We create chemistry

30.11.2018
G-FTT/EC – L440/129
Martin Schwibach
Tel.: +49 621 60-42233
martin.schwibach@basf.com

BASF SE, 67056 Ludwigshafen, Deutschland

- By Email –

Response to Consultation on RSPG Opinion on 5G Implementation Challenges
(RSPG 3rd Opinion on 5G)

Ladies and Gentlemen,

Within the framework of the consultation on the 5G implementation challenges, and specifically with respect to the issue of ensuring connectivity for vertical industries, we take the following position.

In order to maintain our international competitiveness, BASF must be able to operate tailored, flexible, locally/regionally limited "own" 5G networks for communication between machines, systems and plants at its production sites - independently of the major mobile phone providers. This is the only way to ensure that we - as the responsible site operator - can decide on the timing of the expansion and the quality of the 5G network and maintain data availability, confidentiality and integrity.

Many applications in BASF's production plants and sites already have requirements in the field of mobile communications and are dependent on a reliable and efficient digital infrastructure.

Against this background, we would like to point out the special features of the industrial use of 5G technology at BASF's sites.

1. In contrast to production halls etc. in the manufacturing industry, BASF's production sites are typically sites that are more likely to be classified as regional applications. Our large-scale plants, e.g. steam crackers (see Fig. 3), are necessarily located outdoors. The areas within the plant boundaries are 100% owned by BASF as the responsible operator. The installation of transmitter masts within the plant boundaries can only be carried out with our consent.

Examples are:

- BASF Ludwigshafen site (10 km²; approx. 39000 employees, approx. 106 km road, approx. 230 km rail, approx. 2000 buildings, approx. 200 production facilities) (see Fig. 1 and Fig. 2).

Therefore, the extent of these large, self-contained chemical sites (such as BASF Ludwigshafen or Bayer Leverkusen) is comparable with that of medium-sized small towns: Leimen (Baden); Brühl (Baden), etc.

BASF
We create chemistry

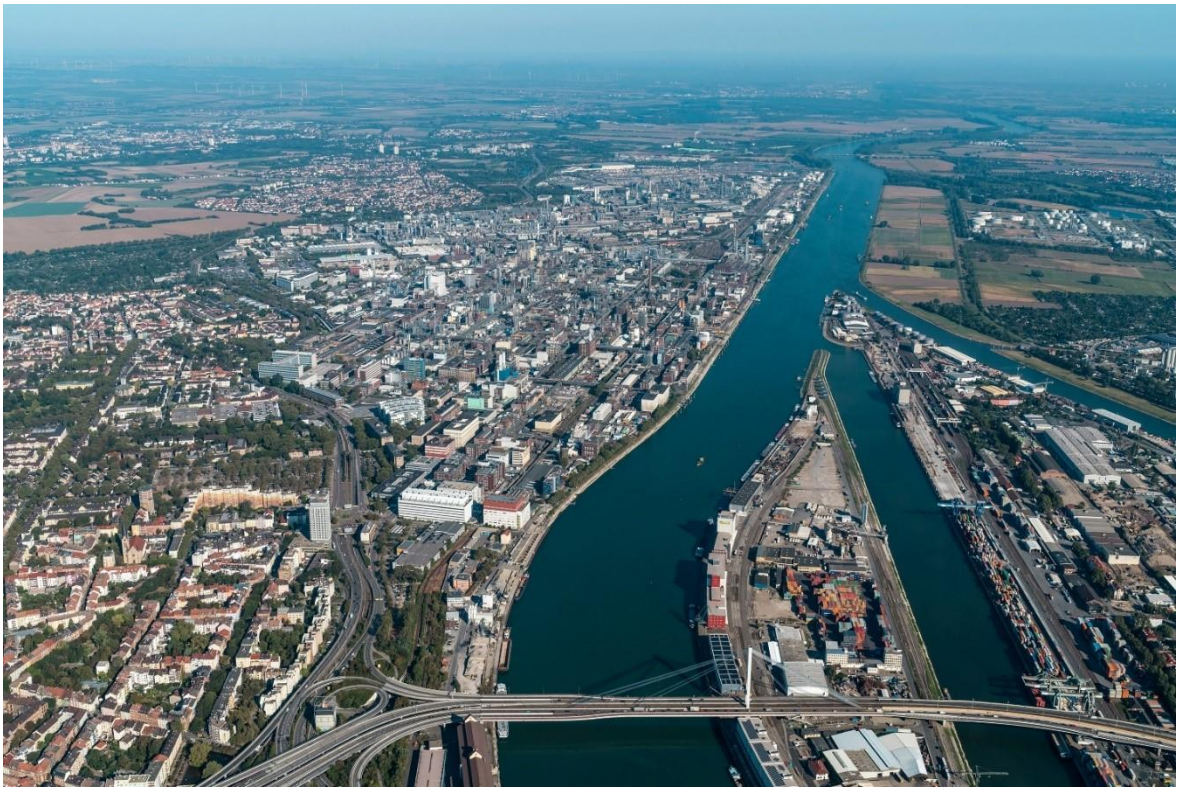


Figure 1: The heart of the BASF Group is BASF SE with its headquarters in Ludwigshafen am Rhein. With about 250 production plants, many hundreds of laboratories, pilot plants, workshops and offices on an area of about ten square kilometers, it is the largest contiguous chemical complex in the world. BASF's main site is also the cradle of the Verbund concept: production plants, energy flows and logistics are intelligently networked to use resources as efficiently as possible.

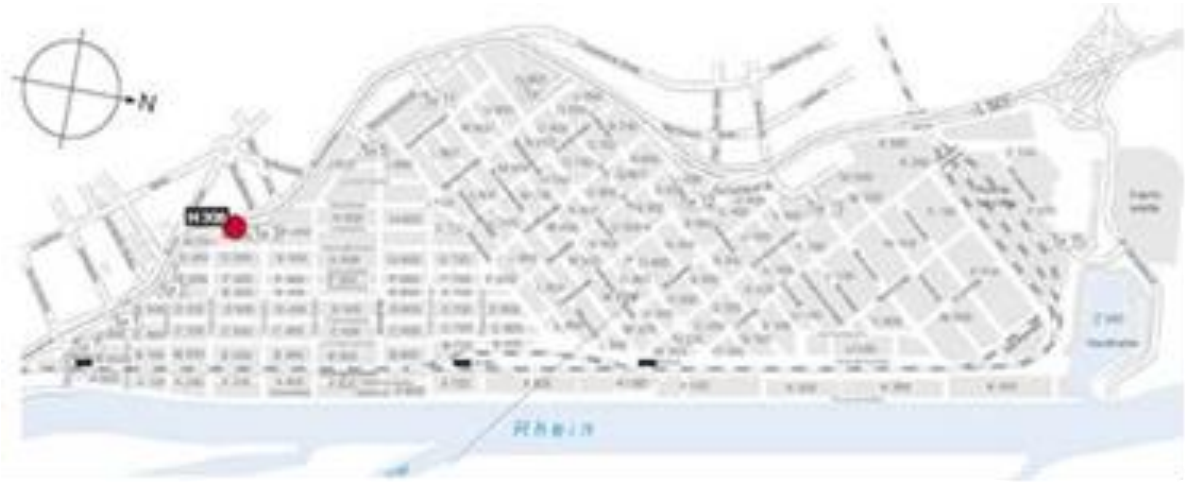


Fig. 2: Plan of Ludwigshafen plant

Figure 3: With an area of around 64,000 square meters, which corresponds to the size of 13 football pitches, the Steamcracker II is the largest single plant at the Ludwigshafen site.

Other sites such as BASF Antwerp (approx. 6 km²; approx. 3000 employees; 50 production plants; 60 km of roads; 44 km of rails) and BASF Schwarzheide (approx. 2.9 km²; approx. 2000 employees; 17 production plants; 12 km of roads; 20 km of rails) are also at least comparable with city districts and their regional requirements (e.g. Hamburg Hafen City (2.4 km²)).

2. Industrial mobile radio applications in the chemical industry have technical and legal requirements which are not met by the business models of the mobile phone providers and which are not covered by them.

The core requirements in terms of legally required operator responsibility and operational reliability are as follows
- adherence to maximum latency times,
- the provision of minimum upload speed, as well as
- compliance with the many legal and normative requirements.

In addition, flexibility, cost-effectiveness and implementation speed are essential factors for successfully investing in industrial IoT innovations and thus being able to compete internationally.

3. In order to best illustrate the above-described special features of the industrial use of 5G technology at BASF's sites, specific use cases are presented below.

a. Logistics application for the supply of a process industry site with tank container by fully automatic conveyor vehicles

BASF has been using mobile communications technology for the operation of autonomous guided vehicles (AGVs) at its Ludwigshafen site since 2017. It is planned to use 20 of these vehicles here by 2020. At the ten square kilometer Verbund site, 150 charging stations will be supplied with new rail-optimized tank containers by AGVs. The logistics concept is an important part of BASF's production and supply chain to ensure smooth and efficient operation. The transport volume at the Ludwigshafen site is around 20 million metric tons per year.

These vehicles are monitored in real time by video stream from a central control center to reliably ensure safety in plant traffic. The use of mobile radio technologies is already the optimal solution for this today, to ensure economical and sustainable operation.

The AGVs are connected to the control station via an autonomous industrial radio network. The communication link transmits control signals to the vehicle in real time (e.g., emergency stop in case of danger of accident) and five video cameras per vehicle stream in HD quality to the central control center. The industrial radio network is operated as a campus network and is designed to meet the special requirements of the AGV application so that an upload of 15 Mbit with a latency of <50 ms is available for each vehicle. To ensure operation, a bandwidth of at least 60 MHz is already required today. Further requirements on the availability and independence of the network result from the high security requirements of automatically driving vehicles in open factory traffic.

The system is based on small cell technologies in the frequency range of 3600-3800 MHz and requires a bandwidth of 60 MHz to supply the site. The current frequency allocation is from the BWA (Broadband Wireless Access) range and is allocated until 31.12.2022.
(https://www.youtube.com/watch?v=CXYuryCn5wo)

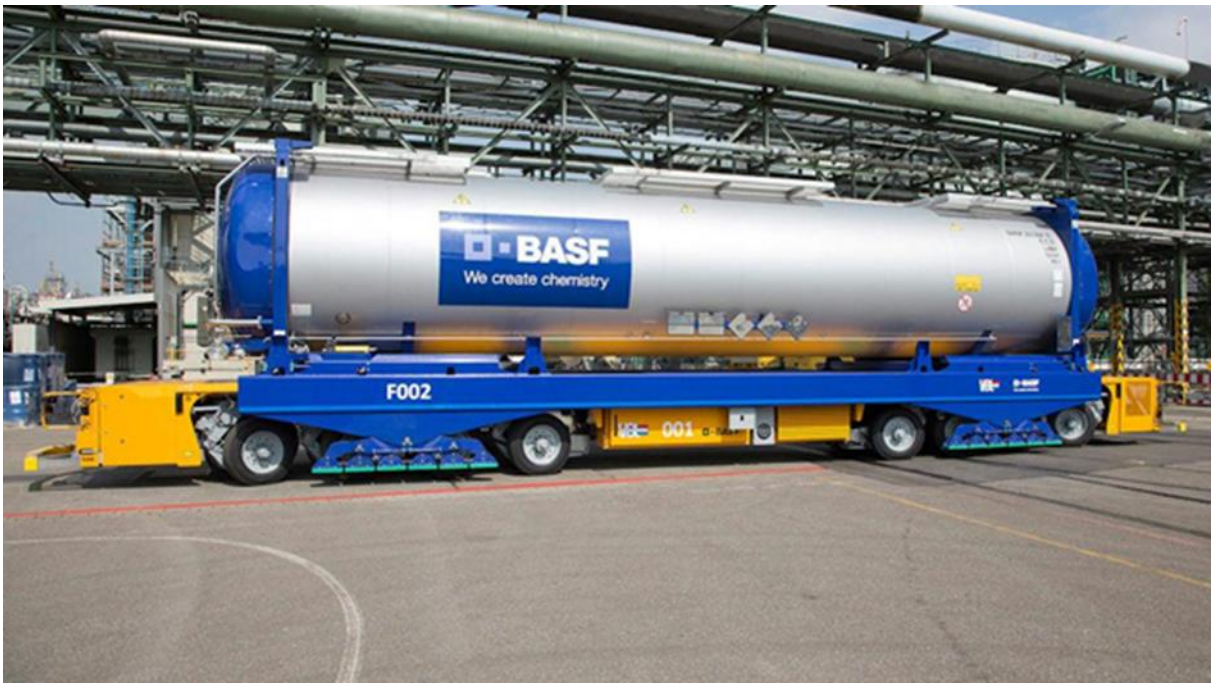


Figure 4: Fully automatic conveyor vehicle

During the preparation and implementation of this project, BASF worked with suppliers and mobile operators to find a solution for the site. However, the tendering process showed that none of the three major mobile operators was able to offer a suitable technical and economic solution. BASF is therefore now implementing an individual local solution together with technology suppliers and the approval of the German Federal Network Agency. In this way, BASF nevertheless uses the advantages of mobile radio, does not lose the connection technologically and can keep up with the competition.

b. Use of augmented reality applications

The operator receives context-related information, which is displayed on the mobile or portable device depending on the situation and position, and which supports them in their work situation. This can be data from various back-end systems, evaluations, images and video information, etc. The need for spectrum and the requirements for latency, for example, depend on the specific application.

c. Assistance systems for mobile work

Employees are supported by assistance systems that support them in working with expert knowledge, video and audio connections or AI applications.

We create chemistry

d. Use of drones and robots to inspect equipment

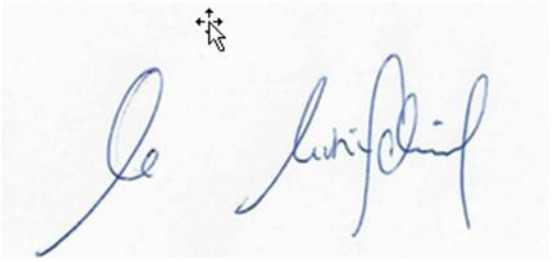
Drones and robots are used for maintenance and inspection tasks or for complex or dangerous tasks in production plants under real-time requirements. The drones are controlled and monitored via mobile radio.

e. IoT applications

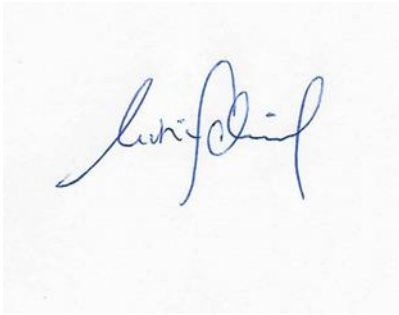
Chemical production plants are currently typically equipped with approx. 3000 - 5000 sensors and actuators. Digitization is expected to result in the cost-effective installation of a large number of additional sensors for monitoring and diagnostic tasks. As in automotive engineering, the number of installed sensors is expected to increase tenfold. At a large site like BASF's in Ludwigshafen with about 200 production plants, one can assume a potential of >500,000 additional sensors, which can only be used economically if the necessary communication infrastructure can be operated economically and reliably.

We thank you for this opportunity to provide the BASF perspective on 5G implementation challenges and, in particular, the importance of ensuring connectivity for vertical industries. If you have any questions regarding the information presented here, please do not hesitate to contact us.

Yours sincerely,



Dr. Matthias Fankhänel
Senior Vice President Technical Expertise



Martin Schwibach
Director Connectivity