

# Why IoT technology is a force for good



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# Introduction

A lot of the focus in IoT has been on either inventing new businesses or creating new opportunities for existing businesses by connecting previously unconnected products. There's great profit potential in IoT but there are also other considerable benefits for organizations to consider. IoT technology is being deployed in multiple industries and providing benefits to society as a whole and this paper showcases just some of the ways in which IoT is creating a better world.

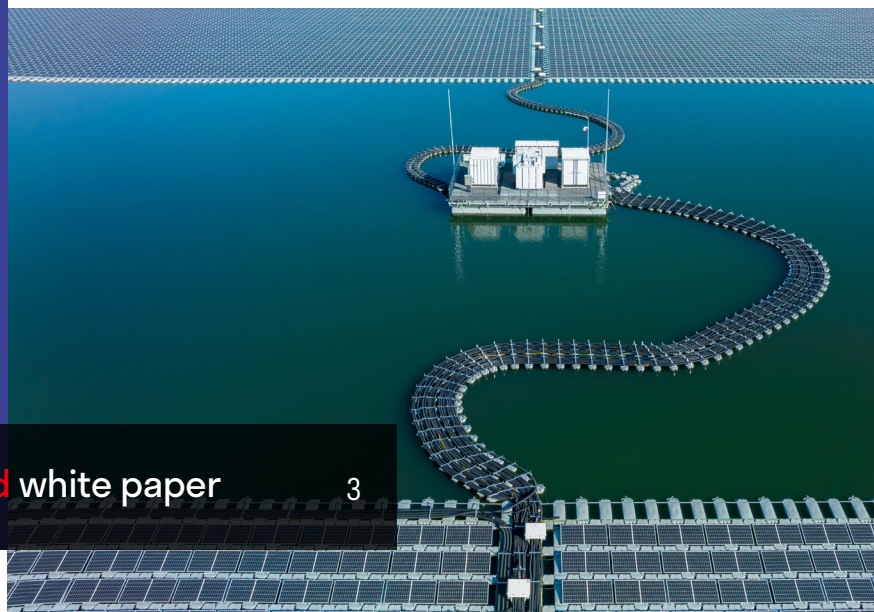
From satellite and/or cellular modules that are connecting the unconnected to agriculture apps that are increasing crop yields to fight starvation or medical services that are shortening waiting lists and systems that are reducing environmental damage, IoT is delivering on its promise to build not only a smarter world but a safer, healthier and more sustainable society. This paper profiles the technological advances that are driving deployments that benefit us all and details some use cases that are being enabled. In addition, the paper reveals how an optimized approach to design, development, distribution and manufacturing is enabling IoT products to have a positive impact while minimizing energy consumption, environmental impacts and costs for the end user.

Critically, intelligent development means that the cost of technologies and components has reduced, democratizing access to innovation and enabling it to be applied to use cases that previously would have remained unviable.

From a technology perspective, a perfect storm of new ideas, economies of scale and deployment experience has come together. Mature wireless technologies – whether cellular, low power or satellite – are now available providing universal coverage, greater capacity than ever before and appealing cost structures. For most use cases, there is now a blend of coverage, capacity and cost to suit each deployment.



***IoT IS DELIVERING ON ITS PROMISE TO BUILD NOT ONLY A SMARTER WORLD BUT A SAFER, HEALTHIER AND MORE SUSTAINABLE SOCIETY***



At the same time computing capabilities have matured with costs coming down, power consumption becoming optimized and the footprint of hardware being minimized. Devices can now readily contain appropriate computing power or be connected to remote or edge compute resources. These advances have opened up huge potential for low value, high volume deployments in revenue-constrained situations as well as ultra-high performance offerings for high value services such as medical imaging.

The development of IoT itself has further positioned IoT technologies to support society and make everyone's lives better. Greater understanding of how to efficiently design, manufacture, deploy and operate IoT devices has made IoT suitable for a wider range of applications and use cases than ever before. These range from simple tracking apps to keep lone workers safe to monitoring patients' consumption of medicines or low-cost sensor networks to ensure maximized crop yields.



# Assuring the vaccines cold chain

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One recent example of IoT's power to help was during the peak of the COVID-19 pandemic when it became clear that vast volumes of vaccine doses would need to be transported at controlled temperatures. The Pfizer-BioNTech vaccine, one of the earliest to market, would have to be transported at unprecedented temperatures: between -90°C and -60°C (-130°F to -76°F).

"We knew we'd need to ship a vaccine at -75°C, which we had never done before," says Danny Hendrikse, the vice president of intercompany operations at Pfizer.

To meet that demanding requirement, Pfizer developed a special thermal shipping box. Then it turned to Controlant, whose Cold Chain as a Service offering was key for meeting the stringent requirements. IoT devices added to each thermal shipping box are a key part of Controlant's monitoring solution for Pfizer. These devices feed temperature data in real-time to Pfizer's existing control tower system for monitoring the status of vaccines throughout shipment. This enables Pfizer to instantly identify emerging problems so they can be quickly addressed in transit, thus protecting vaccines that save lives.

To ensure that its IoT devices always have a reliable, secure connection to Pfizer's control tower, Controlant selected Quectel's [EG25-G](#) module. Several features make the EG25-G ideal for demanding cold chain applications such as vaccine transport. The EG25-G supports all the LTE, UMTS, HSPA+, EDGE, GPRS, and GSM bands used worldwide. This flexibility ensures that it can always find a network to connect to — even in remote areas where 2G or 3G networks are often still in use.

In addition, the EG25-G supports all global navigation satellite systems (GNSS) — GPS, GLONASS, BeiDou/Compass, Galileo and QZSS —, which uses information from nearby cell sites and/or Wi-Fi access points (APs) and then applies techniques such as triangulation to locate an IoT device in an area smaller than a tennis court.

"In the IoT world, people often talk about 'mission-critical' applications," says Norbert Muhrer, the president and CSO of Quectel. "But this was the ultimate mission-critical application, with literally billions of lives at stake. We're honored and humbled to have played a part in ensuring that over 700 million doses of the Pfizer-BioNTech vaccine were quickly, safely and efficiently delivered around the world."

# IoT is the healthy option

The application of IoT technology in healthcare doesn't end there, patients are now routinely monitored utilizing connected sensors and devices. IoT is being used to help treat chronic and life-threatening conditions and the number of remotely monitored patients reached 56.8 million in 2021, reported Berg Insight. The firm estimates that the number of remotely monitored patients will grow at a compound annual growth rate (CAGR) of 14.2% to reach 126.1 million by 2027.

In Australia, patients that suffer from life-threatening medical conditions are being assured of prioritized phone service thanks to Telstra's Priority Assist service. The Priority Assistance service is a free higher priority connection and fault restoration service for customers who have, or live with someone who has, a diagnosed life-threatening medical condition, and whose life may be at risk if they don't have access to a working telephone service. This ensures their downtime is minimized and they remain in contact with medical care and vital support services.

Telstra approached SGW, a specialist in the manufacture, design, sales and distribution of consumer electronics products and services to create a solution for Telstra Priority Assist Customers. SGW quickly identified that an always-on voice solution would meet the needs of customers to continuously have voice connectivity. The company then developed a system that, in the event of a disruption to the fixed voice service automatically switches to the mobile network to maintain a voice connection. The solution contains a battery pack that ensures the customer maintains power for four hours if mains power is unavailable.

Quectel's [EC21-AU](#) module was chosen as the hardware best-equipped to meet Telstra's time-to-market and rigorous certification requirements, set out by local regulator ACMA. SGW and Quectel were able to collaborate closely with Telstra and ensured the EC21 module was certified quickly, allowing Telstra to launch its Priority Assist telephone successfully. This was partly achieved by the local engineering support that Quectel provided SGW to help work through complex Telstra security requirements.

Healthcare apps for IoT are becoming increasingly numerous with Quectel providing LTE modules for Volansys's gateway device which supports remote attendance systems for a healthcare customer in North America, Europe, Asia, Australia and New Zealand. Quectel has also provided solutions to elderly care providers in the form of the GrannyGuard and Unaliwear's Kanega Watch in addition to new companion robots for the elderly from Blue Frog Robotics. These solutions enable seniors to extend their independence, utilizing wireless connectivity to monitor their health, track their locations or to raise alarms in the event of an emergency.



BERG INSIGHT ESTIMATES THAT THE NUMBER OF REMOTELY MONITORED PATIENTS **WILL GROW** AT A COMPOUND ANNUAL GROWTH RATE (CAGR) OF **14.2%** TO REACH **126.1** MILLION BY **2027**

# IoT can help feed the world

The agriculture sector faces increasing pressure to increase yields so the world's growing population can be fed. However, the industry is seeking to avoid causing environmental damage by using excessive amounts of fertilizer, which can also make some crops too expensive for some consumers. The goal is to optimize farming yields while minimizing environmental impacts and costs.

Innovations such as low power wide area networks (LPWAN) are powering highly-cost effective sensor networks that can monitor moisture levels, crop growth, temperature and other data points which can then enable highly granular and accurate approaches to farming. Utilizing low cost devices and cost-effective connectivity is helping farmers increase yields, keep up to date on the latest techniques and ensure they maximize their incomes at market.

Global connected agriculture device/node shipments are set to grow by 30% annually to reach 187 million units by 2030 from 23 million in 2022, according to Counterpoint Research's latest Global Connected Agriculture Market report. The need for connectivity is driven by the need to manage and monitor large farms and livestock herds, and manpower shortages in some countries. The connected agriculture market's crop

farming segment is expected to grow at the fastest pace (41% CAGR) during 2023-2030, followed by drones and robots, tractors and livestock monitoring.

Deployments of IoT systems to support agriculture are gathering pace. IoT modules and antennas from Quectel support the award-winning FarmGO smart agriculture platform, for example, which helps farmers in Brazil optimize their activities. Developed with agronomists, researchers and rural producers, FarmGO acts as a decision-making support tool drawing on data from monitoring a wide range of agricultural sensors and indicators. The FarmGO platform currently is used to monitor two million hectares with 82,000 areas managed.

FarmGO includes crop health monitoring, pest and disease monitoring, identification of anomalies, field inspection records, importation of planting and harvesting maps and importation of soil fertility data – all on a single platform. In addition, analysis of historical behavior of specific areas can be added so automatic identification of productive spots can be undertaken. Climate monitoring enables weather history,

individualized by field to be correlated with weather alerts and a manual rainfall recording option.

The smart agriculture company turned to Quectel to ensure GPRS, GNSS and Wi-Fi communications for its weather stations, utilizing the Quectel [L76-L](#) and [EC21](#) modules as well as the Quectel YEMN001AA antenna. FarmGO was particularly keen to unify the number of communication antennas it deployed on its devices and, prior to selecting Quectel, the hardware operated with three antennas. Now, the weather stations operate using a single antenna.

In the cattle sector, Inova Farm, a Brazil based developer of solutions to create new opportunities in agribusiness by using IoT, machine learning and big data technologies, selected the [L96-M33](#) IoT module from Quectel. The module has been integrated into a new animal marking ear-ring created by Inova Farm to solve the challenge of obtaining accurate positioning information of animals in fields.

The ear-ring, which is similar in appearance to traditional animal marking ear-rings, works by emitting signals via satellite to provide farmers with all the information necessary to ensure traceability and safety for their herds. The small form factor of animal marking ear-rings meant Inova Farm was looking for small sized, low weight IoT modules in order to keep the overall weight of the product light. In addition, because of the nature of farm animals, the device needed to be robust and able to operate in a range of temperatures.



# IoT sustains sustainability

IoT solutions are now being used to enable a multitude of use cases that contribute to lower CO2 production, greater efficiency in fuel and power consumption and reduction in waste. Everything from efficient route planning in vehicles to smart meters that optimize energy and water consumption is playing an incremental part in lessening the impact of humans on the environment. IoT is playing an increasingly essential role in connecting sensors, transmitting data and enabling analytics to be performed so optimal decisions can be made.

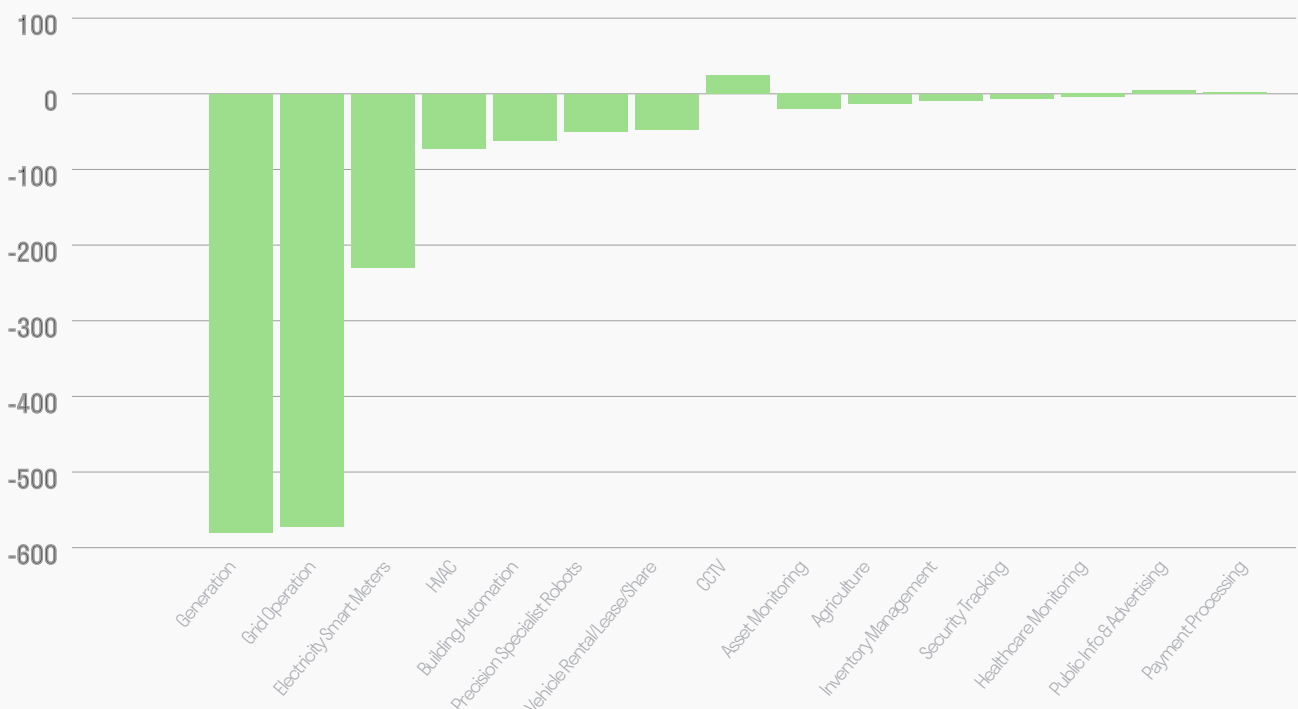
As the figure below from Transforma Insights reveals, significant reductions in electricity consumption are being achieved across industries through the adoption of enterprise IoT applications. Some of this will be achieved by growing adoption of smart metering, which Juniper Research anticipates is set to see substantial growth. The firm projects that hardware, connectivity and service revenues from smart meter deployments,

and those in use, will exceed US\$60 billion in 2027; up from US\$41 billion in 2023. This 44% growth reflects how smart meters are becoming critical to increasing the efficiency of energy grids via analytics; central to lowering costs to customers during the energy price crisis.

One example of a company that has utilized IoT technology to help customers reduce their environmental impact is Sensoneo, a global enterprise-grade smart waste management solutions provider. The company enables cities and businesses to manage their waste efficiently, reduce their environmental footprint, and improve the quality of services they provide has selected a range of IoT modules from Quectel. The company utilizes its smart waste management technology to address lack of efficiency and transparency, the greatest challenge the waste management industry faces. Sensoneo reports that its solution enables customers to achieve 30-63% reductions in waste collection route kilometers driven

## Enterprise IoT applications with most net electricity consumption impact, 2030

[Source: Transforma Insights TAM forecasts, 2021]



and 97% accuracy regarding actual waste production. Sensoneo hardware, developed by the company's in-house R&D teams and enabled by IoT networks, has been installed in more than 60 countries through its reseller partners.

In order to achieve connection to IoT networks, Sensoneo chose Quectel's LTE [BG96](#), GNSS [LC86L](#) and GNSS [L86](#) IoT modules. The Quectel BG96 is an LTE Cat M1/Cat NB1/EGPRS module offering maximum data rates of 375 kbps downlink and uplink. It features global frequency bands, ultra-low power consumption, and is compatible with Quectel's LTE Standard module [EG91/EG95](#), LPWA module BC95-G/[BG95](#), UMTS/HSPA module UG95/[UG96](#) and GSM/GPRS module M95.

Sensoneo Smart Sensors are available in EMEA and both South and North America and are helping to achieve substantial reductions in carbon production. The firm reports customers benefit from an overall waste collection cost reduction of at least 30% and carbon emission reduction of up to 60% in cities. Quectel smart IoT modules were selected because of the quality, availability and versatility Quectel is able to provide across its large portfolio of IoT modules.

Meanwhile, Unitron Connect, a technology partner for customized internet protocol (IP) and radio frequency (RF) solutions, selected the Quectel [BG95-M6](#) module to enable combined narrowband-IoT (NB-IoT) and LTE-M connectivity that can operate in low power modes. Unitron Connect, is part of the Belgium-headquartered UnitronGroup, a family-owned international group of companies that develops, produces and sells telecommunication, multimedia and Internet of Things applications. The company's research and development team draws on its expertise in radio-frequency engineering to build connected solutions used on all continents.

The module has been selected for Unitron Connect's new platform for battery collection and condition monitoring which is intended for deployment throughout the European market.

"Our customers will be able to optimize battery collection, storage and transportation efficiency with performance gains of more than 25%," says Jan Bogaert, the Head of Business Unit IoT at Unitron Connect. "In addition to this efficiency gain, the module allows for safety measures to be automatically triggered such as alarms or fire-extinguishment and suppression applications."

As consumers turn to lower impact vehicles, adoption of electric motorbikes has increased and manufacturers are enabling their vehicles with IoT connectivity to help users manage their vehicles. One example is Brazilian provider of two-wheeled electric vehicles, Voltz Motors. The company has selected Quectel's [BG95-M3](#) module which supports LTE Cat M2, Cat NB2 and eGPRS with integrated GNSS for its EVS motorbike.

The Voltz Motors EVS offers a maximum speed of 120kmh with range of 180km at 45kmh. It can accelerate 0-60kmh in six seconds, outperforming 160cc combustion-engine scooters. The street model is equipped with a smart controller programmed to send data to the Voltz cloud. In addition, the smart digital panel connects to riders' smartphones, so they can check the battery status and cycle, location, speed and riding data that encourage defensive and economical driving.

"We are the first brand in Brazil to sell smart motorbikes and to create an ecosystem of connected motorbikes in which the user has full control of the motorbike by cell phone," said Danillo Aguiar, an engineer at Voltz Motors. "We chose the Quectel BG95-M3 because it is the most suitable module for our M2M application. It is cost effective and has all the functionality requirements for our project in which the customer has access to all motorcycle information through the motorcycle's mobile app, as well as the control of the security and geolocation system."

# IoT helps enhance safety and society

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In addition to the vertical markets detailed above, IoT is helping to power initiatives across horizontal markets that improve health and safety for workers and improve citizens' standards of living. These solutions can encompass highly specific solutions such as devices that help keep mineworkers safe, as well as offerings such as fixed wireless access (FWA) that are connecting populations for the first time and supporting education initiatives in addition to healthcare and economic programs.

Schauenburg Systems, an original equipment manufacturer (OEM) for mine safety systems, has been at the forefront in innovations that improve mine safety yet are simple for mining organizations to deploy. It has recently launched its SmartConnex portable and compact gas detector which can monitor several gases in real-time and communicate with other smart devices in its vicinity. SmartConnex is able to do more than simply detect gases and Schauenburg was keen to add rich functionality to the new product. It turned to ICORP Technologies, its electronics components distributor, to locate a wireless module that could accommodate customer needs for multiple forms of wireless connectivity and location-awareness. ICORP recommended the Quectel [SC20-E](#) module because it addressed Schauenburg's application design and requirements.

The digital divide is also being breached by the availability of cost-effective FWA solutions.

One example is ELSYS, a Brazilian technology company that has been providing technological solutions for more than 33 years in Latin America and the United States, that chose the Quectel [EC25](#) module for its Amplimax – an outdoor LTE customer premise equipment (CPE). The product features an embedded directional antenna for fixed wireless access (FWA) and enables customers to access the internet and make voice calls, even in remote areas. With no obligation to use a specific carrier and easy install, the product is resistant to powder, water and sunlight, and enables a signal that is up to six-times stronger than alternatives. The product is powered by the Quectel EC25, a series of LTE Cat 4 IoT modules offered in an LCC form factor measuring 32.0mm × 29.0mm × 2.4mm. The EC25 delivers maximum downlink rates of 150Mbps and uplink rates of 50Mbps under LTE, and multiple-input multiple-output (MIMO) technology meets demands for data rate and link reliability.



# Secure data and protected privacy

The more society relies on IoT, the greater the concern that devices could be hacked, data stolen, privacy interrupted and frauds committed. Trust in the technology is a challenge facing everyone in IoT and concerns every sector. The scale of the problem has been underlined by Deloitte's 2022 Connectivity and Mobile Trends Survey which found that 52% of users are worried about the security vulnerabilities of smart home devices.

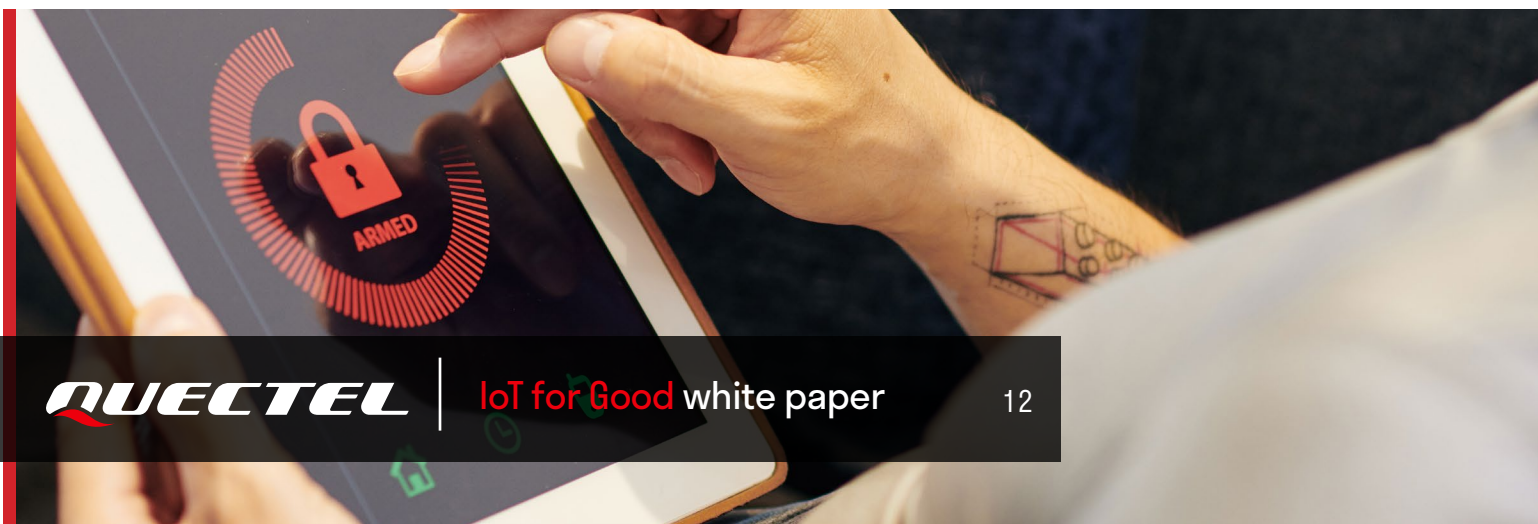
In the business-to-business sector, there are similar levels of concern. AT&T's Cybersecurity Insights Report has revealed that 85% of the 5,000 enterprises it surveyed are in the process of deploying IoT devices but only 10% feel confident they could secure these devices against hackers. Similar concerns exist regarding data privacy as consumers and enterprises recognize the radical uplift in volumes of data and the data points created everyday by IoT.

These issues are well known and understood within the IoT community and significant steps have been taken to protect the privacy of users and to ensure IoT has maximized security. Quectel attaches great importance to the information security and privacy protection for its device OEM customers who are responsible for all data management and has established best practices with a number of international authoritative certification organizations around the world. By obtaining more and more international authoritative

security certifications, Quectel continuously works to enable and improve data security for its OEM customers.

Quectel collaborates with a diverse group of strategic partners, including leading companies such as Amazon, Microsoft, NVIDIA, Qualcomm and STMicroelectronics, and globally recognized standards organizations to achieve our goals. As a member of the GSMA, CTIA, 5GAA, 3GPP and the GSA, Quectel actively participates in working groups to advance the IoT sector and security standards.

Quectel has obtained ISO27001 Certification for information security, ISO27701 Certification for privacy information and Certification for multi-level protection scheme (level 3) and is in the process of obtaining the internationally authoritative TRUSTe Privacy Certification and ISO/SAE 21434:2021 Certification for automotive industry cybersecurity. Quectel is committed to complying with the General Data Protection Regulation (GDPR) and has implemented appropriate technical and organizational measures to ensure full GDPR



# An improved future for all

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Many of the innovative services and products outlined in this paper have only been made possible by the sustained development work put in by the entire IoT ecosystem over the last two decades. Technologies that would previously only have been affordable for high-value applications have now commoditized, and the combination of low cost technology with high efficiency design, development, manufacture and distribution are driving IoT's applicability into new areas.

The result is that solutions can now be deployed into low GDP markets at volume, thereby multiplying the positive impacts IoT can have on society in general. IoT has never been an elitist technology looking to only serve high value industries in wealthy nations. IoT is for the world's population and the next decade will demonstrate this even more clearly than the use cases detailed in this paper.

Our transport systems, energy, healthcare, food, safety and educations will be richer, deeper, more efficient and more productive, with less waste and minimized environmental impact, thanks to the innovations that IoT enables. That might be a cause for celebration but, for IoT and for Quectel, it's simply an encouragement to work even harder to make the next round of innovations real and to accelerate delivery of further improvements as we help build a smarter world.




**THE RESULT IS THAT SOLUTIONS CAN NOW BE DEPLOYED INTO LOW GDP MARKETS AT VOLUME, THEREBY MULTIPLYING THE POSITIVE IMPACTS IOT CAN HAVE ON SOCIETY IN GENERAL**

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