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Radio Technologies in Automation
- Background and Status -

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I IA ATS 34

Content

- Trends in Industrial Automation
- Industrial Automation Requirements
- Classification of Wireless Applications
- Communication Networks in Automation
- Status of used Radio Technologies
- Coexistence Issues
- Potential Contribution from ETSI

Trends in Industrial Automation and Communication

- **Request for new and advanced automation features is driven by:**
  - **Trend to shorter product live cycles**
  - **Need of more flexible production**
  - **Requirement for easy reconfiguration of plant layout**
  - **Increasing role of advanced asset management**
- **Users of automation systems hope that Wireless (Radio) Communication will help to enable such new features**
  - **Mobility is a precondition for more flexible production**
  - **Radio technologies are established in everyday's life**
  - **A variety of wireless products for office/consumer applications are available**
  - **First automation products using all mainstream technologies are available**
  - **Equipment costs are still going down**

It’s up to the users to launch the party...

... but..

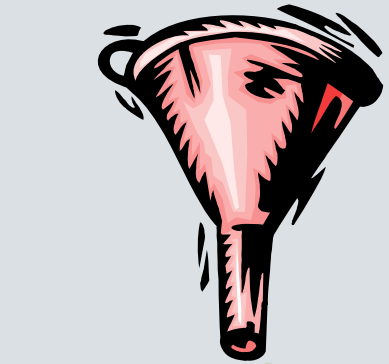
WLAN
802.11...
IWLAN
Propr. LAN

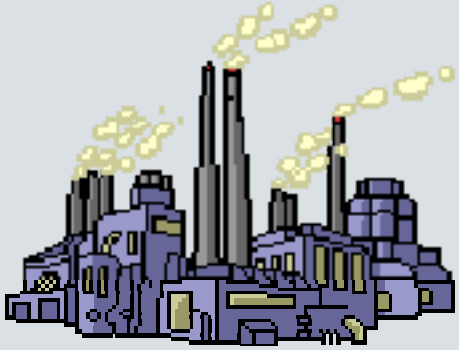
PAN/WSN
WL HART
Zigbee
Bluetooth

RFID
13 MHz
....
2,4 GHz
...

Mobile Networks
GSM
UMTS

Wireless Phones
DECT

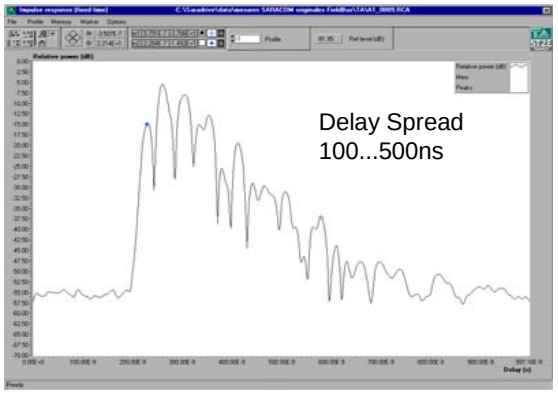


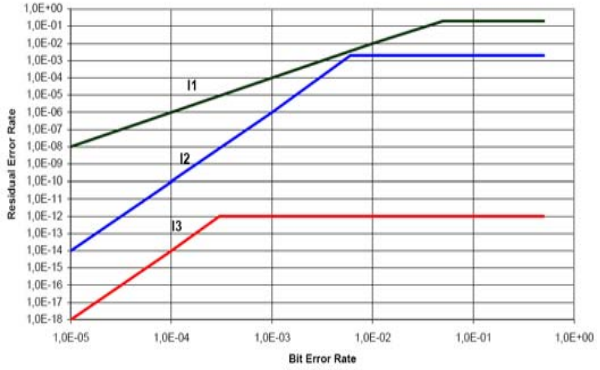


...which technology meets my special requirements ????

Communication Systems Requirements in Industrial Automation

- **Special environmental conditions**
  - Metal constructions
  - Extended temperature range
  - Pollution, contamination, wetness
  - Explosive atmosphere
  - Special EMC conditions
- **Deterministic timing**
  - Cyclic communication (measurement values, control commands)
  - Acyclic communication (status, configuration, downloads)
- **Reliability / Availability**
  - For critical applications comparable with Data Integrity Classes I2 or I3 according to IEC 870-5-1
  - Time-bounded message delivery
  - No message loss
- **Security / Safety**
  - Encryption
  - Authentication
  - Redundancy
- **Integration into existing architecture**





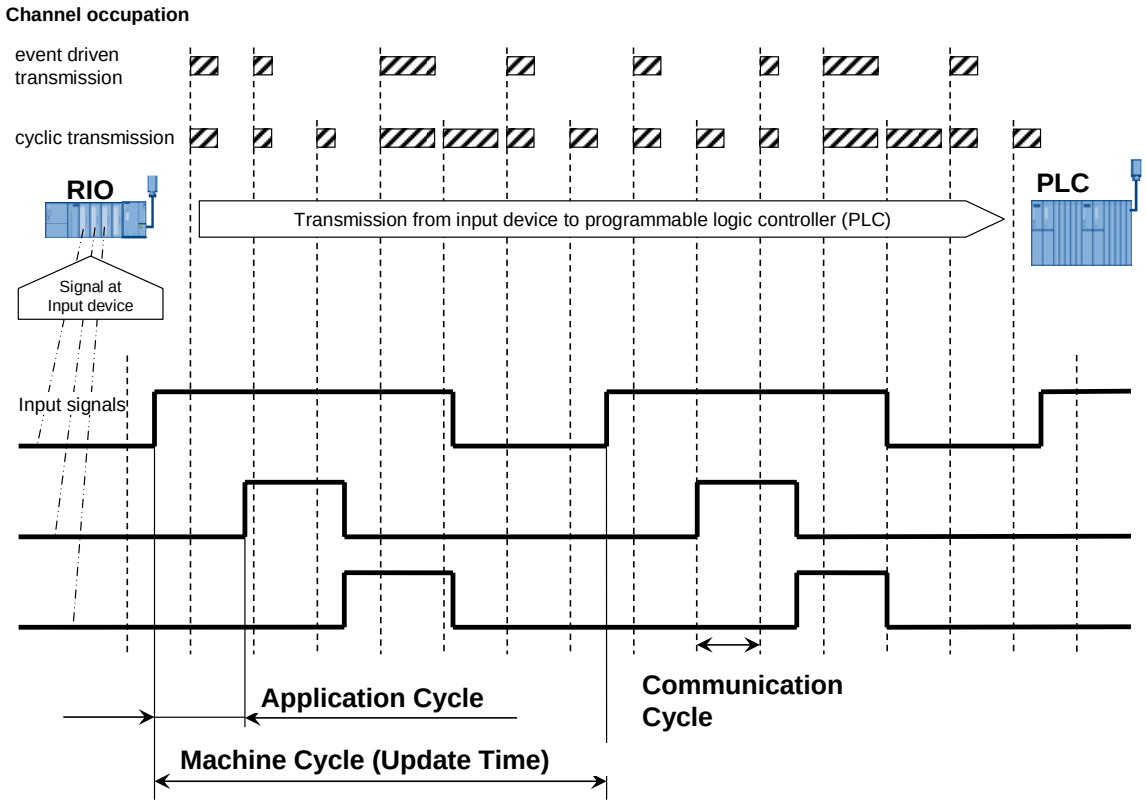
Timing Requirements in Industrial Automation

Process Automation Monitoring
- 200ms ... 1h

Process Automation Control Loop
- 20ms ... 1s

Factory Automation Control Loop
- 10ms ... 300ms

Drives Control Loop
(e.g. rotary printing presses)
- 1ms ... 10ms

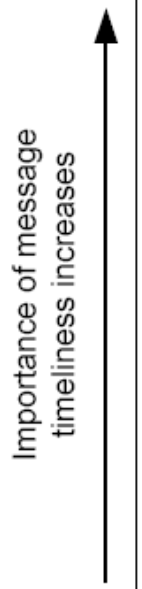


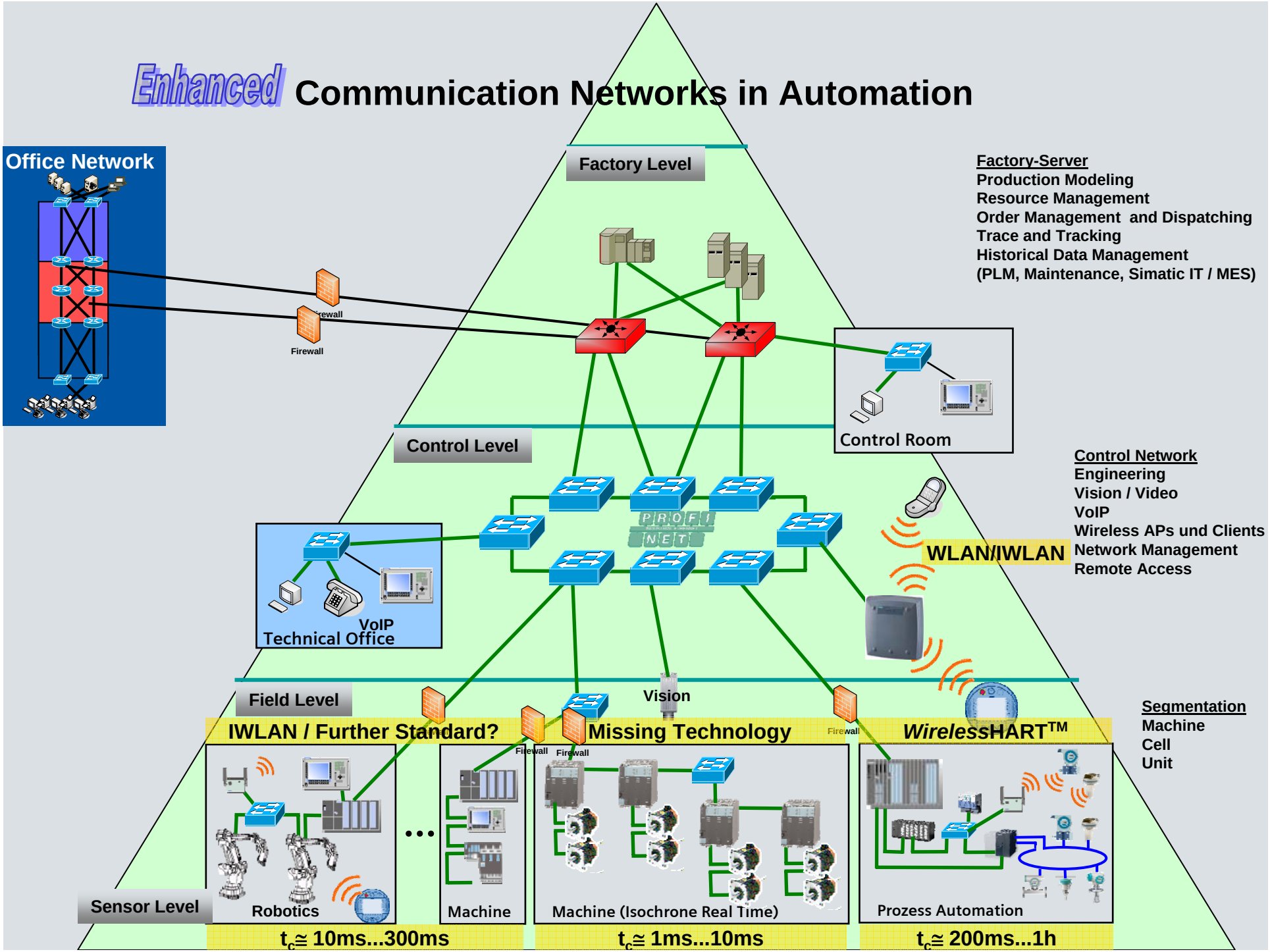
Source: VDI/VDE Guideline 2185

Update Times varies from 1ms to 1h

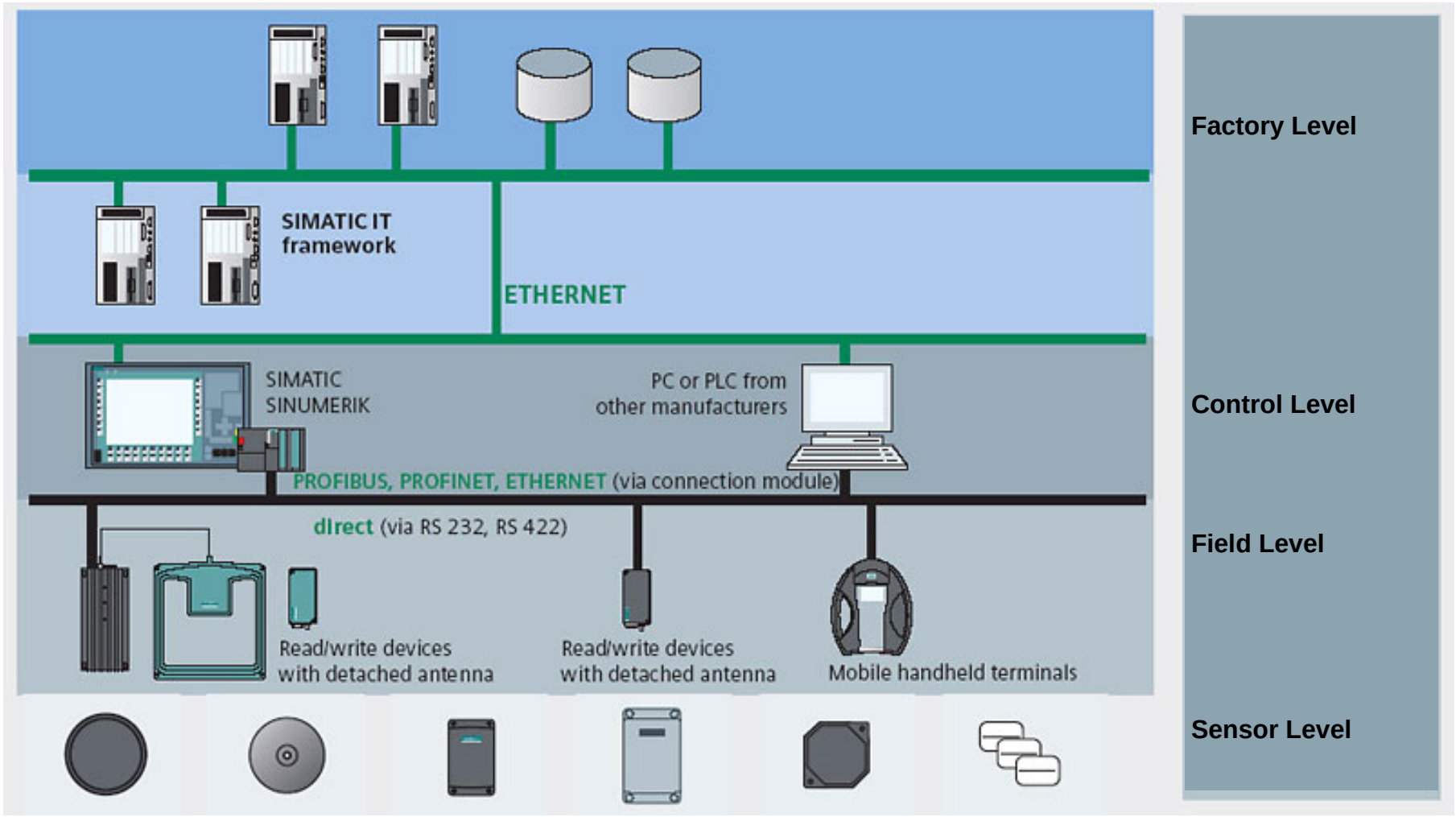
ISA SP 100 Usage Classification for Wireless Communication

Category	Class	Application	Description
Safety	0	Emergency action	*(always critical)*
Control	1	Closed loop regulatory control	*(often critical)*
	2	Closed loop supervisory control	*(usually non-critical)*
	3	Open loop control	*(human in the loop)*
Monitoring	4	Alerting	*Short-term operational consequence (e.g., event-based maintenance)*
	5	Logging and downloading/uploading	*No immediate operational consequence (e.g., history collection, sequence-of-events, preventive maintenance)*




Enhanced Communication Networks in Automation
Office Network
Firewall
Factory Level
Factory-Server
Production Modeling
Resource Management
Order Management and Dispatching
Trace and Tracking
Historical Data Management
(PLM, Maintenance, Simatic IT / MES)
Control Level
Control Room
Control Network
Engineering
Vision / Video
VoIP
Wireless APs und Clients
Network Management
Remote Access
PROFINET
WLAN/IWLAN
VoIP
Technical Office
Field Level
Vision
IWLAN / Further Standard?
Missing Technology
WirelessHART™
Firewall
Segmentation
Machine
Cell
Unit
Sensor Level
Robotics
Machine
Machine (Isochrone Real Time)
Prozess Automation
tc≅ 10ms...300ms
tc≅ 1ms...10ms
tc≅ 200ms...1h

RFID System Architecture



Summing-up of Radio Technologies used in Industrial Automation

- **Communication**
  - WLAN (IEEE802.11 b, g, a, h)
  - IWLAN (IEEE802.11 b, g / RT-extension)
  - Wireless HART (IEEE802.15.4, ISA SP 100?)
  - Zigbee (IEEE802.15.4)
  - Bluetooth (IEEE802.15.1)
  - DECT (ETSI)
  - GMS / GPRS / UMTS
  - Proprietary systems
    - 868 MHz
    - 2,4 GHz
- **RFID**
  - 13 MHz ....2,4 GHz
- **Others**
  - Location Systems (2,4 GHz, UWB)
  - Microwave Oven / Drying Plant

Nearly all technologies are using the 2,4 GHZ ISM band

Now it's most likely that the users ask a question...

...concerning coexistence :

WLAN
IWLAN
Propr. LAN

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13 MHz
....
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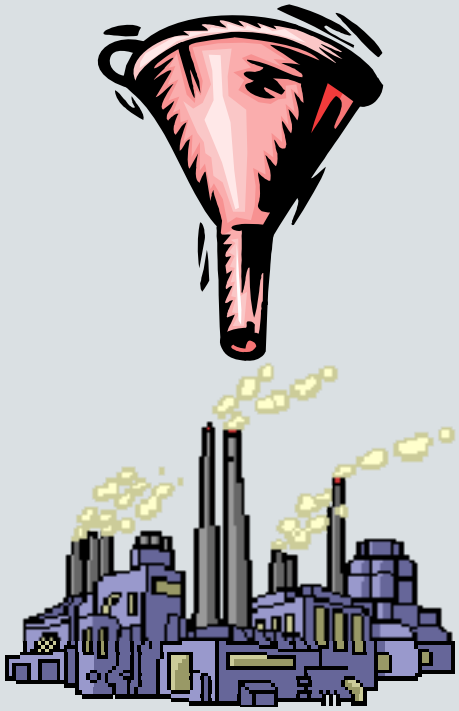
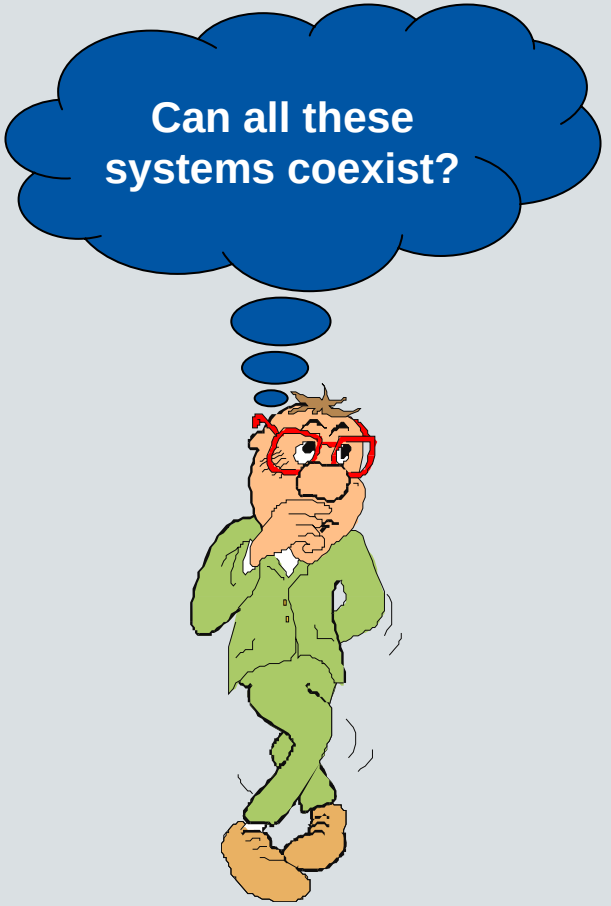
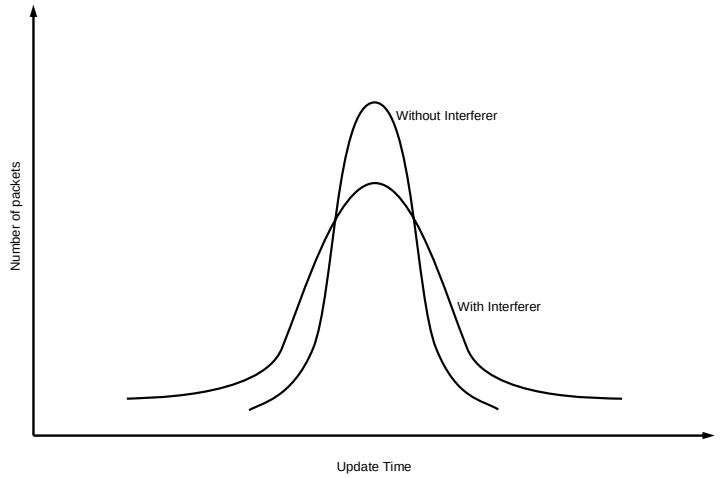


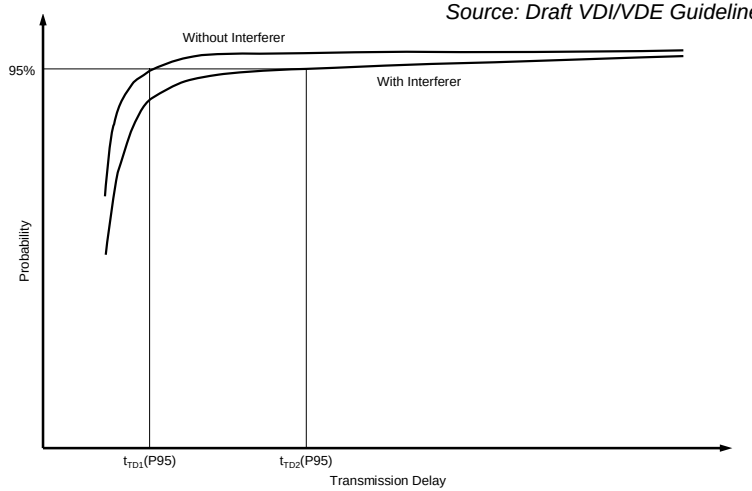


What does “Coexistence” mean?

- **Different wireless communication systems using the same frequency range are interfering if their operation areas overlap**
- **Definition of coexistence according to the draft VDI/VDE Guideline (short form)**
  - **Wireless communication systems coexist in a predefined environment if specific key performance parameters are within defined limits when all systems are operating in parallel with maximum communication load.**
- **Coexistence is not a constant characteristic, it may change**
- **Update Time and Transmission Delay are appropriate key performance parameters for many applications in industrial automation**

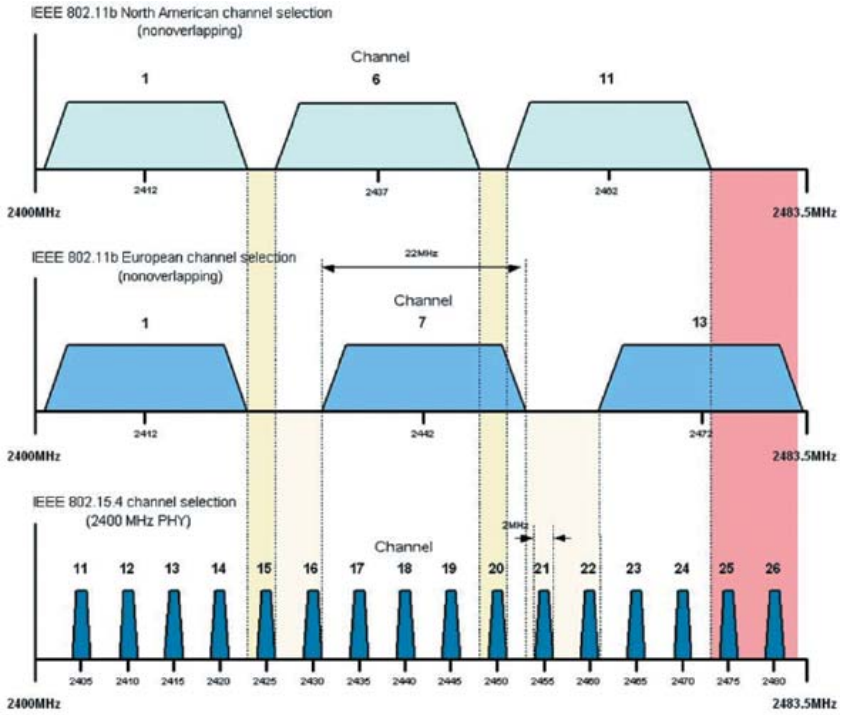


Source: Draft VDI/VDE Guideline 2185



Siemens Radio Coexistence Policy

- Users must be confident that their systems are highly available over the complete system lifecycle
- Coexistence shall not be a matter of fortuity
- WLAN is an established technology, related investment has to be protected
- It is highly recommended to operate further radio systems (e.g. WSN, PAN) outside the occupied WLAN channels
- WLAN according to IEEE 802.11 and WSN according to IEEE 802.15.4 can coexist if a channel management process is established
- Limitation to public ISM bands is a serious barrier for future use of wireless communication in industrial communication



Potential ETSI Contribution to Radio Communication in Automation

- **Transfer of substantial radio knowhow to the automation area**
  - Many players in the automation community are using radio technologies with only little radio knowhow
  - Knowledge of DECT channel characteristics and models can accelerate similar work for
- **Find ways out of the 2,4 GHz deadlock**
  - DECT was a very successful attempt to claim a frequency band for a specific application
  - The automation industry needs a similar protected frequency band, at least for critical applications (class 0)
  - UWB may provide a new chance for additional bandwidth
  - ETSI has the expertise to push the necessary development in Europe
  - Cooperation with international standardization organizations (e.g. IEC) can set global rules
- **Strengthening of the European Automation Industries**
  - Europe has a strong position in advanced communication systems for Automation
    - PROFIBUS is the leading Fieldbus worldwide (20 Million nodes)
    - PROFINET is up to continue the success story
  - Combination with strong position in mobile phone technology can generate new benefits
- **Support in security**
  - Security issues are associated to any wireless technology including RFID

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THANK YOU