

# ONLINE MONITORING FOR THE ANALYSIS OF THE DYNAMIC BEHAVIOR OF ROLLER COASTERS



www.nemi.one

www.i4m-tech.de

Foto: © Mack Rides GmbH und Co KG

**OBJECTIVE** • Continuous online monitoring to analyze the dynamic behavior of roller coasters and the condition of their tracks

**PERIOD** • 2021

**CHALLENGES**

- Extreme demands on the radio link due to dynamic driving behavior and magnetic interference fields
- Limited energy supply while vehicle is on track
- Weather conditions
- No cabling possible between cars
- Enormous data volumes (several gigabytes per day) to be transmitted via 4G cellular connection

**REALIZATION**

- Wireless nemione measurement system based on three compact sensor / telemetry modules and a gateway with integrated sensors
- Flexible installation of the nemi G+ acceleration sensors in the front and rear area of the train in weather-resistant boxes; accelerations, rotations and magnetic fields are measured in each of 3 axes (9 DoF IMU)
- Localization of the train on the roller coaster track using inductive and optical switching sensors connected to the telemetry module nemi DAQ
- Mounting of the gateway nemi EdgeBase underneath the train in a weather resistant box
- 9 DoF IMU & temperature sensor integrated in nemi EdgeBase
- Due to low power technology of all components, power can be supplied by supercapacitors, which are charged in the station via 24 V on-board network
- Transmission of measurement data from the sensor / telemetry modules to the gateway via nemi Link 2400 - i4M's radio technology in the 2.4 GHz frequency band
- Data collection and transmission via VPN-tunneled 4G cellular connection & (S)FTP server

**ADVANTAGES**

- Simple and fast mounting / dismantling due to compact, lightweight components
- Uncomplicated handling of wireless sensors
- Reliable data through i4M's robust radio technology nemi Link 2400

**DEPLOYED**

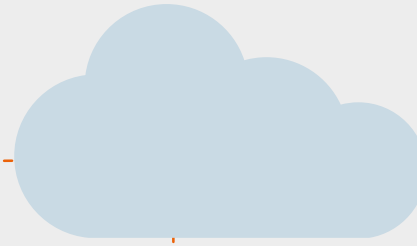
**nemione® PRODUCTS**








- nemi G+
- nemi DAQ
- nemi EdgeBase

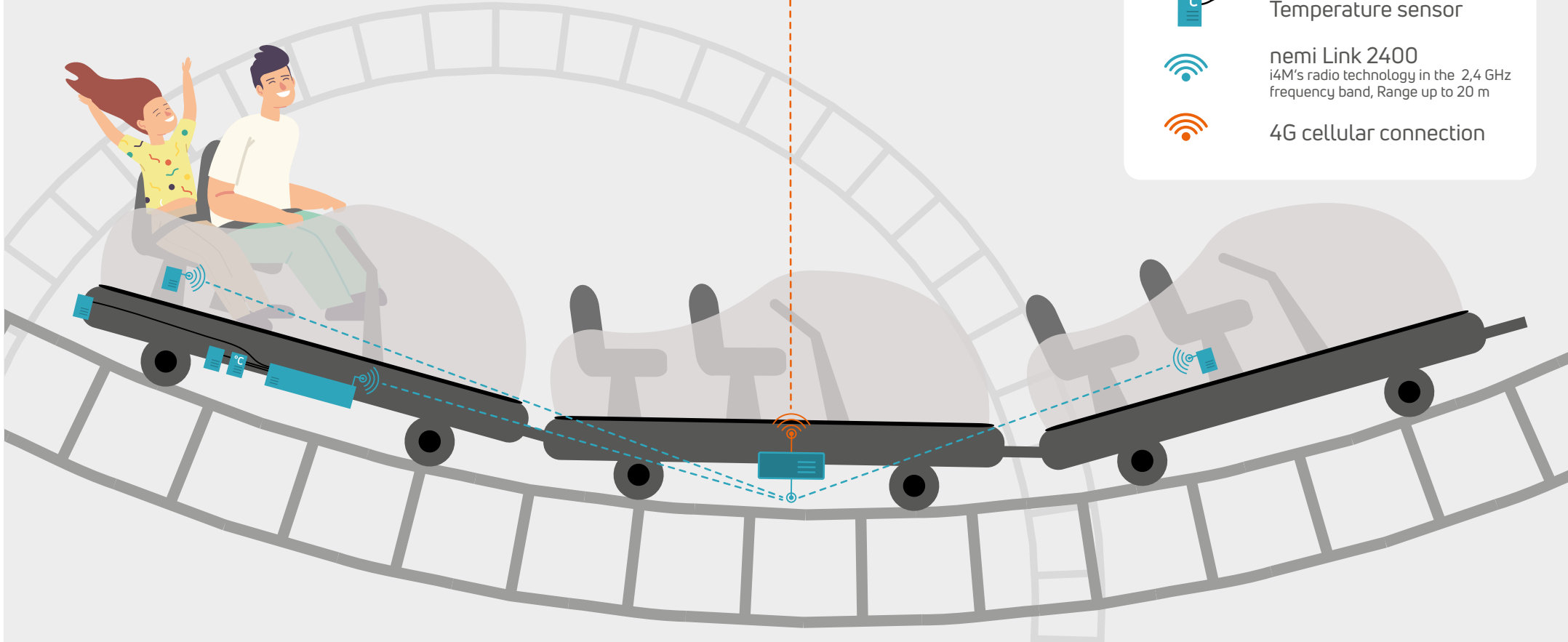


*„At Mack Rides, i4M's wireless nemione measurement system was used to monitor a catapult roller coaster. The compact components convince us with easy installation, robust wireless data transmission even in case of magnetic interference field and high data quality. We thank the team of i4M for the good cooperation and the fast implementation of the project.“*

**Felix Maier**  
Design / Structural Analysis  
Mack Rides GmbH und Co KG



-  **nemi G+**  
Acceleration sensor with 9 DoF IMU
-  **nemi EdgeBase**  
4G-Gateway with 9 DoF IMU
-  **nemi DAQ**  
Telemetry module with 9 DoF IMU
-  **Optical / inductive switching sensor**
-  **Temperature sensor**
-  **nemi Link 2400**  
i4M's radio technology in the 2,4 GHz frequency band, Range up to 20 m
-  **4G cellular connection**



www.nemi.one

www.i4m-tech.de