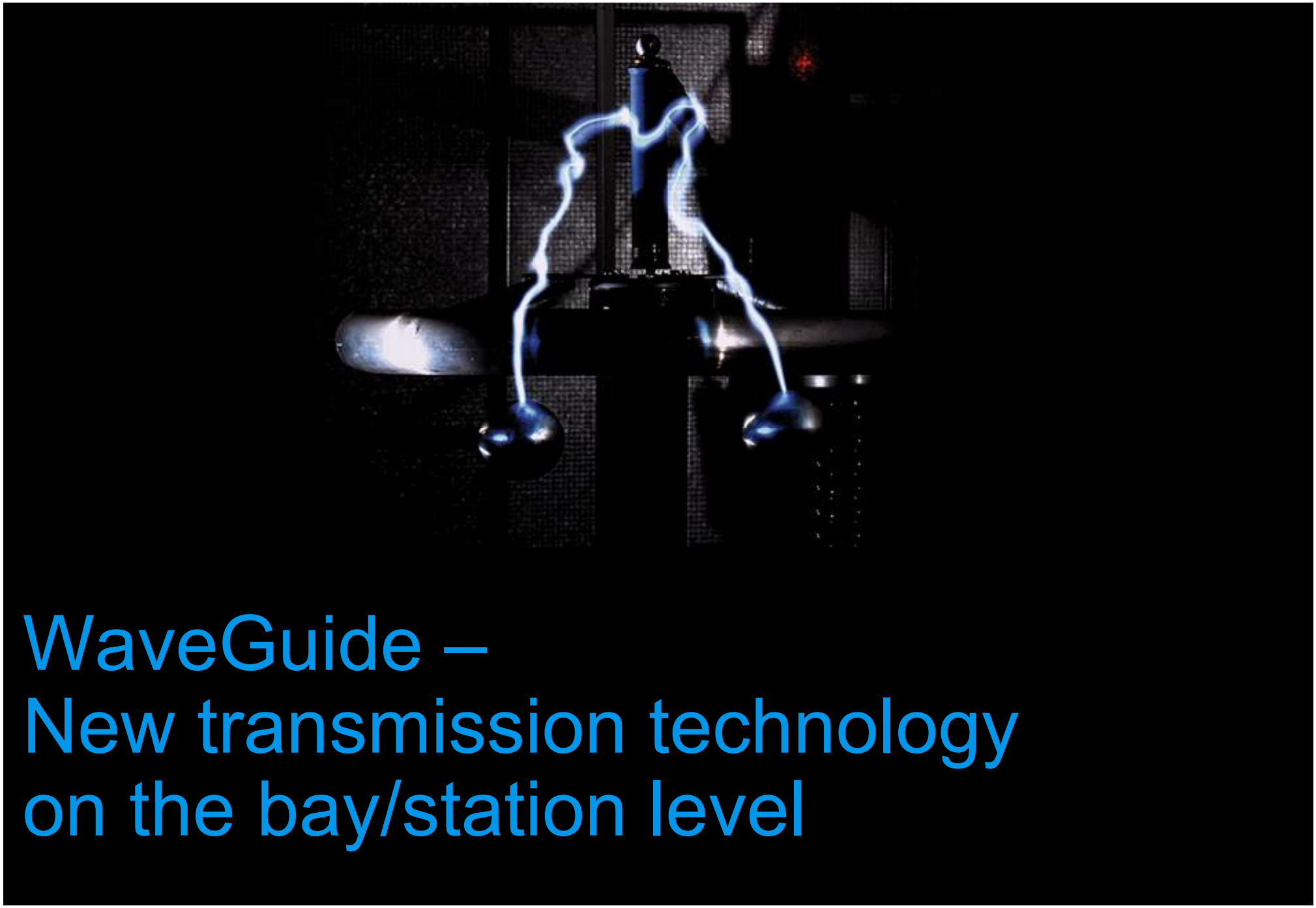


# WaveGuide – New transmission technology on the bay/station level

# WaveGuide –
# New transmission technology on the bay/station level

**WaveGuide:**

Rectangular Waveguide –

a new communication solution for modern medium voltage switchgear

- Robust system
- Low attenuation
- High bandwidth

# WaveGuide –
# New transmission technology on the bay/station level

**WaveGuide in an UniGear ZS1 at LyondellBasell Industries**

**Air insulated**

**medium voltage switchgear**

- Type: UniGear ZS1
- Number of panels: 6
- Rated voltage: 12 kV
- Rated current: 1.250 A
- Rated short-circuit current: 25 kA
- Protection and control relay: REF542 *plus*
- Communication: IEC 61850
- Communication system: WaveGuide
- Connection to the control system: COM615 with Protocol **IEC 60870-5-101**

# WaveGuide –
# New transmission technology on the bay/station level

**WaveGuide in an UniGear ZS1 at LyondellBasell Industries**

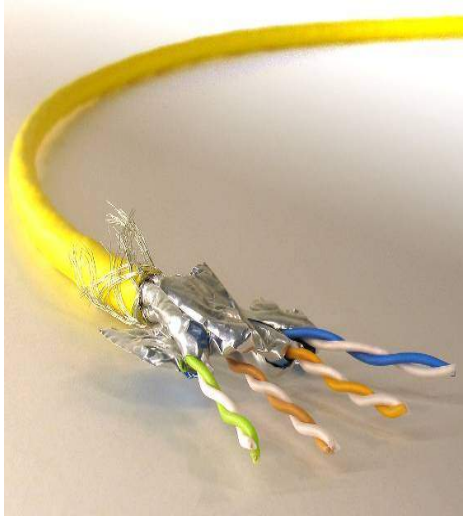
WaveGuide WGA631 and REF542 *plus*

WaveGuide WGA631 and COM615

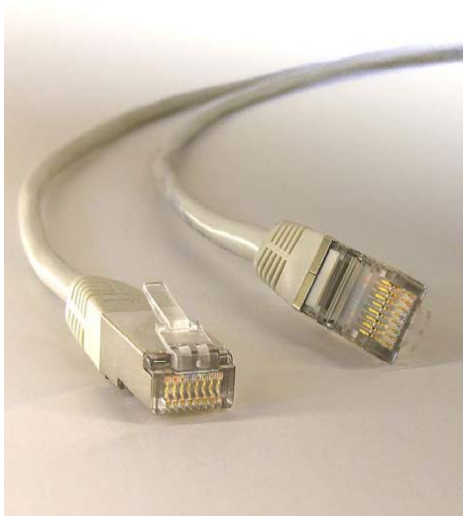
Operator's station

# WaveGuide –
# New transmission technology on the bay/station level

Single core cable



CAT 7 cable
(twisted pair)



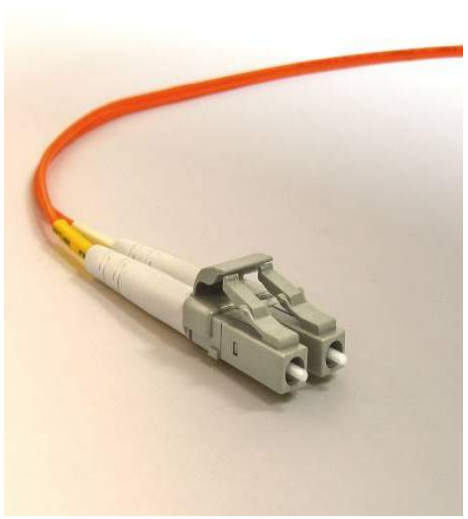
Ethernet cable;
preassembled

## Retrospective

# WaveGuide –
# New transmission technology on the bay/station level

Coaxial cable

Optical fiber cable

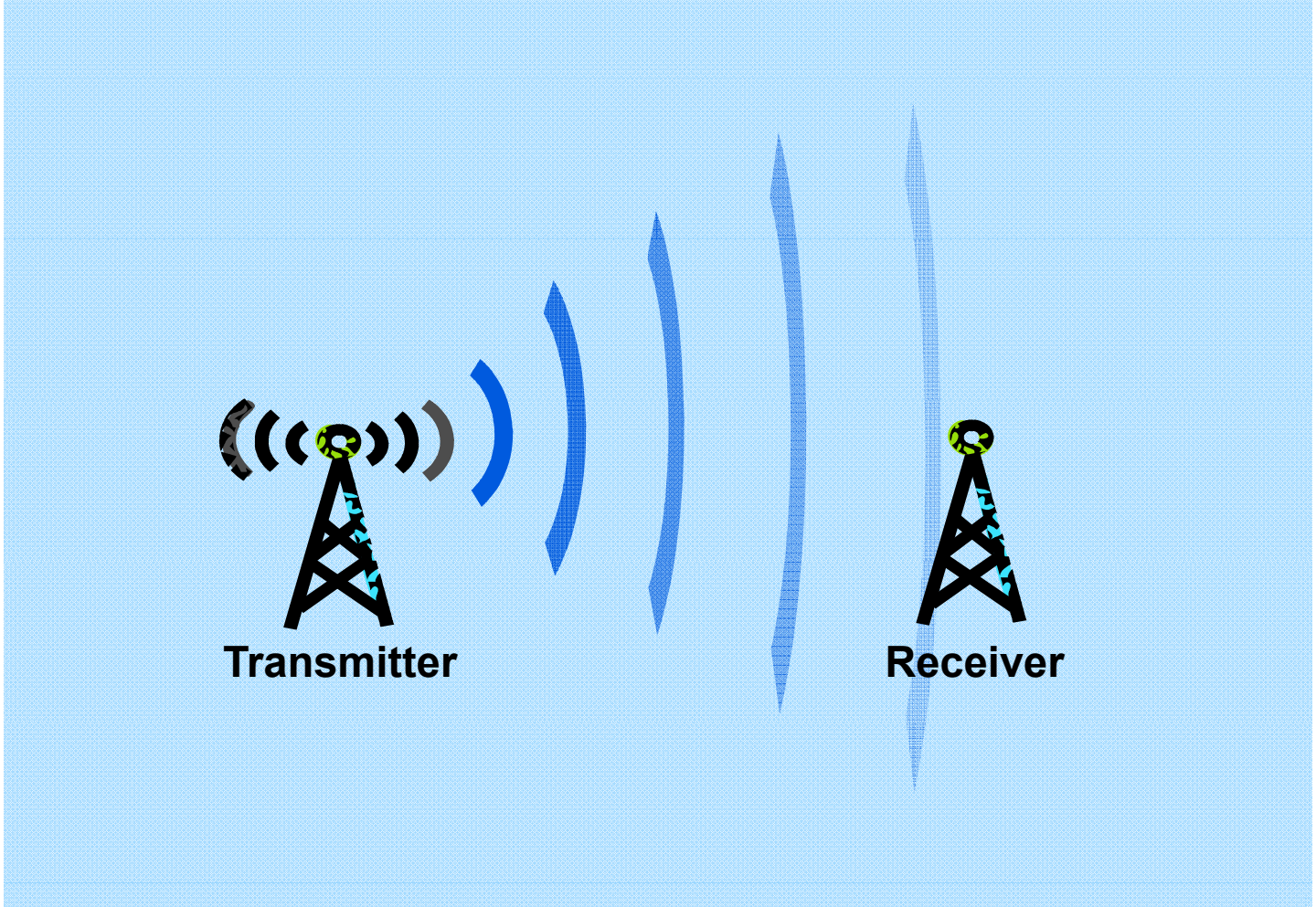


Optical fiber cable;
preassembled
(LC Connector)

Retrospective

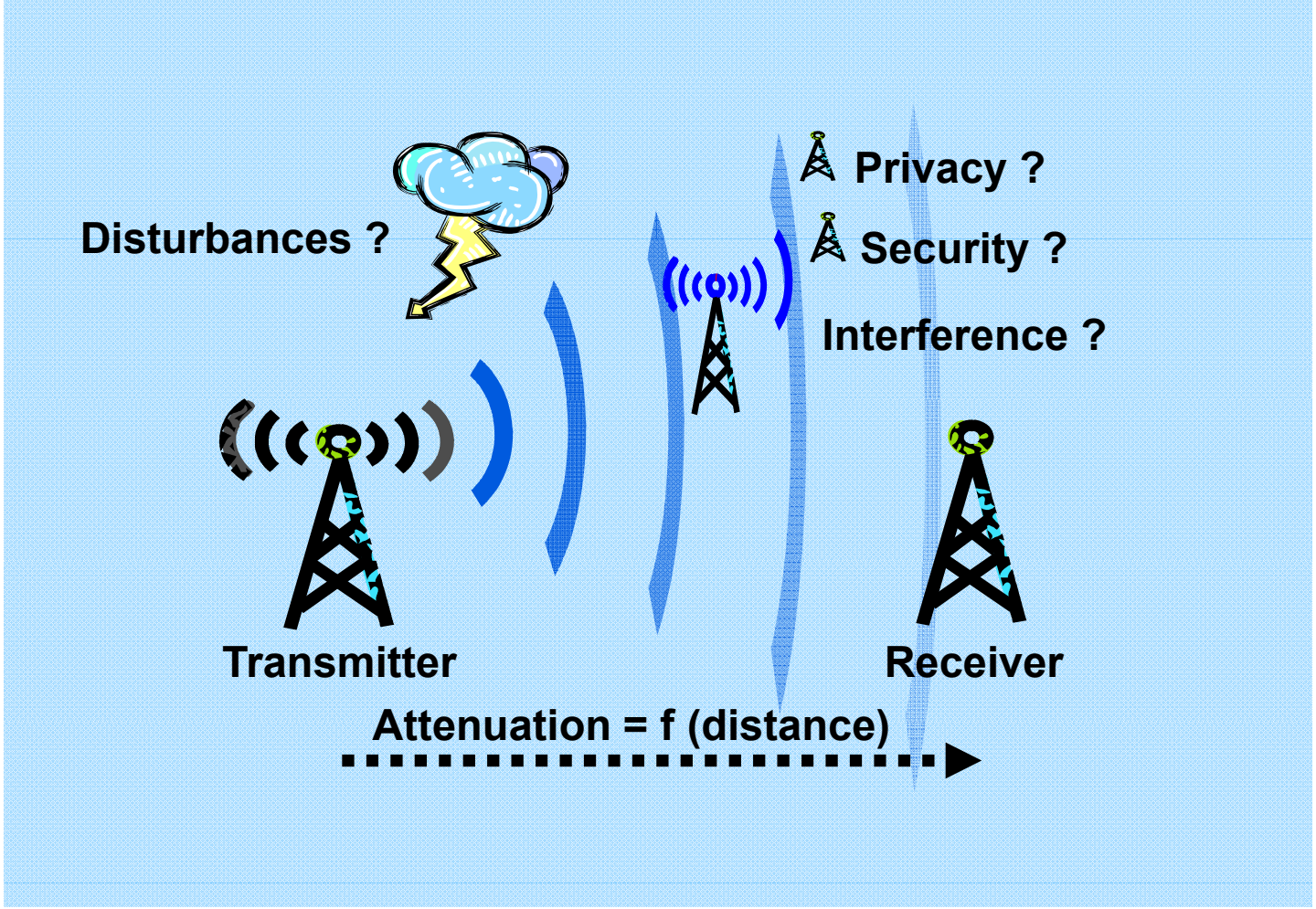
# WaveGuide –
# New transmission technology on the bay/station level

**State-of-the-art: Wireless LAN**



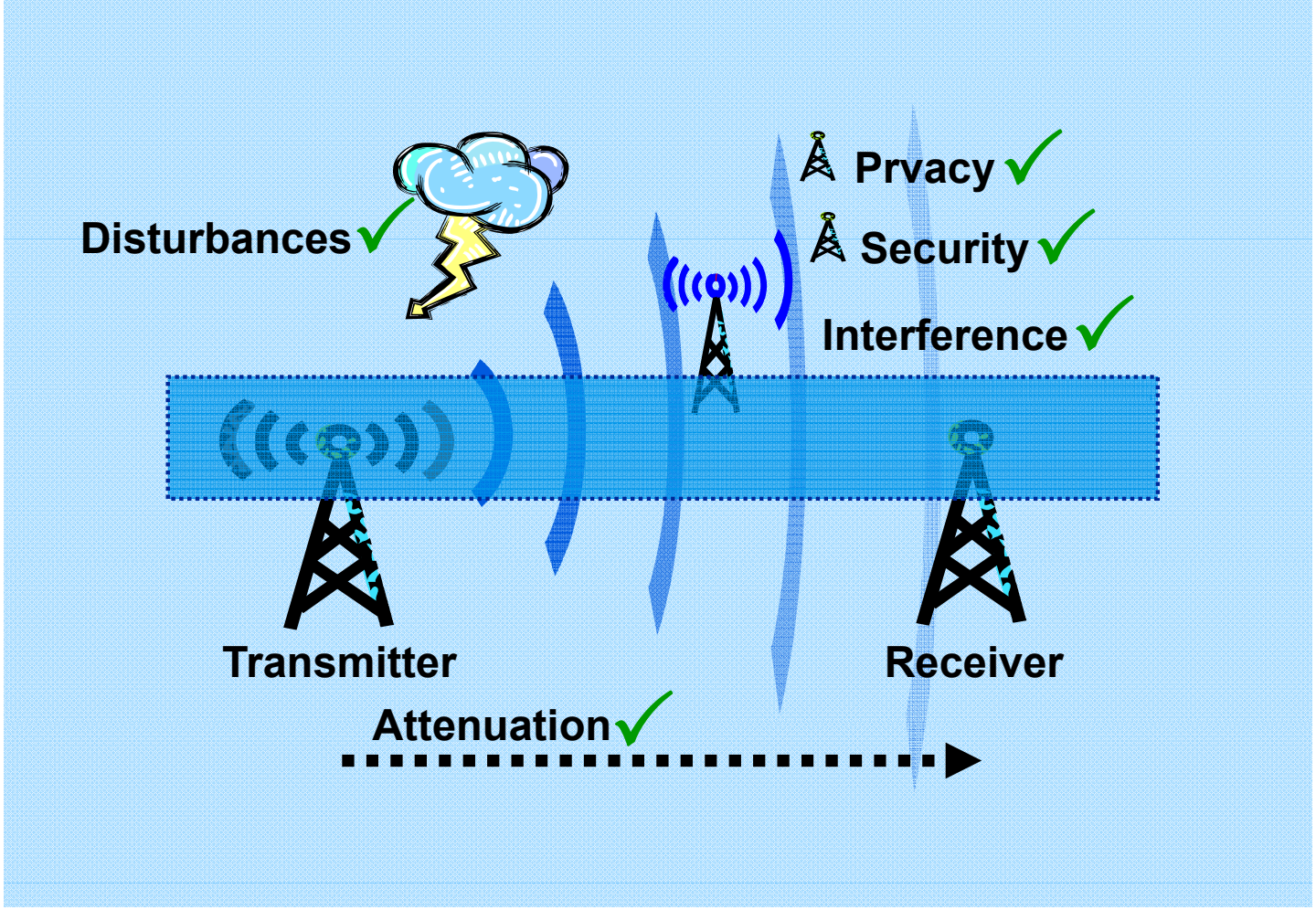
# WaveGuide –
# New transmission technology on the bay/station level

**State-of-the-art: Wireless LAN – risks**



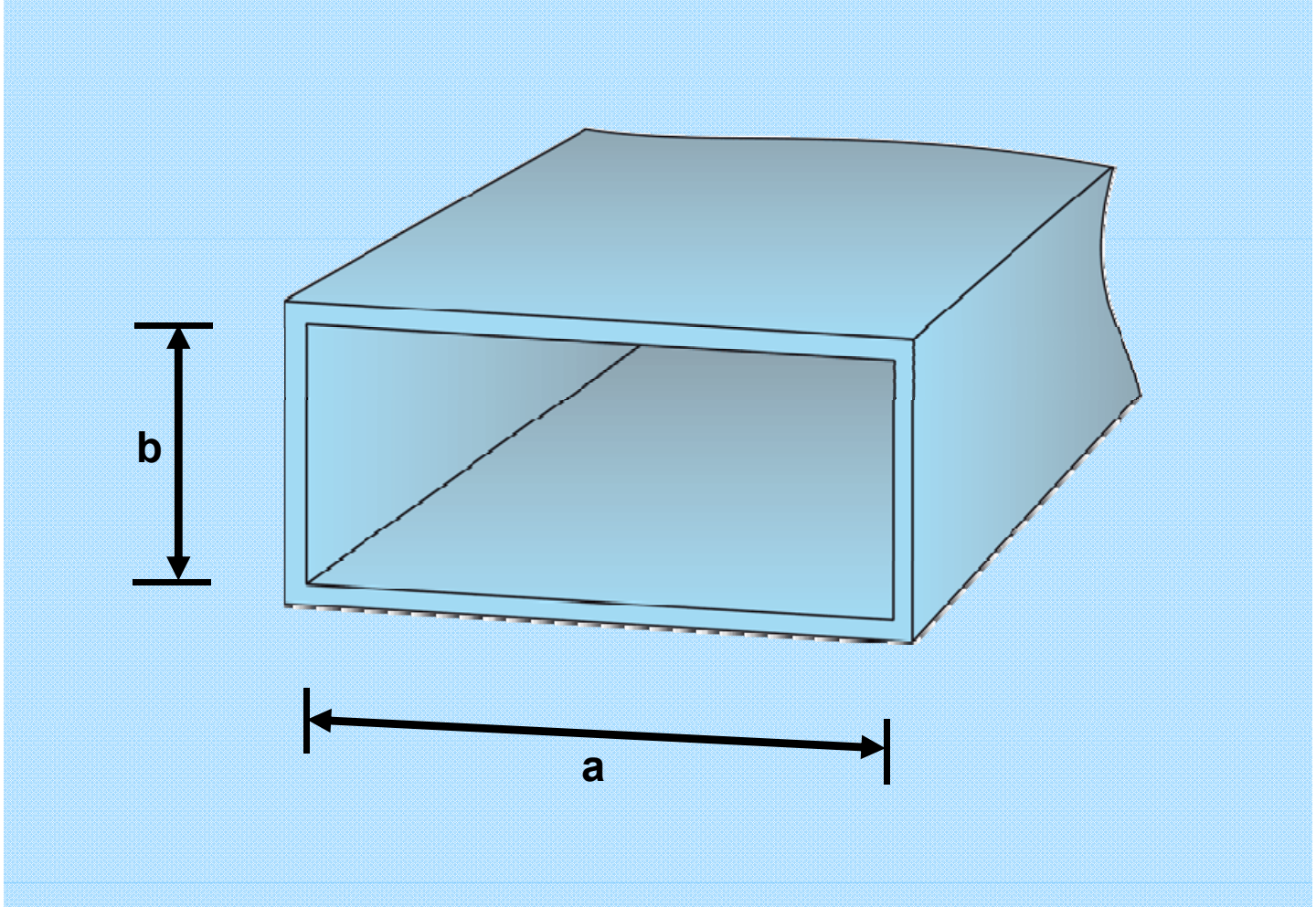
# WaveGuide –
# New transmission technology on the bay/station level

**The solution**



# WaveGuide –
# New transmission technology on the bay/station level

**Rectangular WaveGuide**



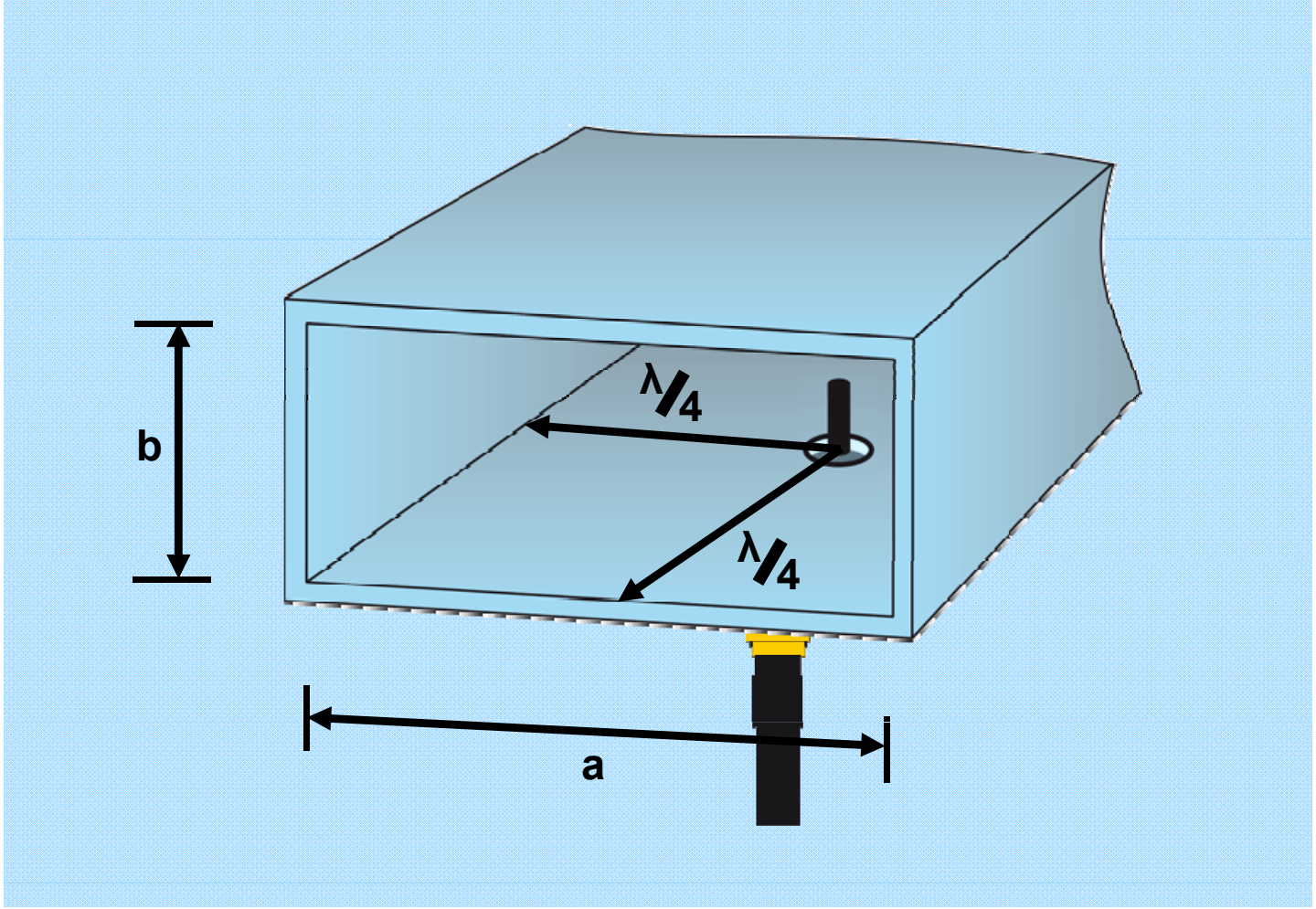
# WaveGuide –
# New transmission technology on the bay/station level

**WaveGuides in „everyday“ life:**

- Wind instruments
  - Flutes, organ pipes, trumpets, …
- Microwave ovens
- Transmitters
- Glass fiber cables
- …

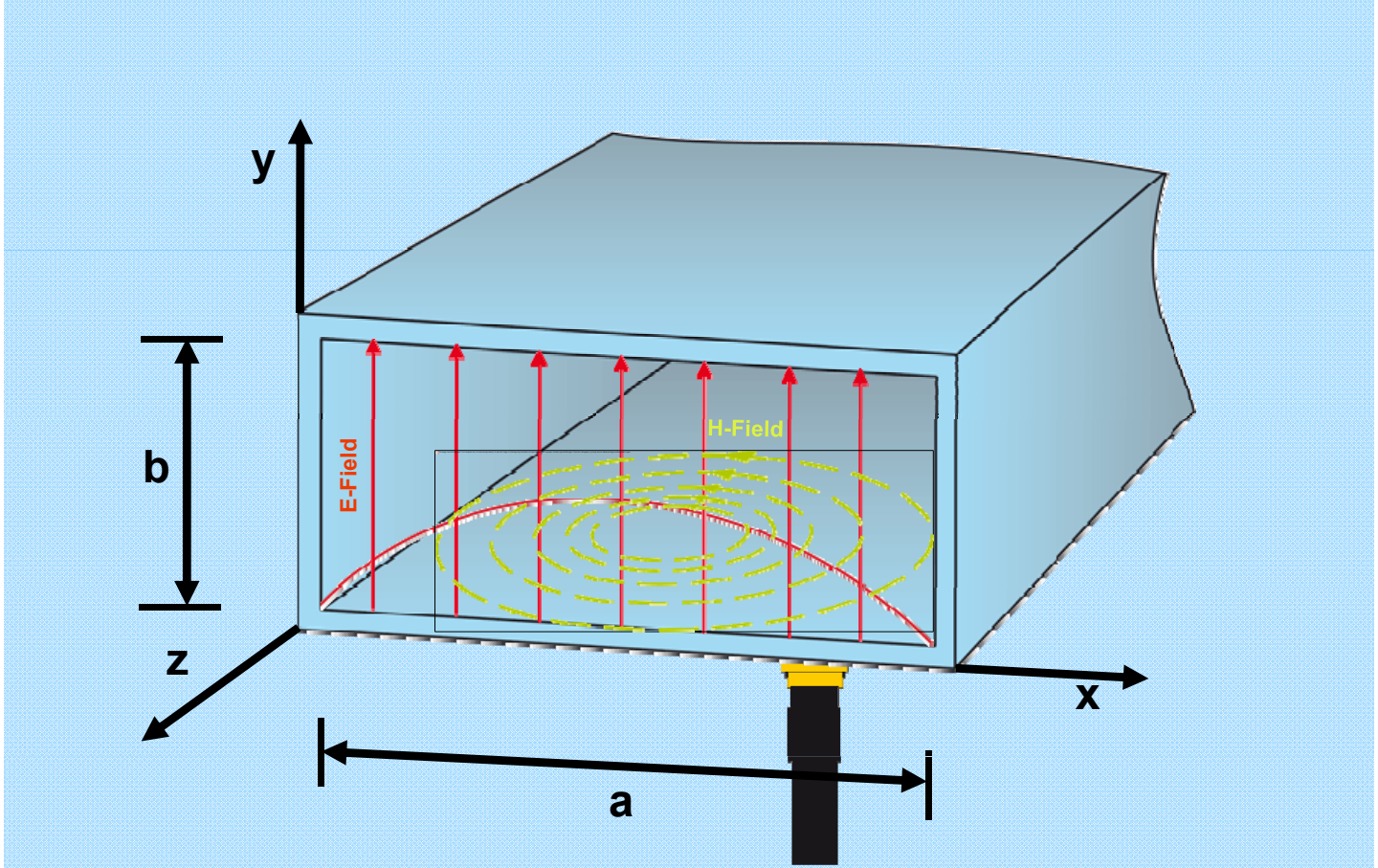
# WaveGuide –
# New transmission technology on the bay/station level

**Rectangular WaveGuide**



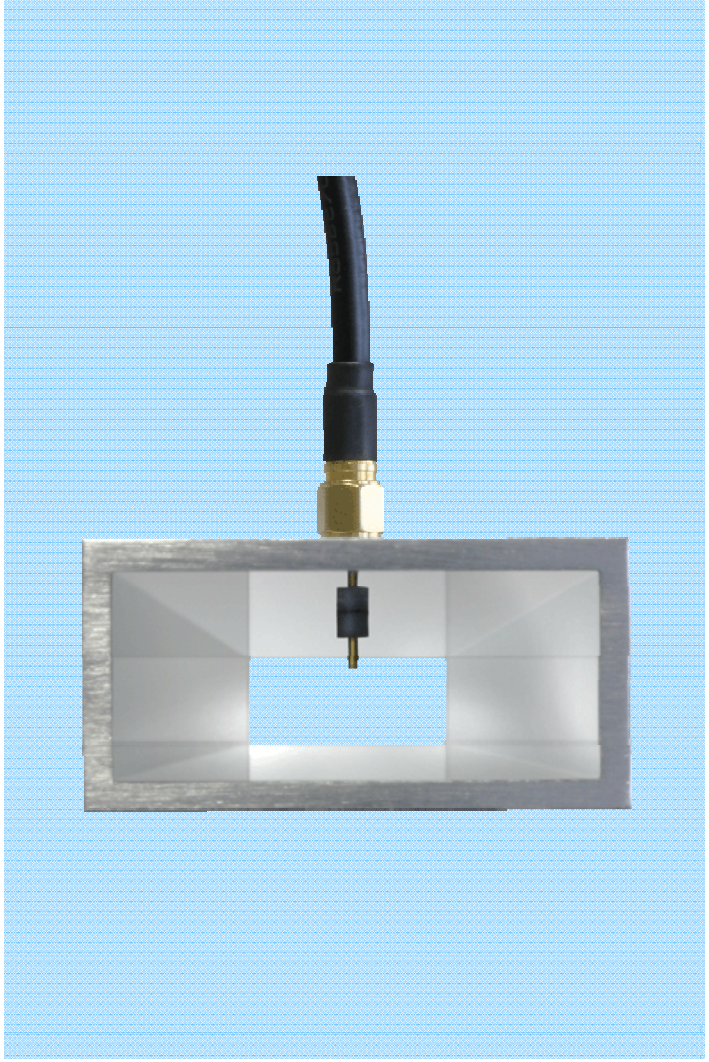
# WaveGuide –
# New transmission technology on the bay/station level

**Rectangular WaveGuide**




Attenuation = ~2dB / 1 km

# WaveGuide –
# New transmission technology on the bay/station level



**The future has begun:**

- WaveGuides as a transmission medium in medium voltage switchgear

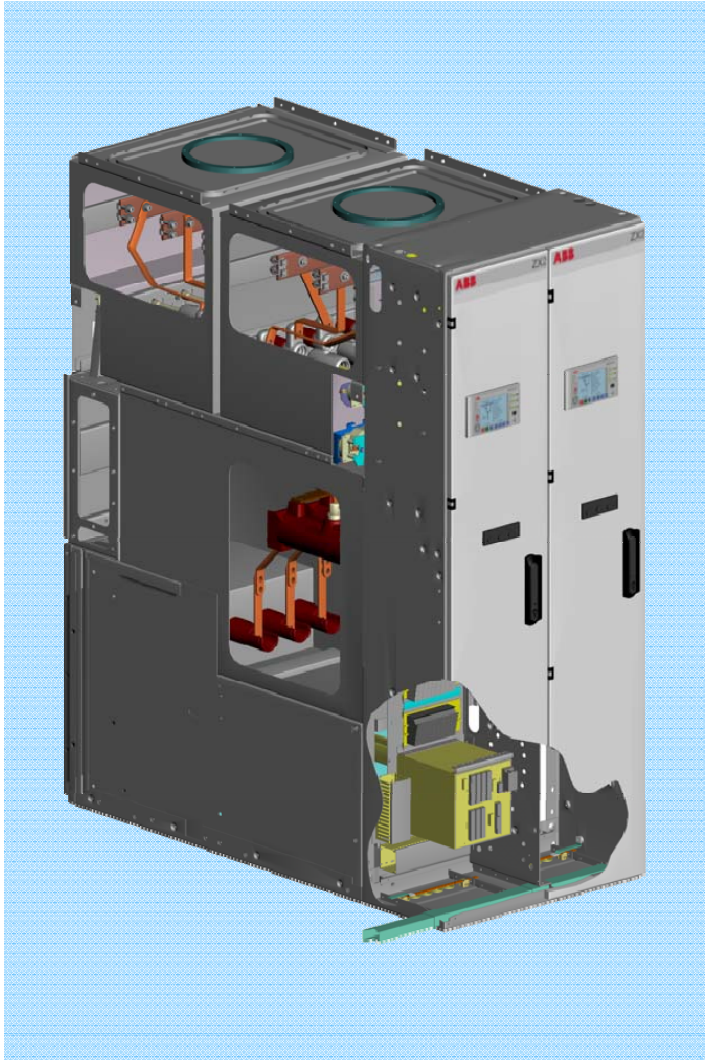
# WaveGuide –
# New transmission technology on the bay/station level

**Assembly situation in a ZS1 UniGear**


## WaveGuide access point WGA631

- Multi port version
  - 3 x Ethernet, 1 x WLAN
  - Aux. voltage: 110 … 220 V AC/DC
- Temperature range
  - Operating: -20° C to 55° C
  - Storage: -30° C to 70°C
- Humidity (non-condensing)
  - 5 % ~ 95 % typical

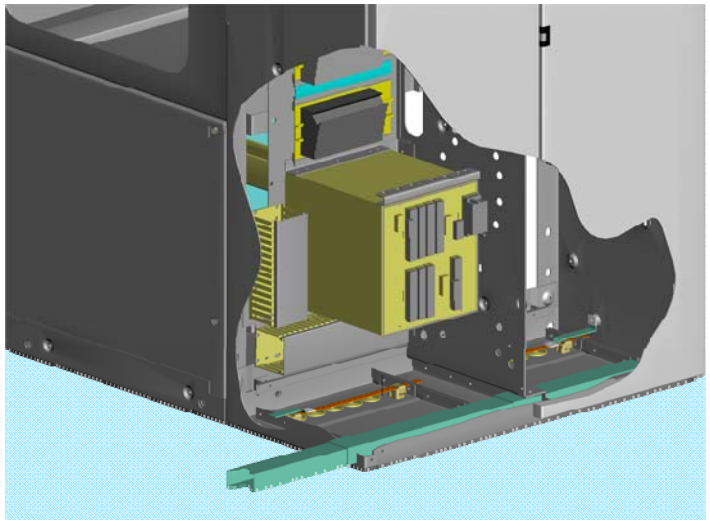
# WaveGuide –
# New transmission technology on the bay/station level



**Installation position**

WaveGuide in a gas-insulated medium voltage panel – ZX2 double feeder panel

# WaveGuide –
# New transmission technology on the bay/station level



**Installation position (detail view)**

WaveGuide in a gas-insulated medium voltage panel – ZX2 double feeder panel

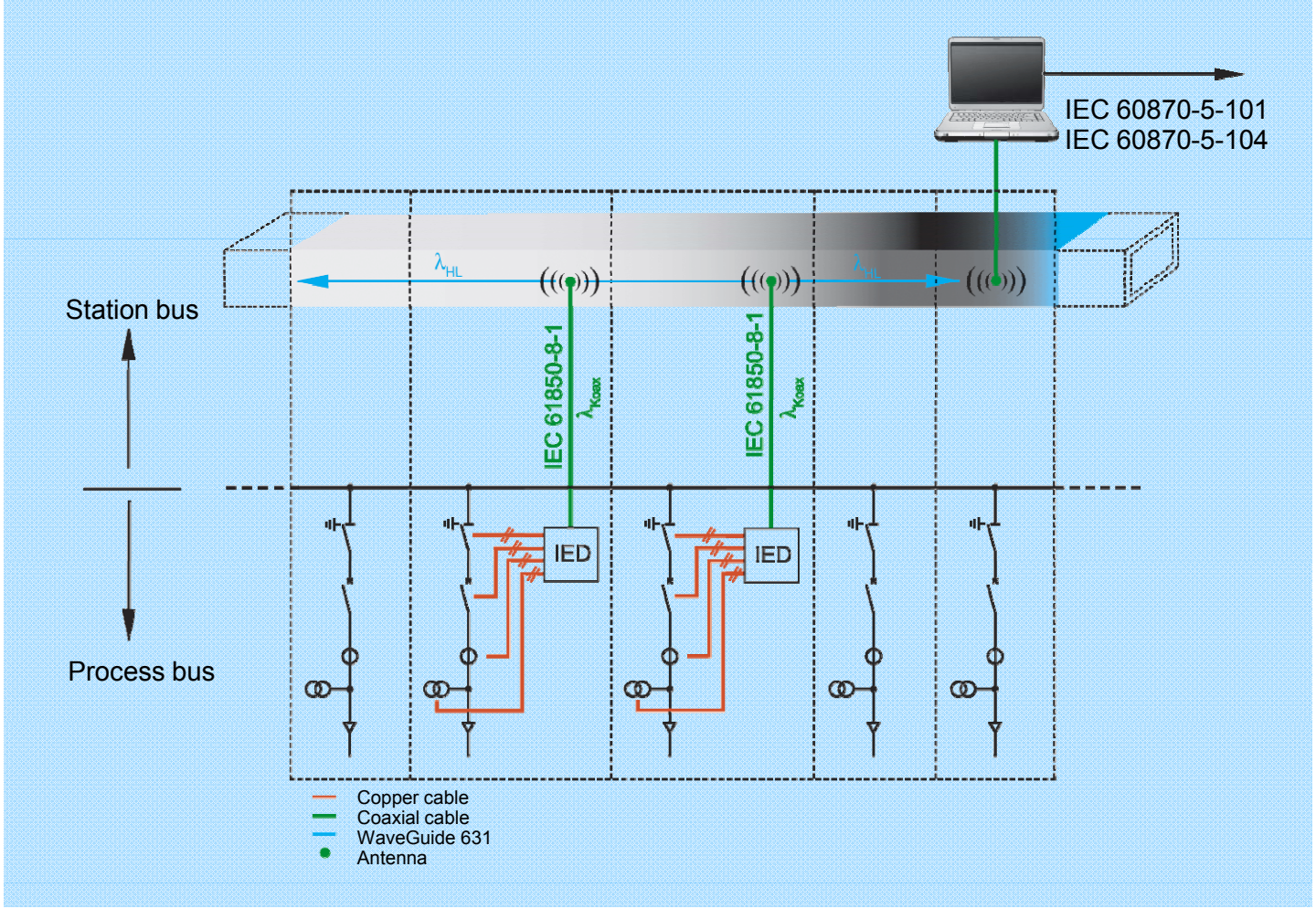
# WaveGuide –
# New transmission technology on the bay/station level

**Comparison: electrical – optical – radio signals**

| Transmission media | System-availability | EMC | Thermal influences | Mechanical influences | Assembly work | Expand-ability |
|---|---|---|---|---|---|---|
| Electrical connection (twisted pair CAT 5, RJ 45) | + | -- | + | + | O | O |
| Optical fibers (Multimode 2G 62.5/125 µm) | + | + | O | - | - | - |
| **WaveGuide 631** | ++ | + | + | ++ | + | ++ |

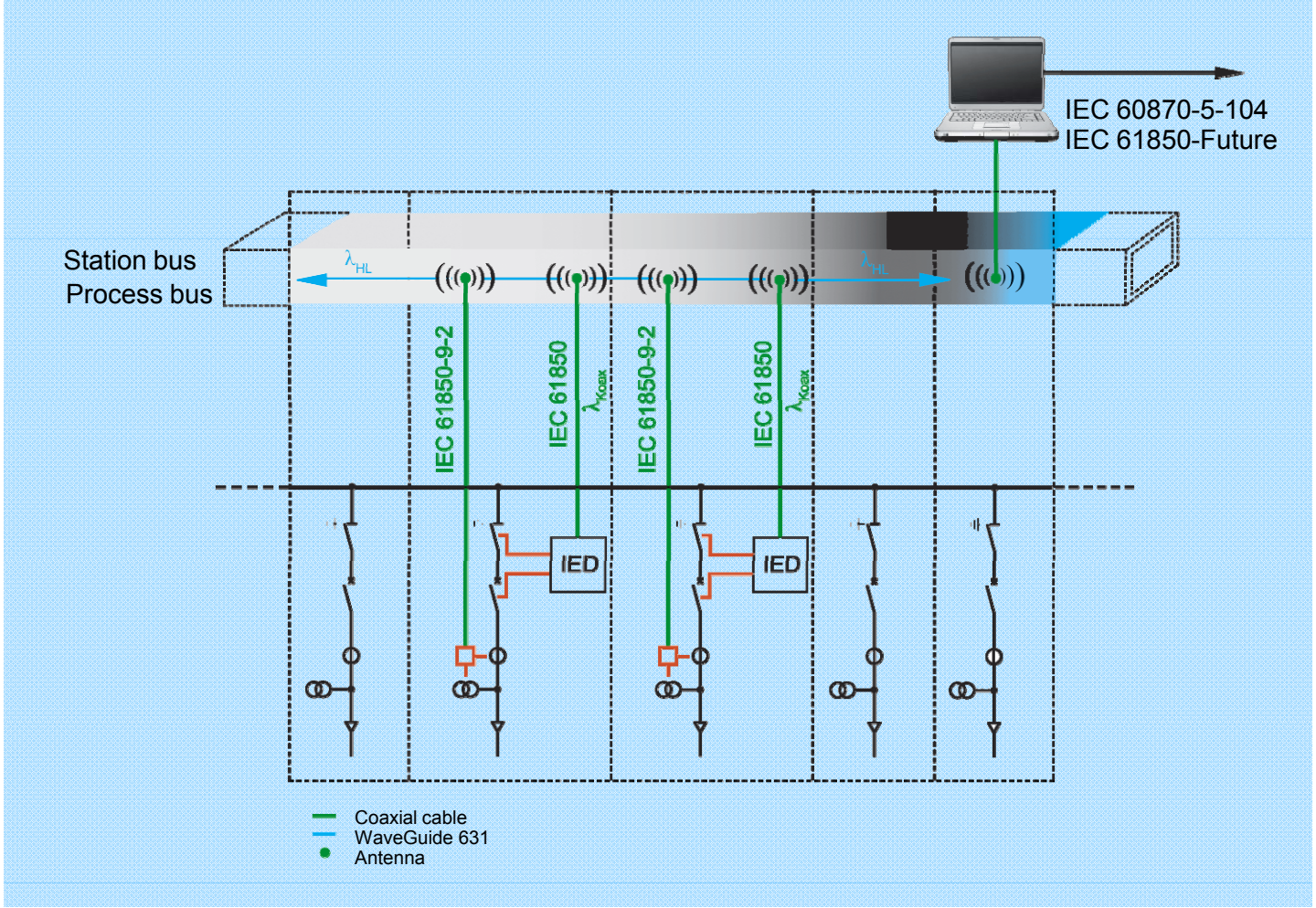
# WaveGuide –
# New transmission technology on the bay/station level

## View of the present

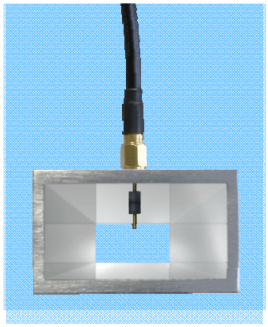


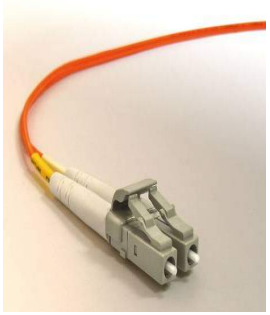
# WaveGuide –
# New transmission technology on the bay/station level

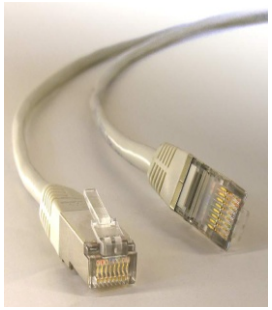
## View into the future



# WaveGuide –
# New transmission technology on the bay/station level







**WaveGuide – benefits**

- Communication to IEC 61850
- Control and automation with the necessary safety
- Robust transmission technology by radio signals without electrical or optical links
- High system availability
- Closed system
- Small amount of installation work
- No time-consuming making up of cables
- Easily extendable
- No interference from outside:
  - EMC
  - Thermal
  - Mechanical
- Merging of process and station levels

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