

Casambi Whitepaper

Wireless lighting control for: Retail



Introduction

Light is an essential element in modern retail store design. Good retail lighting can really highlight displayed products, add a sense of direction to space, enhance customer experience, and even reflect a brand's visual identity. However, among all building types, retail stores consume the most energy on lighting (51kWh/sqm per year)¹. This is primarily due to the intensity of lighting required for displaying products.

The retail category covers a broad range of outlets - from small shops to vast big box stores spanning 100,000 square meters and more. Large retail stores are the most energy-intensive buildings as they traditionally have uniform, high-light levels across very large spaces. In such retail establishments, reducing operational overheads with energy savings while cutting down maintenance costs is crucial.

Well-designed use of daylight in stores can provide significant energy savings while also improving the retail experience for customers. Thanks to the perfect color rendition characteristics of daylight, the displayed products appear more vivid while retaining a connection with the outdoors, adding to the well-being of shop personnel. A study that assessed a chain retailer's stores in California found that up to a 40% increase in retail sales can be achieved with better daylighting conditions². Additionally, tunable white light can further enhance the atmosphere in food stores by displaying the perfect color for fruit, vegetables, or meat.

Today's in-store retail experience is changing and adapting to online shopping trends. As a result, retail lighting is no longer limited to just displaying merchandise but also about giving a sense of direction, adding drama, or highlighting the architecture. Fashion stores, in particular, are increasingly adopting flexible and multi-task lighting design, using several elements, including display lights, decorative fixtures, and architectural accent lighting. These are then combined in light scenes that are either time-based or initiated by the shop personnel.

Similar to online shopping, retailers are also looking for ways to track the in-store experience of visitors and extract knowledge from the use of physical space. According to a McKinsey study, insights gleaned from the IoT can help optimize store layouts and staff allocation, propagate personalized promotions in real time, or enable predictive, condition-based maintenance of assets.

Casambi offers the perfect solution to meet the lighting control demands of today's retail space.

1. Building Stock Distribution and Electricity Use for Lighting: A Technical Report of IEA SHC Task 50. International Energy Agency (IEA). 2016. Available from: http://task50.iea-shc.org/data/sites/1/publications/Technical_Report_T50_D1_final.pdf

2. http://eneref.org/reports/eneref_daylight_retail_bigbox.pdf - Pacific Gas and Electricity Company (PG&E) commissioned Heschong Mahone Group (HMG; now part of TRC Companies) in 1999 to investigate the effects of skylights on retail sales. Over an 18-month period, the study analyzed the sales performance of a chain retailer's 108 outlet stores, two-thirds of which had skylights and one-third of which had none. The results showed that the non-skylit stores would likely have seen 40% higher sales with the addition of skylights.

Casambi's mesh technology provides lighting designers and manufacturers with the ability to wirelessly link devices together enabling the creation of customizable smart lighting networks that are configured and controlled using the Casambi App. Thanks to its simplified system architecture and user interfaces, the solution is easy and fast to specify, install, commission, and use.

The Casambi system offers extremely flexible control functionality that brings new dimensions to design and total freedom to create: from tweaking color temperature, lighting colors, dimming, human-centric lighting, blind control, to the activation of lighting in response to movement detection – to name but a few of the possibilities. By providing lighting that's fit for bespoke purpose – just the right light, in the right place, at the right time – Casambi offers a cost-effective way to reduce maintenance needs and energy consumption.

Key drivers and trends in the retail sector

The retail sector is in the midst of an accelerated transformation. Despite the challenges – scarcity of fuel and raw materials, inflationary pricing, economic uncertainty, geo-political factors, and many others – the future is still exciting. Here are three trends driving the dynamics of this sector.

Online and in-store experiences are merging

Shoppers' behaviors and expectations have changed dramatically in recent years and continue to evolve. By some estimates, e-commerce penetration in the US made ten years' of growth in less than three months during the pandemic, rising to 33% for all retailers³. A 2022 survey shows that 81% of shoppers shop across multiple channels, covering both online and in-store⁴. Providing a merged customer experience across both online and in-store is more important than ever. It is reported that brick-and-mortar stores are making a comeback post-pandemic, with US retailers announcing approximately twice as many store openings going forward as store closings in 2021.

Because of the shift in customer behavior, the role of the physical store is changing. Today it is more of a place to experience and tell the brand story. Retailers today try to provide unique customer experiences in-store through the design of the space, or consultative services on offer. Interior design and retail lighting done well can really enhance the retail experience and strengthen a brand's visual identity.

³. Bank of America· US· Department of Commerce· ShawSpring Research· Forrester Analytics· McKinsey Retail Practice

⁴. PWC· June 2022 Global Consumer Insights Pulse Survey

To transform brick-and-mortar stores into a place where customers can have a pleasant shopping experience and employees feel comfortable working, biophilic design has been incorporated to reestablish connections between people and nature with many positive effects on health, productivity and well-being.

There are many direct and indirect methods to introduce nature into indoor spaces like integrating plants or vertical gardens, using biodegradable material, and reproducing elements or shapes of nature. Regarding lighting, there are strategies to maximize the use of daylight and introduce Human-Centric Lighting that programs artificial light to mimic natural light through tunable lights with a dynamic color spectrum.

Focus on Sustainability

Based on McKinsey's 2021 Consumer Expectations Survey⁵; consumers, especially Gen Z and millennial segments, are increasingly making their retailer and brand choices based on sustainability, diversity, equity, and inclusion. More than half of Gen Z and millennial consumers say they're aware of brands' commitments to sustainability, and more than 40% consider sustainable practices in their purchases. Meanwhile, retailers are responding with innovations in their business models such as moving to eco-friendly packaging solutions or relying on renewable energy to power their premises.

The retail and wholesale sectors cause an estimated 40% of overall EU greenhouse gas (GHG) emissions, less than 5% directly from its own operations and about 95% from other activities up and down the value chain⁶. In order to achieve the world's decarbonization commitments by 2050, the sector needs to mobilize fast. According to McKinsey, in 2016, only a few major retailers adopted science-based targets to reduce carbon emissions. Just five years later, more than 65 global retailers have set such targets, and the number is more than doubling each year⁷.

To lower emissions, retailers must look within and beyond: not only making changes to their own operations, but considering who they purchase energy from, and accounting for upstream and downstream emissions of a product or service across the value chain. In their own activities, one strategy is to improve energy efficiency by installing LED luminaires and adopting a lighting control system that optimizes their use.

In addition to net-zero commitments, the sustainability transformation is an opportunity for retailers to create value, differentiate their assortments, build greener businesses, generate traceability, and develop new circular business models.

5. *2021, McKinsey & Company. Customer Expectations Survey. Available from: <https://www.mckinsey.com/industries/consumer-packaged-goods/our-insights/great-expectations-navigating-challenging-stakeholder-expectations-of-brands>

6. <https://www.mckinsey.com/industries/retail/our-insights/transforming-the-eu-retail-and-wholesale-sector>

7. <https://www.mckinsey.com/industries/retail/our-insights/climate-sustainability-in-retail-who-will-pay>

Improving business with IoT

IoT technology is a reality in all industries and it couldn't be different for retail. By rethinking strategies to establish connections with customers and embracing digital transformation, the retail sector is speeding up the integration of IoT in their business.

It is a good opportunity for retailers to innovate their businesses smartly and efficiently in both the physical and digital worlds. IoT can be applied to the various sectors of retail - from warehousing to supply chain management and, of course, shopping itself - by bringing benefits not only for retailers but also for customers.

After the pandemic, concerns such as safety and hygiene are now top of mind for consumers. They would like to spend less time in stores and be able to quickly and easily find what they are looking for. Additionally, 59% of consumers say it's important for stores not to be too crowded⁸. Retailers are therefore advised to adopt technologies that will enable convenient and safe customer experiences.

Data-driven decision-making tools offer limitless opportunities for retail players. It unlocks the potential in indoor positioning services for heatmapping, optimization of store layouts and staffing rotas, asset and inventory tracking, customized promotions, real-time energy consumption monitoring, predictive maintenance and much more.

Casambi provides iBeacon profiles embedded into each Casambi device that can be used to enhance customer experience based on location awareness. Casambi also offers a Cloud API, which allows integration of Casambi networks into third-party dashboards and applications, opening the doors to remote monitoring of lighting fixtures, as well as gathering data from the field such as energy consumption, failure states, or even air quality or occupancy patterns in store.

How it works

Casambi's solution forms a mesh network, which enables encrypted device-to-device wireless communication inside a lighting network. Mesh networking is essentially a low-latency, low-power mesh network protocol, which translates to a super-fast, battery-life-extending, and highly reliable connection. Bluetooth Low Energy (BLE) is used for communication between a mobile phone or the control device and the Casambi network.

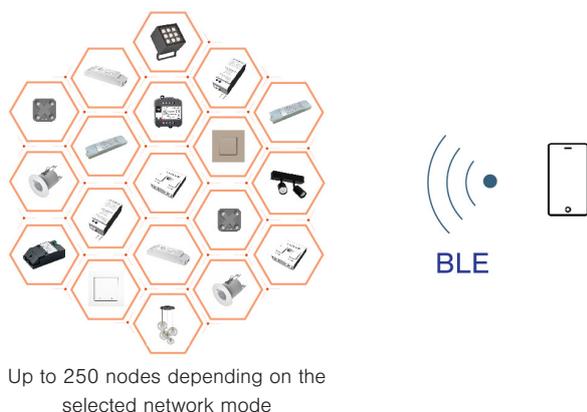
Casambi's mesh topology is self-healing, which means that if a device fails, the signal flow automatically reroutes through other devices, increasing reliability through multiple nodes and redundancy of nodes.

⁸. McKinsey. 2020. Retail reimagined: The new era for customer experience

Therefore, there is no single point of failure because no single critical element that stores the information is needed for the proper functioning of the network or part of it.

No special wiring for lighting controls is needed and all hardware complexity is reduced to a minimum. This is because no central units such as routers, controllers, or gateways are needed for the operation of a Casambi network. A Casambi network can contain up to 250 devices and each one is independent and has a backup of the entire network, i.e., all nodes of the mesh network carry the complete system intelligence.

Essentially luminaires, switches and sensors gain Casambi connectivity by either incorporating Casambi chips or by using Casambi's external Bluetooth modules. Minimal hardware is required. No cables, no internet, no routers are needed to run a network.

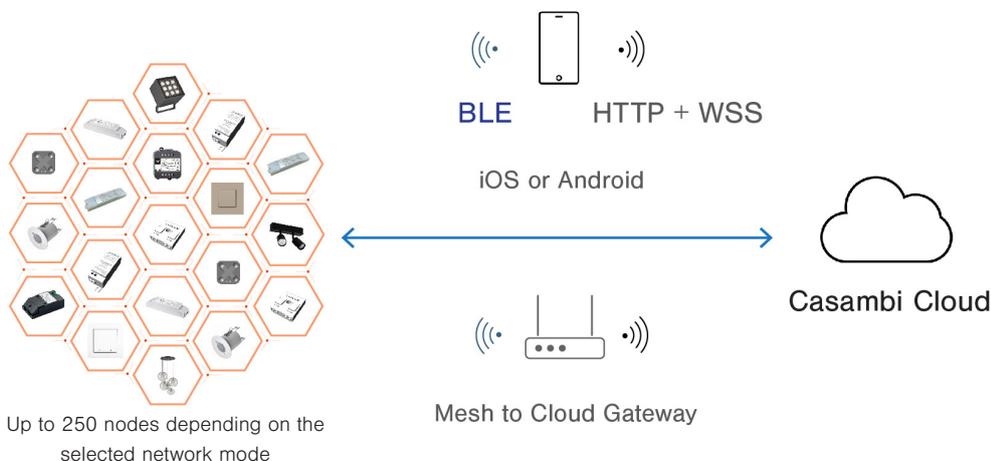


Up to 250 nodes depending on the selected network mode

Figure 1 - Casambi Stand-alone mesh network

All system configurations and end-user controls are managed via the Casambi App on mobile devices, available for free on iOS and Android.

Casambi network operates without an internet connection. An internet gateway can be used if it is required to have remote control over the network or to interface building management systems via a cloud connection.



Up to 250 nodes depending on the selected network mode

Figure 2 - Casambi wireless mesh network with internet gateway

Casambi benefits for retailers

The Casambi solution caters well to today's retail installations by directly answering the need for powerful, highly customizable lighting control. Such benefits are:

Lighting design beyond just light

- The Casambi Ecosystem consists of 1000+ interoperable lighting products, including luminaires, drivers, sensors, switches, dimmers, and other control gear from all major manufacturers. All ecosystem products share the same core, meaning 100% interoperability and full performance, for today and in the future.
- Flexibility to support design changes without the hassle: Store layouts, partitions, or other preferences may change and with Casambi's wireless lighting control solution, everything can be rewired in the software. Control groups, light scenes, and automation programs can be created and changed time and again without having to consider any physical communication cables, as per a traditional wired system.
- Discrete and easy installation: Casambi technology is fast and easy to integrate into luminaires without wireless controls. A small external Casambi Bluetooth module can be added to a luminaire without the need for surface reconstruction or the pulling of wires.
- All products in a Casambi network can be controlled via a mobile device with the Casambi App, as well as by any wall-mounted or wireless switches from the Casambi Ecosystem. You can also retrofit a traditional wall switch with a Casambi Bluetooth module, and you are ready to go.
- Casambi Pro, our new configuration and commissioning tool, speeds up project configuration by allowing most of the programming to be done offsite. It's especially great for large lighting projects and gives specifiers more control over the final outcome. Once programmed, settings are then uploaded over the air via Bluetooth to the physical devices onsite, which significantly reduces the time spent on site.
- The Casambi App has been designed by user interface experts with one core principle; regardless of technical proficiency, anyone can use it. Luminaires can be controlled remotely, and easily reconfigured and recommissioned from a smart device.
- A Casambi network consists of up to 250 units depending on the network mode, and an endless number of networks can be created and used in a single site, giving you endless possibilities to scale up in the future.

Full functionality for lighting personalization

A unique atmosphere can be created through the lighting control system, which allows personalized lighting. Complete functionality is available in the Casambi solution such as:

- **Static and dynamic scenes:** Preferred scenes can be created to tailor the right moods for different occasions: Seasonal scenes can be set with tunable white luminaires (warmer in winter and autumn, and cooler in spring and summer) or RGBW luminaires can be used to create scenes for eg. the Christmas season.
- **Time-based scenes:** It is possible to create time-based scenes that turn on, off, or dim selected luminaires to preset levels according to bespoke needs. Configuration can be set up for certain days of the week, time, or based on sunrise/sunset. Subtle transitions between multiple time-based light scenes that run and fade through the day can be configured.
- **Sunrise/sunset:** Enabling localization on the app, timers and time-based scenes can be set, using local sunrise and sunset times. It is adjusted automatically based on an astronomical time clock.
- **Daylight harvesting:** Adjustable lighting strategies can be programmed and implemented – such as daylighting, whereby automated controls can adjust the lighting to maintain a target level, reducing energy costs.
- **Task tuning:** Lighting can be adjusted to the optimal level for individual tasks. The lighting level required for back-of-house is different from that required for a sales area.
- **Gallery:** The Casambi App's Gallery feature allows you to take or upload photos of a space, or a floor plan, and mark the positions of the luminaires within the images. This helps to visually identify and intuitively interact with them. The user can change light settings by simply touching the luminaires on the photo inside the app.

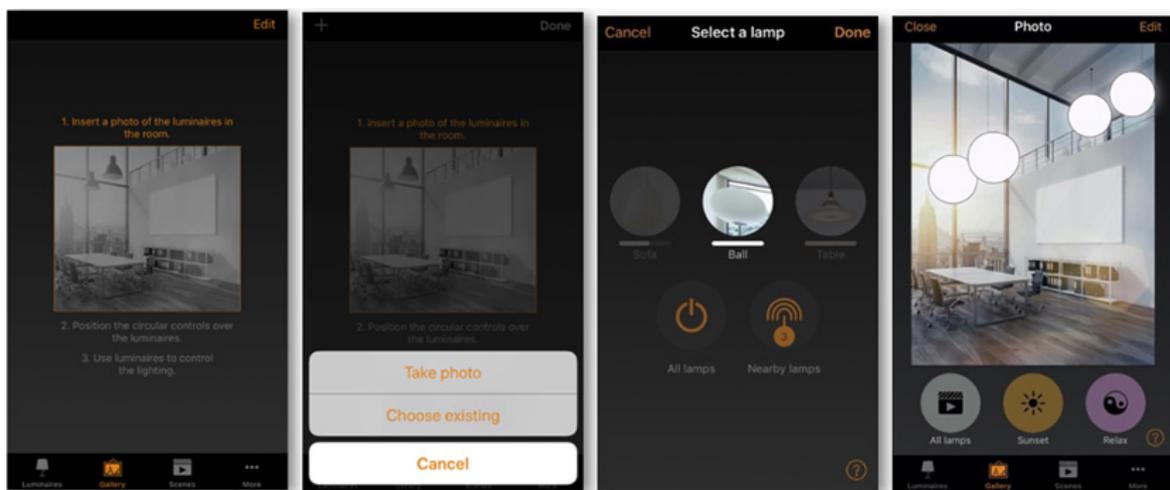


Figure 3: Gallery feature in the Casambi App

Smart lighting and IoT

- **Location awareness:** iBeacon profiles are embedded into each Casambi device, helping retailers track the in-store experience of visitors and extract knowledge from the use of physical space.
- **Collect and use sensor data:** With Casambi, any sensor information can be collected and processed to create heatmaps or other analytics that you can use to increase the efficiency of your stores. Through its modern API, Casambi networks can be integrated into IoT tools that enable network monitoring and the usage of collected data from the network. Casambi API consists of Rest API & Websocket services, and all received data is in human-readable JSON format.
- **Reduced operation and maintenance costs:** No controllers nor any special software licenses are required to use Casambi control. The active control of lighting levels helps to extend the luminaires' lifespan, which translates to fewer lamp replacements and additional labor maintenance savings.
- **Saving energy:** Lighting control reduces energy use – especially when multiple control strategies combining occupancy detection and daylight-responsive controls are deployed – but it can also contribute to the reduction of heat dissipation. In addition to lighting, Casambi can automate blinds to prevent heat from escaping or to keep a building cooler during hot weather. Consequently, this also lightens the strain on HVAC systems and associated spending.

Application for retail

Casambi's technology is integrated into fixtures, drivers, switches, sensors, and a diverse collection of modules, that are 100% interoperable and together meet all lighting control demands and strategies of the retail sector. Casambi offers different control types, functionalities, and the ability to create up to 255 different scenes.

Here is an example of how Casambi can be considered for a street store:

Control Type	Functionality
Manual Control	Each changing room has its own Casambi Ready Switch (Xpress) giving each client the opportunity to change the light scenes, and also the chance of dimming and modifying the color. Instead of a Casambi Ready Switch, one QR code can be used, allowing them to browse and modify the light scenes via their mobile phone.
Circadian scene	In the general area of the store, the color temperature (K) of ambient lighting follows a customized profile that runs automatically based on the time of day (i.e. Running smoothly from 2700K to 4000K from opening till noon, 4000K to 2700K from noon till closing).
Daylight harvesting	Light outputs of shop window luminaires are adjusted based on the amount of available daylight measured by a daylight sensor.
Schedule	The time-based scene function is used to turn scenes on and off based on the time. For example, the following scenes can be set out for the sales area: 09:00-19:00: Store Open 19:01-20:00: Cleaning – Lights are dimmed down to 50% while the staff is cleaning and closing the store. 20:01-9:00: Closed – Lights are off.
Movement detection (Presence)	In the back of house, motion sensors can activate a scene when it detects any movement and lights are dimmed to 10% when there is no occupancy for 20 minutes. Or in the shop window, at late hours (00:00-09:00), lights are switched on when a presence is detected in front of the window. No occupancy for 10 mins, lights are switched off.

Specifying with Casambi – How to get started

Specify a project with Casambi in **five simple steps**:

- 1. Every project starts with luminaire selection.** Any luminaire can be chosen, regardless of whether it is an off-the-shelf Casambi Ready luminaire or a pre-existing luminaire without Casambi connectivity. Casambi's CBU modules or equivalent ecosystem devices can convert a multitude of non-wireless devices to Casambi.
- 2. When selecting sensors and switches,** for manual control, it is possible to take a switch from the Casambi Ecosystem or simply use the Casambi App as the end-user control. If a specifier wants a specific switch because of the form factor and material finish, or is working on a refurbishment and wants to keep the original wired switches, it is easy to give them wireless connectivity by deploying a Casambi unit.
- 3.** If non-Casambi Ready devices were chosen, it's necessary to **identify the control type and select controllers** to make them Casambi enabled. Both Casambi and its ecosystem partners offer several devices that can be used to convert almost any other control method to Casambi, such as DALI, 0-10V, 1-10V, PWM or phase cut dimming.
- 4. When defining the functionality and the connectivity** of the project, a specifier may find they need to link multiple networks in the same site together or to interface the lighting network with other systems. For example, it might be necessary to interface with a pre-existing DALI installation already in use on a site. In the case of interfacing BMS or other third-party systems and software, an internet gateway will be necessary to connect the Casambi network to the Casambi cloud from where data can be transferred to other systems and interfaces through the Casambi API. Alternatively, an ethernet based gateway from the Casambi Ecosystem can be used to interface other systems while always keeping the network data inside premises.
- 5. When specifying the solution,** all information need to be consolidated. Full lighting control system tender texts complete with system requirements, control functionality, device specifications with datasheets, and app notes are available to download from Casambi's website.

Case studies

By creating atmospheres and new experiences, light is an essential component of dialogue with customers. The unique presentation of space and products demands an adaptable and easy-to-use lighting control solution. Casambi can cater to flexible lighting strategies with ease and that is why it is a perfect lighting control solution for retail projects. Our technology is tried and tested, and fast becoming the de facto standard in Europe.

To date, over 4 million Casambi Ready devices have been sold worldwide. Casambi has been specified in over 150,000 projects, spanning every application from small high-end residential to 10,000+ node industrial spaces. In addition to our Finland HQ, we have established regional headquarters in North America and APAC regions to serve our global networks. Casambi is deployed in highly sensitive environments, such as in hospitals and airports. Our system is robust in design and has been certified as cyber-secure in accordance with global standards.

Level Shoes, United Arab Emirates

Level Shoes occupies a 96,000 sq. ft. area inside the world-famous Dubai Mall. It was first established in 2012 and is dedicated to offering luxury designer footwear and accessories. As of early 2020, Chalhoub Group, the owner of Level Shoes, decided to refurbish the store and replace the metal halide lamps with LED fittings.

The lighting design called for CRI 90 LED light fittings and smooth lighting control transitions provided via Casambi Ready products.

The LED light fittings were programmed to dim at 30% from 7:01 AM until 10 AM, 80% from 10:01 AM to 2AM, & 60% from 2:01 AM until 7 AM. Overall, the wireless lighting control system designed and installed at Level Shoes rendered at least 40% energy savings.

Location: Dubai, United Arab Emirates



Flannels, UK

Flannels, one of the UK's leading luxury retailers, first opened in the north of England in 1976. Billed until recently as 'the biggest luxury retailer you've never heard of,' carefully curated men's and women's luxury designer clothing and accessories can now be found in 37 Flannels stores across the UK. The company's first Newcastle store, designed by London and Miami-based designers Argent, was opened in 2019.

Using mini track spotlights, RGBW linear LEDs, and tunable white spotlights, the design team created a dramatic contrast that places the products center stage and complements the luxurious look and feel of the brand. In addition, the concept offers store managers exceptional control over the lighting environment. The space is fitted with 100 lengths of RGBW LED fixtures that can be adjusted via the Casambi App. The system enables light colors and temperatures to be changed to suit the brands on display or highlight a certain product.

To provide the best possible in-store experience, a unique solution was provided to allow customers to adjust light settings in each fitting room. Using the Casambi App, customers can select from four different light scenes to suit the type of clothes being tried on by adjusting the output of spotlights and tunable white lighting.

Location: Newcastle, United Kingdom



Möbel Martin, Germany

The refurbishment of the 30,000 m² Möbel Martin store in Kaiserslautern, Germany, included the development of a bespoke LED light and a modular lighting system, which sets a new technical standard with its dynamic controls for natural light. The lighting concept by Tobias Link Lighting Design Studio provides for seasonal and daytime tracking of the artificial light so, for this purpose, color temperature and light intensity are controlled in the individual departments.

Since the project involved a conversion during ongoing business operations, it was decided to use Casambi's wireless lighting control solution because Casambi equips the luminaire with control competence right from the start and the wireless solution doesn't require the costly, highly disruptive installation of control cables. By going wireless, they reduced the fire load in the ceilings too.

Berlin-based company, Lichtmanufaktur, also supplied the higher-level control system, complete with Casambi gateways, which maps all areas on the floor plan of the store and allows higher-level access. It also connects the lighting control system to the rest of the house network and supplies data from the daylight sensor or various warning and emergency systems.

Location: Konz, Germany



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