embedded vehicle or asset systems but the near-ubiquitous availability of 4G, plus the ongoing deployments of 5G, especially along major highways, is opening up low-latency connectivity that can support real-time video communications. Commercial video telematics vendors are progressing with capabilities such as gesture and object recognition, 360° views of in-cab and road triggers and live streaming for up to eight cameras, says ABI Research. Edge computing, coupled with more powerful connectivity, has also seen increased demand to capture and analyze data in real time.

The firm reports that the adoption of video telematics-based capabilities is fueling a projected 24% growth in video solution shipments by 2030, with anticipated revenues surpassing US\$10 billion.⁶ Berg Insight also sees a growing installed base for active video telematics. It reports that the North American market reached almost 4.9 million units in 2023. Growing at a CAGR of 19%, the active installed base is forecast to reach 11.7 million units in North America by 2028. In Europe, the installed base is estimated to have reached almost 1.4 million units in 2023. The active installed base in the region is forecasted to grow at a CAGR of 18% to reach 3.1 million video telematics systems in Europe by 2028.⁷

A world of expanded connectivity options

Commercial telematics, as 2G and 3G networks, retire will increasingly focus on 4G and 5G cellular connectivity to support data communications. The next generation of telematics hardware includes telematics gateways, cameras, embedded vehicle systems and retrofitted options. Increasingly, these devices will need to offer a blend of high-capacity, low-latency wireless connectivity, varying degrees of edge intelligence to suit the use cases being enabled

and the robustness necessary to cope with millions of miles and thousands of hours of sustained hard use.

A further concern is security. There can be no weaknesses here because of the danger that hacked telematics systems could present to workers, the general population and to the sites in which they operate.

⁶ <https://www.abiresearch.com/press/video-telematics-to-improve-commercial-vehicle-road-safety-driving-global-revenues-to-us10-billion-by-2030/>

⁷ <https://www.berginsight.com/the-installed-base-of-video-telematics-systems-in-north-america-and-europe-to-reach-15-million-units-by-2028>

How Quectel helps

Quectel has a comprehensive range of modules and antennas that address the 4G and 5G requirements of commercial telematics which are detailed in Appendix 1 of this paper. In addition to these, Quectel supports customers, developers and designers with a comprehensive range of original design manufacturer (ODM), testing and certification services. These help ensure simplified and accelerated routes from concept initiation to global market launch, drawing on Quectel's extensive experience and large R&D resources.

Of particular importance for commercial telematics, Quectel IoT modules are significantly more secure than the industry average. Independent, third-party cybersecurity firm Finite State has confirmed in a recent report that nearly 95% of all modules shipped to the US since the beginning of 2022 have industry-leading security scores based on penetration testing and binary analysis by the firm.

The report highlights a notable enhancement in Quectel's security position, expanding the number of modules tested and with scores across the tested modules improving from an average of 33 to 18, up from an average of 62 to 24 in previous testing. This represents a substantial improvement, as both the initial and revised scores significantly surpass the industry average of 98 with the lowest (best) score of 10. The advanced testing encompasses an array of sophisticated security assessments designed to fortify Quectel's modules against the evolving landscape of cyber threats, including binary analysis of numerous Quectel products and both penetration testing and binary analysis of several Quectel cellular modules.



Conclusion

Commercial telematics have matured from early M2M use cases to now encompass solutions that cut across multiple data sources to enable safer, faster, less polluting journeys while helping to improve driver or operator habits. The days of crude solutions to track vehicle fleets are ending as richer data, including video, is adopted to keep drivers safe and ensure maximized machine uptime. Commercial telematics are now focused on utilizing edge intelligence allied to high-speed wireless networks and the positioning capabilities of 5G.

In-vehicle, embedded systems still populate telematics solutions with valuable data but increasingly additional sources, such as smart highways and smart cities, will contribute to the commercial telematics experience. The connection and the computing power is central being able to blend data into useful insights and enable action to be taken.

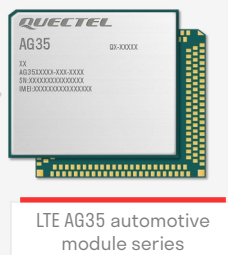
APPENDIX 1

> THE MODULES

Quectel has created a comprehensive portfolio of modules and antennas to support commercial telematics applications. The modules encompass 4G, 5G and GNSS connectivity with the speed, robustness and security needed to support telematics use cases.

The range includes the Quectel **AG55xQ**, an automotive-grade 5G NR sub-6GHz module which meets the 3GPP Release 15 specification and supports both standalone (SA) and non-standalone (NSA) modes. The AG55xQ supports maximum downlink rates of 2.4Gbps and uplink rates of 550Mbps for 5G NR, and maximum downlink rates of 1.6Gbps and uplink rates of 200Mbps for LTE-A. Available in Europe, the module is deployed in telematics boxes, telematics control units, advanced driver-assistance systems, C-V2X (V2V, V2I, V2P) systems, on-board units and roadside units.

An alternative is the Quectel **AG15**, which in combination with the Quectel AG251S, creates an overall solution for C-V2X. The AG15 supports vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and vehicle-to-pedestrian (V2P) communications on the unified 5.9GHz ITS band without the need for a (U)SIM, cellular subscription or network assistance. It is able to meet connected vehicles' demand of communication with lower latency, higher reliability and high throughput. The AG15 is a global V2X communication solution to meet enhanced driving safety, autonomous driving, ITS and ADAS application demands.



The Quectel **AG35** is a series of automotive grade LTE Cat 4 modules which meets the 3GPP Release 10 specification, is designed and manufactured according to the IATF 16949:2016 standard, and supports maximum downlink rates of 150Mbps and uplink rates of 50Mbps. The AG35 offers excellent performance in ESD and EMI protection ensures great robustness in harsh environments. It is backward-compatible with existing EDGE and GSM/GPRS networks, allowing it to be connected even in remote areas devoid of 3G or 4G coverage. The AG35 supports multiple input multiple output (MIMO) technology which greatly reduces errors and optimizes data speed. The module also combines high-speed wireless connectivity with embedded highly sensitive multi-constellation GNSS receivers (GPS, GLONASS, BDS, Galileo, QZSS) for positioning. The AG35 is especially suitable for automotive applications such as fleet management, vehicle tracking, in-vehicle navigation systems, remote vehicle monitoring, remote vehicle control,

remote vehicle diagnostics, vehicle wireless routing and in-car entertainment.

The modules detailed above introduce just some of the Quectel range of modules and showcase how the portfolio is suited to commercial telematics deployments with the AG55 5G Release 15 solution, the AG15 C-V2X Release 14/15 solution and the AG15 cost-optimized LTE Cat 4 solution. There is a vast choice of modules in the Quectel range which spans all wireless technologies and can be customized for specific use cases, such as embedded in-vehicle telematics systems.



Quectel modules can ensure reliable global connectivity is accessible across cellular, satellite and other wireless options such as Wi-Fi, Bluetooth and LPWA. With extensive experience in creating custom solutions for commercial telematics, Quectel's experts have the knowledge to identify the optimum module for your requirements and customize it for your deployment scenario.

To view the comprehensive roadmap for cellular automotive modules, visit our [Product Selector](#).

> THE ANTENNAS

Quectel's extensive range of internal, external and combo antennas have been designed to fit the requirements of all types of telematics deployments. Offerings extend across cellular, GNSS, GPS, Wi-Fi and Bluetooth, satellite communications, AM/FM, V2X and UWB, with mounting options including terminal, screw, magnetic, bracket, adhesive, pin and SMD. In the commercial telematics market, antennas are typically automotive internal antennas that have been custom-designed for the use case.

These antennas are normally embedded on printed circuit boards within the customer's device and the key functionality is 4G and 5G cellular connectivity alongside GNSS. It is simple to accommodate 2G, 3G, NB-IoT and LTE Cat M connectivity if access to those technologies is needed in markets in which vehicles are deployed. Quectel offers a wide range of standard internal, external and combo antennas to address common requirements and also offers customized solutions for use cases that need specific solutions. Quectel's focus here is to assist commercial telematics customers from design to the

manufacturing phase. We're able to help customers plan their solutions, consider the certification and performance requirements they need to address for mobile operator acceptance and ensure product quality via our manufacturing services. Our manufacturing services include sample creation, tooling and molding, assembly and production testing and delivery.


We offer solutions for the entire wireless front end, the vertical integration of antennas resources, complete RF antenna testing services, global one-stop engineering support and the comfort of knowing that Quectel antennas are approved for use with Quectel modules. With an antenna range encompassing more than 3,000 antenna products, 17 chambers and fully equipped labs, and over 4,000 completed IoT projects, Quectel is uniquely positioned to help our customers at every stage of their commercial telematics projects.



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