FRAUNHOFER INSTITUTE FOR INTEGRATED CIRCUITS IIS
DESIGN AUTOMATION DIVISION EAS

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DUAL ANALYSIS FOR WIRELESS AUTOMATION APPLICATIONS

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In industrial automation, wireless communication systems offer key advantages over wired solutions. Flexible positioning of the wireless nodes opens up more flexibility, for instance for establishing data connections between widely separated or mobile system components. It is essential, however, that wireless solutions operate reliably and robustly in an industrial environment, even under difficult conditions such as enclosed metallic environments.

Wireless systems must therefore be adapted to their usage environment already during the planning and configuration. They must also be monitored during operation to ensure that system operators can respond promptly to critical changes in the radio conditions. Fraunhofer IIS/EAS offers services with which wireless systems can be safely planned and operated, including the precise investigation and elimination of any transmission problems. Our measurement and diagnosis system analyzes wireless networks based on the frequency spectrum and the logical data of the communication telegrams. With this dual analysis we can monitor the condition of the wireless connections and identify the causes of potential transmission problems.

Your Benefits

Save both time and money in the planning, installation, and operation of wireless networks with:

- System- and environment-compatible configuration of wireless networks
- Early detection of interference sources and detailed analysis of the causes (even for complex systems)
- Identification of existing reserves in the wireless network (e.g. in capacity utilization)
- Efficient and reliable use of unlicensed frequency bands
- Individually customized solution strategies for your application

Dual Analysis of Wireless Communication

The telegrams sent by wireless communication systems can be detected in the radio spectrum. In addition, the logical information contained in the telegrams sheds light on the entire radio environment. The dual analysis of wireless communication therefore combines the results of telegram and spectral analysis to enable precise conclusions about the system state and the causes of transmission problems.

The spectral analysis supplies information for identifying existing wireless communication systems and interference (e.g. from production systems or nearby wireless systems). The capacity utilization of frequencies can also be determined. However, because many radio standards in industry use the same un-licensed frequency bands, this information alone is generally an insufficient basis for system operators to identify and eliminate specific interference sources.

This is where protocol analysis comes into play. With its help, it is possible to separately observe the telegram information of every wireless connection. Any disruptions in the communication process are revealed for each connection in this way. The network reserves with regard to capacity, reliability and timing are also individually revealed. Overall, this approach allows system operators to identify problems at an early stage, precisely diagnose them and implement specific solutions. In particular, this also includes propagation problems and mutually interfering wireless nodes or connections (coexistence problems).

The results of the dual analysis are extremely detailed and reliable even under difficult conditions such as complex wireless systems and a diverse set of technologies. For instance, if a WLAN data connection is being interfered by Bluetooth communication on the neighboring machine, this can be accurately identified.

Our Services

We analyze the requirements of the specific application and evaluate manufacturer-independently various technologies and components with regard to suitability. We also support our customers in the planning and commissioning as well as the status and interference analysis of wireless automation systems.

An overview of our services:

- Feasibility studies
- Planning and support in technology and system selection
- Analysis of technical measurement reliability and diagnosis of problems
- Development of measurement systems for permanent network monitoring and preventive fault detection
- Development of customer-specific prototypes of wireless systems
- Supported wireless technologies: WLAN, industrial WLAN, Bluetooth, WirelessHART, and other sensor networks according to IEEE 802.15.4
- Supported frequency bands: 2.4 GHz and 5 GHz

1 *Application example: Warehouse with an unmanned transportation system*

Interference Detection in Wireless Automation Applications by Dual Analysis

Transmission disrupted
WLAN
Bluetooth

time
power density
frequency

Simultaneous Capturing
of radio spectrum and telegram data, e.g.:

Telegram: PLC to Actuator B
Telegram: Sensor C to PLC
Telegram: PLC to Actuator D
Telegram: Sensor A to PLC

PLC
PLC
Sensor **A**   Actuator **B**
Sensor **C**   Actuator **D**

Dual Analysis and Evaluation
detection of transmission problems and causes
(telegrams from sensor C to PLC and from PLC to actuator B are interfering with each other)