QUECTEL

Build a Smarter World

Whitepaper

How wireless connectivity adds value to EV charging points

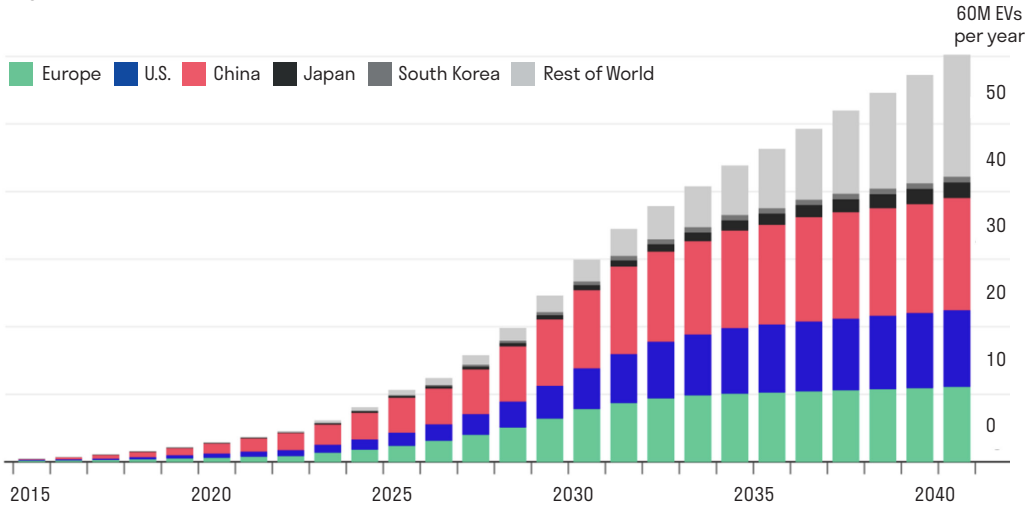
Contents

Introduction

The installed base of charging points is set to hit 22.8 million in 2025 according to estimates from research firm Berg Insight, which sees the market in Europe and North America dominated by private charging points. Uptake of electric vehicles is driving trend and the firm expects approximately 1.8 million units to shipped in North America and Europe in 2025, subject to further supply chain delays caused by new variants of Covid-19. Of these, the firm expects the number of connected charging points in the two regions to reach 7.9 million in 2025[1].

This projected uptake reflects a steep increase in the number of electric cars being sold globally and BloombergNEF estimates that 2021 was another record year for EV sales with more than 5.6 million sold worldwide, in spite of pandemic-related supply chain constraints. This is 83% higher than sales in 2020 and an increase of 168% over 2019 sales, the firm said[2].

Figure 1: Global electric car adoption 2015-2040

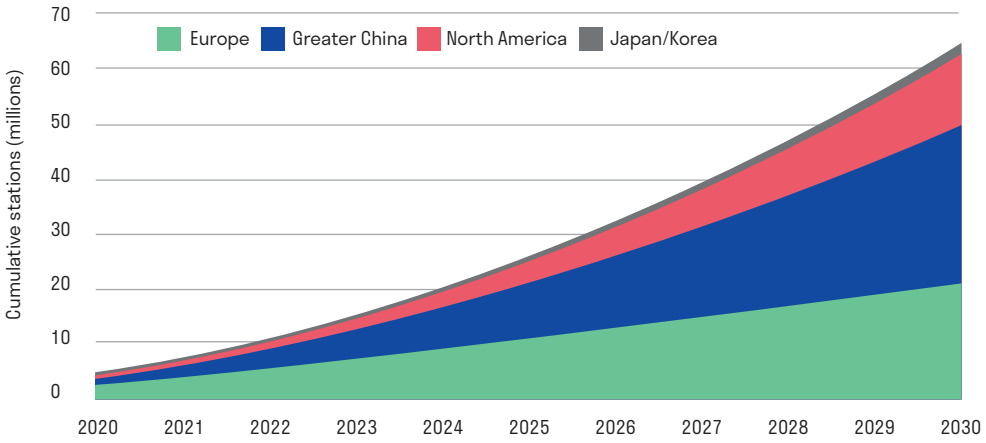


Source: Bloomberg New Energy Finance

1 https://www.berginsight.com/the-number-of-connected-ev-charging-points-in-europe-and-north-america-to-reach-79-million-by-2025
2 https://www.utilitydive.com/news/global-ev-sales-rise-80-in-2021-as-automakers-including-ford-gm-commit-t/609949/

Domestic, private charging has been and is expected to remain, a preferred mode of charging, motivated by factors such as convenience, cost and limited battery degradation. The use of public or semi-public charging stations is predominately aimed at addressing non-routine charging events such as long duration trips and is most likely to be the charging activity that demands wireless connectivity. However, domestic and public charging trends are different in various regions and depend on existing vehicle usage habits.

Figure 2: Cumulative charging station deployment forecast



Source: IHS Markit

According to the IHS Markit's EV charging infrastructure forecast, the global deployment of EV charging stations will increase at a 31% CAGR to more than 66 million units by 2030. The preferences for the type and location of the charging infrastructure are remarkably different across the major regions, the firm says, with the Greater China region expected to account for more than 60% of the global public and semi-public charging stations deployed by 2030.

In Europe, the focus is more on domestic charging with consequent lower need for connected public charging stations, although some domestic chargers will contain cellular connectivity as a back-up or because it is simpler to connect to this rather than home networks. IHS Markit forecasts that the cumulative deployment of EV charging stations will increase at 24% CAGR during the 2020-30 period. By 2030, circa 20 million houses within Europe are expected to be equipped with domestic charging stations, while public or semi-public charging stations will increase eight-fold on the 2020 deployment level.

3 https://ihsmarkit.com/research-analysis/ev-charging-infrastructure-report-and-forecast.html

Why wireless?

Although often in easily-accessible public places that are well-served by infrastructure, public EV charge points, or charging piles, within multi-charger sites, need communications capabilities in addition to electricity connections. It may seem obvious that fixed line connections could be run to terminals but this does not take account of large car parks at highway service areas that are seldom being networked by cables. In addition adoption of wireless connectivity can simplify and accelerate charge point roll-out and provide a useful back-up to fixed connectivity.

The connectivity is needed so the charge point can meter usage, identify users and bill accordingly. They are also essential so charge point operators (CPOs) can monitor site status in real-time in order to book maintenance, understand demand and ensure payment. Even in cases where fixed line connections are available, a wireless back up makes sense because, it can help ensure a charge point remains operational. In this competitive market in which customers rely intensively on access to charging, downtime is unacceptable and CPOs can't afford reputational damage nor lost revenue from non-operational sites.

"The integration of communications equipment in EV charging stations can improve operations and the delivered service noticeably in several ways", Caspar Jansson, an IoT Analyst at Berg Insight has explained. "Charging stations can be equipped with load balancing functions to reduce strain on local grids, while charge point operators can monitor and manage their charging stations remotely. Electric vehicle drivers, in turn, can locate chargers, monitor charging availability, book chargers and manage payments using a smartphone app."

EV chargers need to collect information including the vehicle ID, service type, charging volume and state of charge (SOC), capacity of charging and recharging current and the vehicle departure time. All these inputs and data need to be passed together with the charging point or pile's ID and location information to the CPO and then from the pile to the EV itself. From a communications perspective, none of this is complex and relatively small amounts of data are involved with limited requirements for low latency. Services can readily be supported by highly available 3G and 4G cellular connections, with higher speeds and lower latency enabling improved performance for new versions of charging piles which could be updated over-the-air, for example.

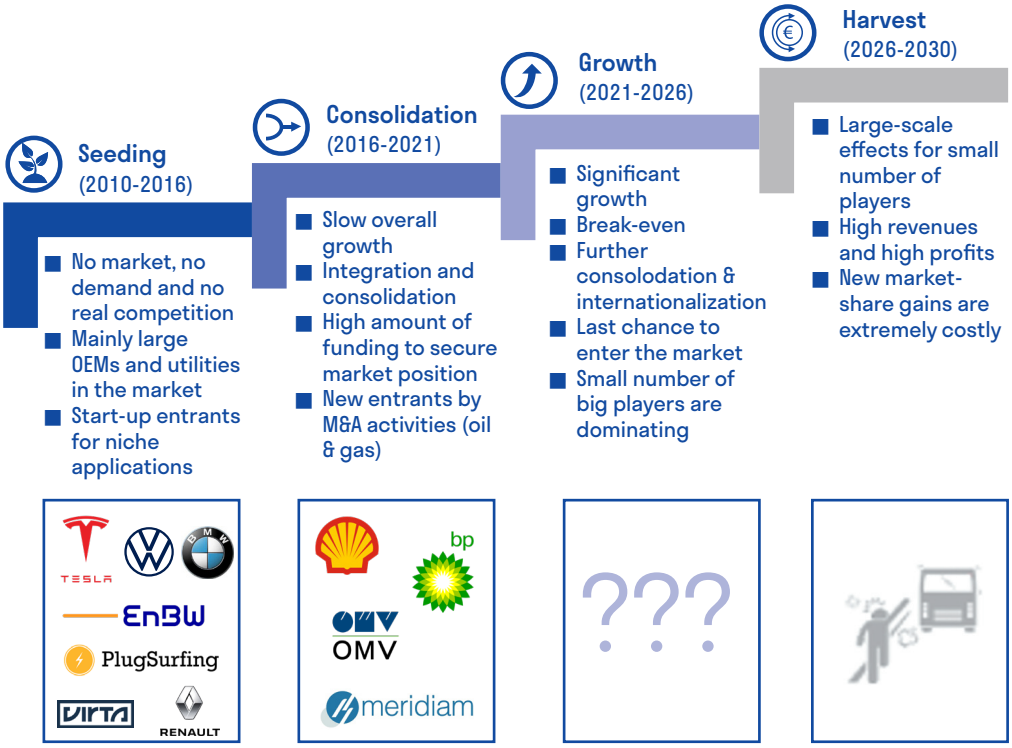
The reality of already-existing wireless connectivity to support EV charging should make it an attractive option for CPOs but there are some challenges for the wireless market to overcome. EV charging CPOs currently compete in a fragmented market which has a relatively high cost of entry in terms of rolling out charging points and infrastructure. The current, still low rates of charger utilization mean there are fewer incentives to develop this vertical market than in other sectors and therefore if a fixed network is available, there is little reason to look to wireless connections to enhance an offering because of the long ROI associated with the EV charging business.

After more than ten years in operation, the EV market is only now entering its growth phase and a widely disparate range of CPOs has emerged. The market began with EV makers who needed to roll out charging points to support their vehicles and the case for electrification. These were shortly joined by specialists such as ChargePoint in North America, Ecotricity in the UK and many others.

Market fragmentation

More recently, traditional fuel vendors have entered the market in a bid to derive new value from their forecourts as the market moves away from fossil fuels. Now a further wave of automotive supply chain companies, battery providers and real estate businesses are entering the market. This is likely to lead to consolidation over the coming years, as **Figure 3** illustrates.

Figure 3: Market stages in public EV charging

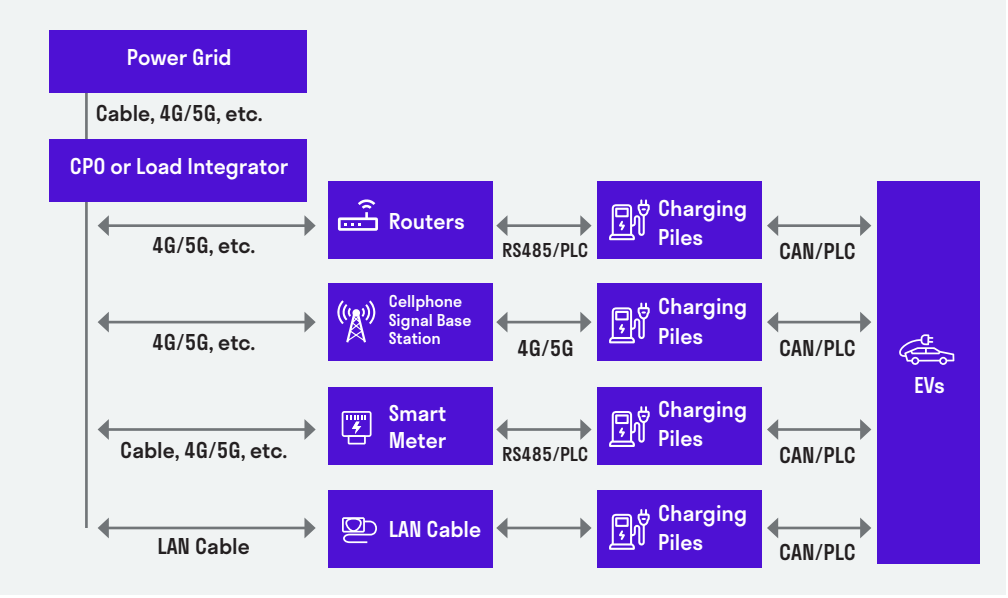


Source: Arthur D. Little analsis

With a race for charging spaces underway alongside major roads and in cities, there is a need for deployment speed but also to keep the cost of every charging pile to a minimum. In addition to this, there is a perception that cable connections offer better reliability of data transfer than cellular options and, when usage of charging points becomes higher, the speed of data transfer could suffer. At the moment, wireless connections represent a small additional cost in terms of construction and maintenance of charging points and come with cellular data usage fees. However, their versatility and ease of deployment across the globe makes them attractive to enable rapid deployments, global products, and to support interaction between EVs, users and charging points.

As the market matures, cellular connectivity at charging points could be used to offer additional services to EV owners and also to support a growing ecosystem around EVs. **Figure 4** below illustrates how CPOs might utilize wireless connections to support their charging piles and enable connections to EVs.

Figure 4: How communications occur during EV charging



What Quectel offers

Already working with leading EV CPOs across the globe, Quectel's extensive module portfolio and its comprehensive range of antennas can offer CPOs the capabilities they need to facilitate connectivity for their charging points.

The company's BG950 and BG951 LTE Cat M1 modules, which also offer Cat NB1 and will soon add Cat NB2 connectivity are fully-compliant with the 3GPP E-UTRA Release 13/14 specification and provide global carrier band combinations. The modules feature the MIPS 5150 processor and offer ultra-low power consumption by utilizing integrated RAM and flash to achieve extremely low current consumption in various standby or hibernation modes. These are ideal for periods of non-use at charging points and the modules offer 3GPP power saving mode (PSM) and extended discontinuous reception (eDRX) capabilities. In addition, the BG95xA-GL contains a GNSS and cellular-based location engine that supports GPS, GLONASS, Galileo, Beidou and QZSS.

The modules boast comprehensive hardware-based security features, with integrated security elements (ISE). Offering an ultra-compact SMT form factor of 19.9 mm × 23.6 mm × 2.2 mm and a high integration level, the module enables integrators and developers to design applications easily using the module's low-power consumption and compact structure. The modules' advanced LGA package allows for fully automated manufacturing required for large-scale applications.

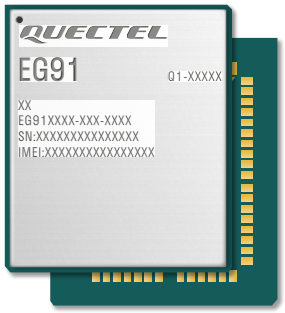
Key features include:

- Extremely compact LTE Cat M1/NB1/NB2 module with ultra-low power consumption
- Integrated RAM and flash
- Super slim profile in the LGA package
- Embedded with abundant internet service protocols
- Support for VoLTE (Cat M1 only), QuecLocator®, PoLTE and
- DFOTA
- A rich set of external, multi-band interfaces that ensure convenient application support
- Fast time-to-market: reference designs, evaluation tools and timely technical support minimize time and efforts in design and development
- Robust mounting and interfaces

In addition, LTE-Cat1 also has significant attractions for EV charging and can be an even-better suited method of connection than Cat M1 for many EV applications. Quectel's EG91 series and EG915U module deliver excellent performance for EV deployments.

The EG91 is a series of LTE Cat 1 IoT modules in an LGA package measuring 29.0mm × 25.0mm × 2.3mm, which meets the 3GPP Release 11 standard. The EG91 is pin-to-pin compatible with Quectel's UMTS/HSPA+ UG95 and UG96 modules, and LPWA BG95 and BG96 modules, enabling simple, flexible and scalable migration from 2G and 3G to 4G. The series consists of eight variants to meet various geographical demands.

The EG91 provides cost-effective LTE connectivity, delivering maximum downlink rates of 10Mbps and uplink rates of 5Mbps under LTE, is designed using space-efficient surface mounted technology, and features an embedded power management unit for ultra-low deep-sleep current consumption. The module is therefore ideal for size-constrained, low-power IoT applications which are not reliant on high-speed connectivity but do require the longevity and reliability of LTE networks.

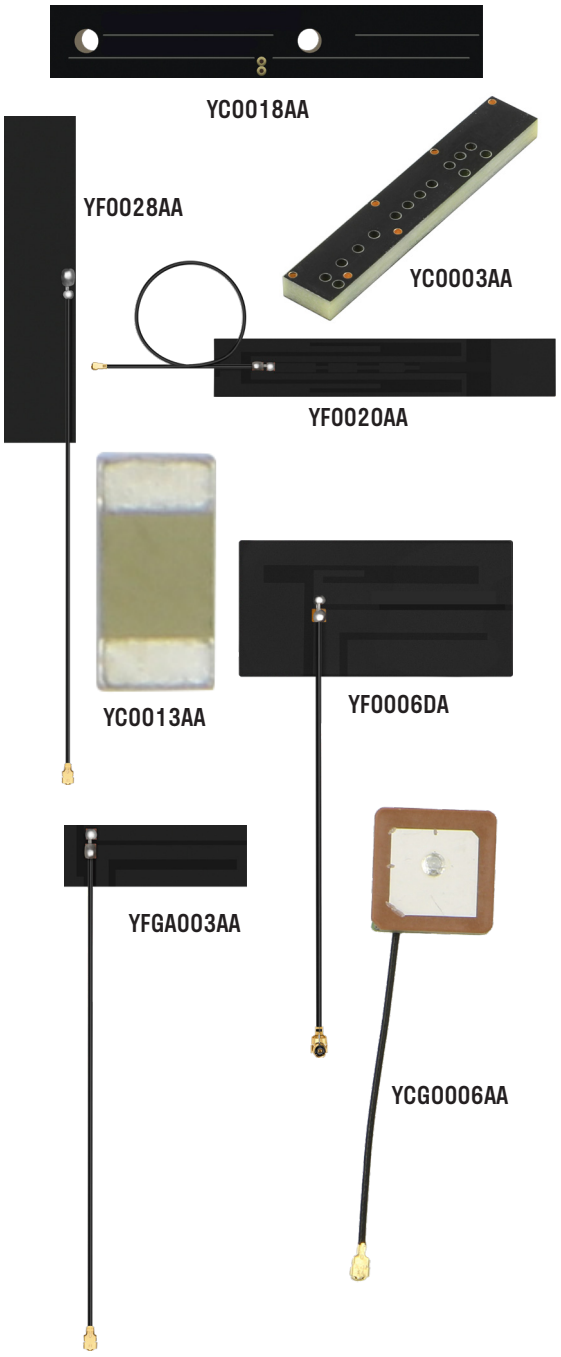


Key features include:

- Pin-to-pin compatible with Quectel's UMTS/HSPA+ UG95 and UG96 modules, and LPWA BG95 and BG96 modules
- Multi-band LTE coverage
- Quectel enhanced AT commands
- USB 2.0 high speed interface
- Multi-constellation GNSS receiver available
- Embedded power management unit

The Quectel EG915U module is optimized specially for M2M and IoT applications. It delivers maximum data rates of up to 10Mbps downlink and 5Mbps uplink. Designed in a compact and unified form factor, the EG915U series is compatible with Quectel multi-mode LTE Standard EG912 and BG95 modules, ensuring that it can easily migrate from 2G to 4G network to meet the needs of different industry applications.

For more information or to order an EVB kit for the EG915U, please click here to see our in depth technical QueXs video.



In addition to modules, EV chargers also need antennas in order to ensure optimized connections to vehicles and users. Typically, antennas rely on both cellular and satellite connections to ensure uninterrupted coverage. For EV chargers, antennas are usually embedded into the charger with nothing external that can be broken off. EV designs are typically large units so there is no issue in relation to space available for antennas. However, casings do need to be plastic where the antenna is located rather than metal which would not allow the antenna to radiate.

In the 5G market, Quectel offers the **YC0018AA** SMD antenna. Operating at 600-6000 MHz frequency bands this diverse antenna offers dimensions of 40 x 7 x 3mm. An alternative 5G antenna is the **YF0020AA** FPC . Operating at 600-6000MHZ frequency bands, this antenna measures 90.15 x 15.2 x 0.13mm and offers a cable and an IPEX IV connector.

In the 4G/LTE market, Quectel offers the **YC0003AA** SMD antenna. This wideband LTE/cellular/CDMA SMT antenna is suitable for 4G/3G/2G applications. Operating at 698-960MHz, 1695-2200MHz and 2300-2700MHz it's a high-efficiency antenna which is mounted to the device host printed circuit board (PCB) using conventional PCB reflow processes. Ideal for all 4G/LTE applications, it also supports worldwide Cat M and NB-IoT frequency bands too and is supplied on tape and reel for high-volume applications.

Alternatives include the Quectel **YF0028AA**, which is an adhesive mounted cable and an IPEX I connector LTE antenna that measures 94 x 21 x 0.2mm. The antenna operates at 698-2700 MHz frequency bands. Another alternative is the **YF0006DA**. This operates at 690-960, 1710-2170 and 2300-2690MHz frequency bands. It measures 50 x 25 x 0.13mm.

Finally, for deployments in which satellite connectivity is desirable, Quectel offers four GNSS antenna types, the small SMD **YC0013AA** chip antenna, the ceramic SMD **YG0062SS** (not shown), the ceramic with cable and connector antenna, the **YCG0006AA**, and the FPC antenna **YFGA003AA**.

Quectel provides comprehensive antenna design support such as simulation, testing and manufacturing for standard and custom antenna solutions to meet your specific application needs.

Visit our **Antenna Selector** for more information on Quectel's range of high quality antennas.

Conclusion

With EV adoption well underway in markets across the globe, the public charging market is developing rapidly. New technologies such as wireless charging, which do not require EVs to use cables to recharge are coming, and charging will become commonplace both in domestic and public situations.

The market for EV chargers – both wired and wireless – will keep growing with higher demand for EVs. Allied Market Research reports that the plug-in segment, which had 98% of the global EV charging system market in 2020, will retain the majority share of the market. However, the wireless charging system segment is projected to post the fastest CAGR of 28.8% throughout the 2022-2030 period.

Regardless of whether charging is via plug-in or wireless means, for CPOs offering access to public charging, the functionality of wireless connectivity adds another dimension to their offering. Wireless connectivity can enable rapid site roll-outs immediately, while setting them up for future additional, connectivity-enabled revenue streams.

For more information on how to use Quectel modules and antennas to connect your EV charging projects, visit: www.quectel.com