



**WSIS  
FORUM 2022**

Starting on 15 March  
Final week 30 May - 3 June

# Physical layer technologies and standardization for 5G and beyond

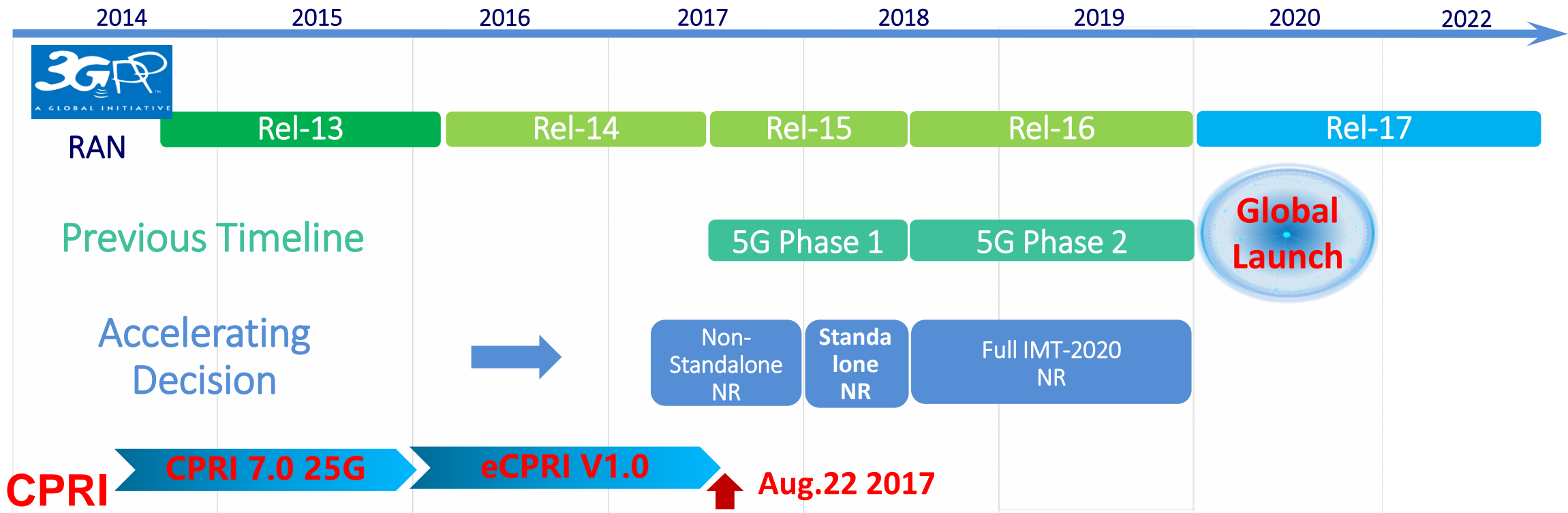
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- 5G and development in future
- Progress of relevant standards of ITU-T Q5/SG15

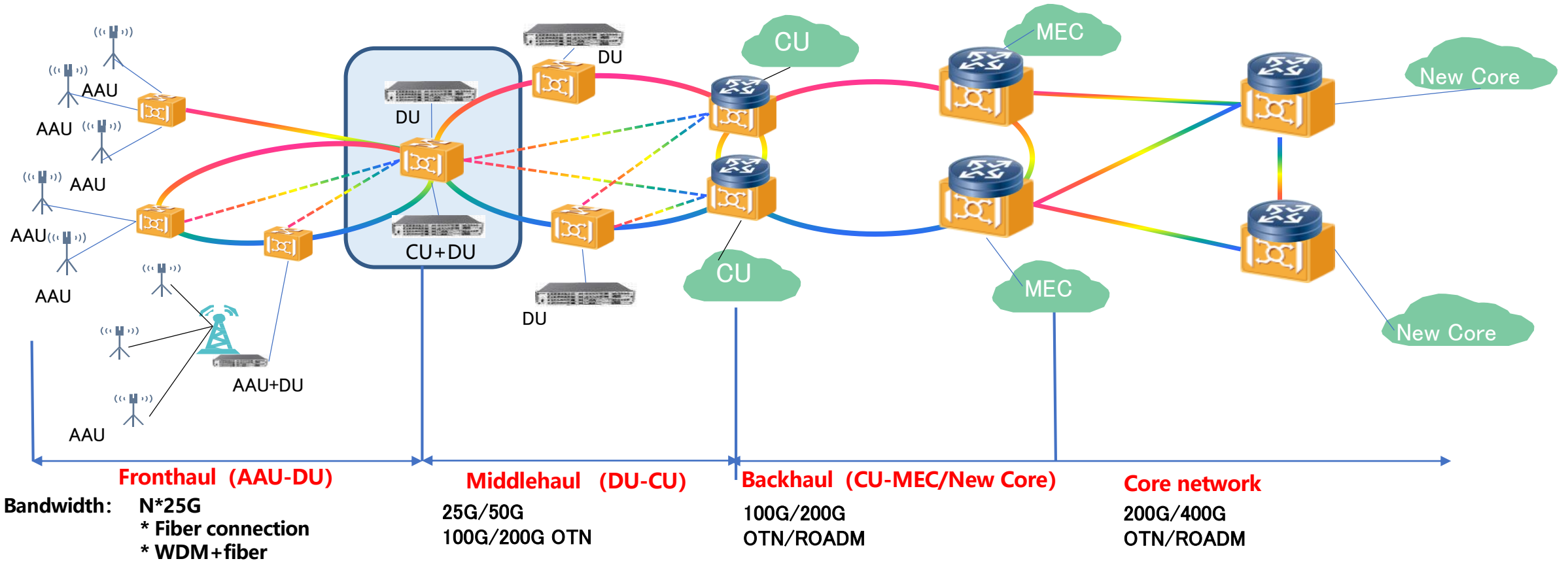
# Part 1 5G and development in future

- 5G and Standardization process
- Integrated development of 5G network

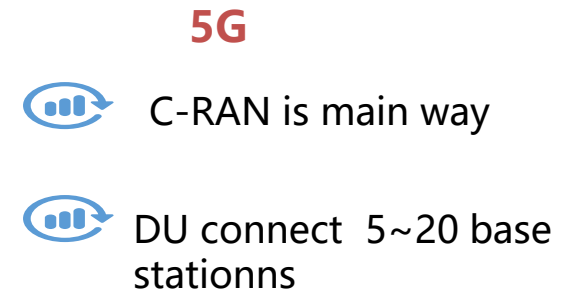
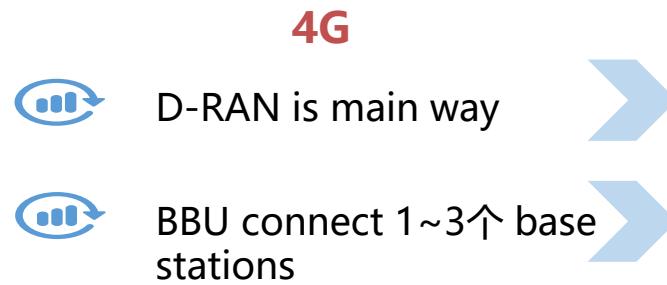
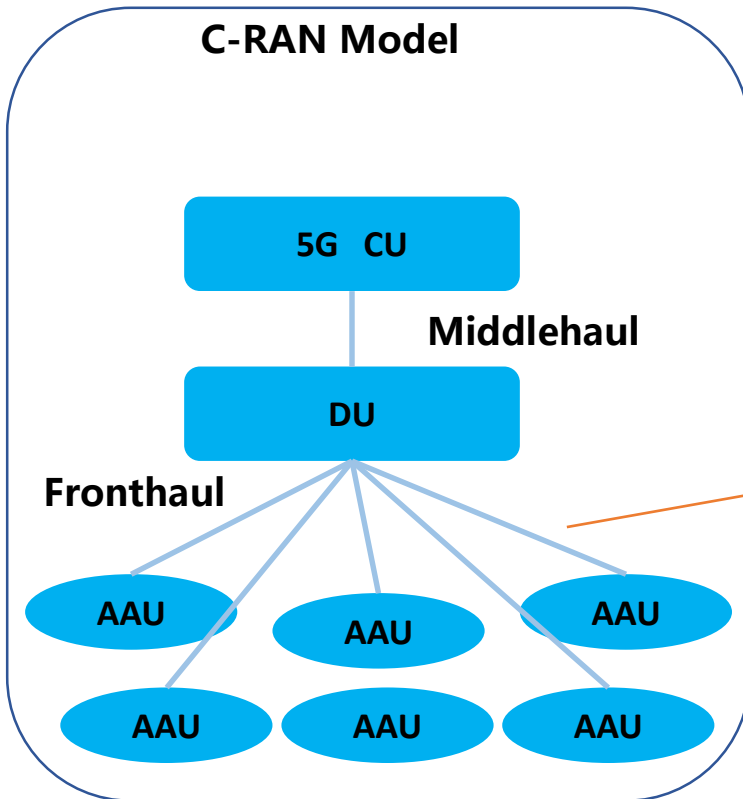
➤ 5G and Standardization process



➤ 5G network architecture



✓ 5G Fronthaul Technology Selection

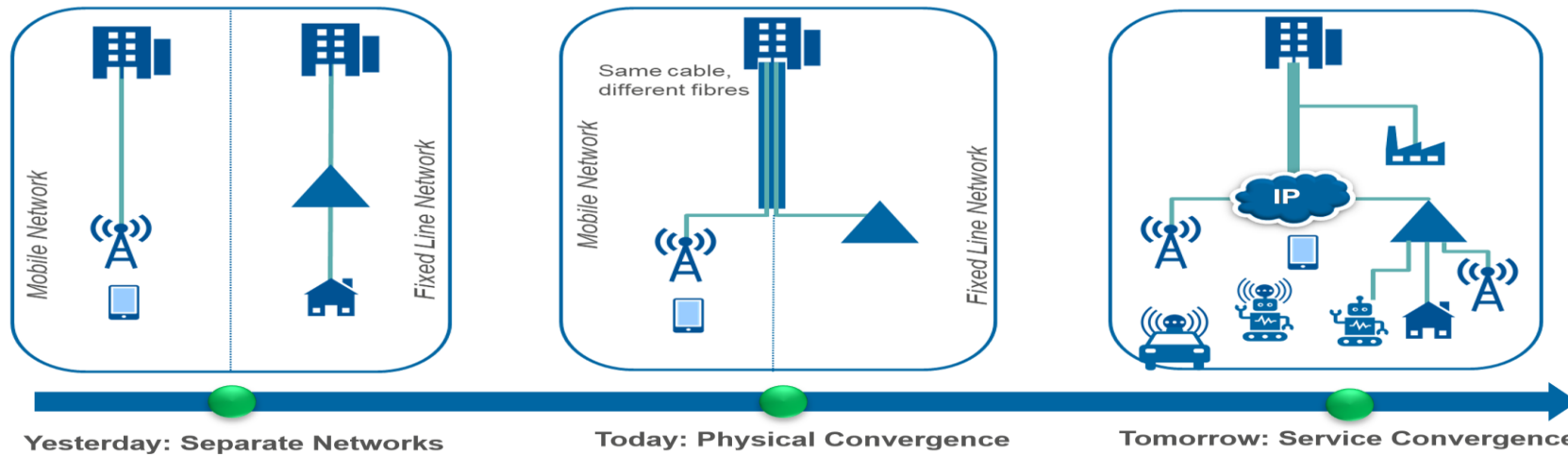


**DU to AAU**

- Fiber direct link
- WDM+fiber

✓ Fiber and cable technologies for Mobile Front Haul(MFH)

5G advances *access networks evolves from separate networks into future's service convergence*





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# Progress of relevant standards of ITU-T Q5/SG15

- L.250
- L.oehc
- L.109



- L.250 Recommendation L.250 “Topologies for optical access network” ( Revision of ex.L.90 )
  - Editor Mr. Liu Tai

## Tradition access network architecture Revision

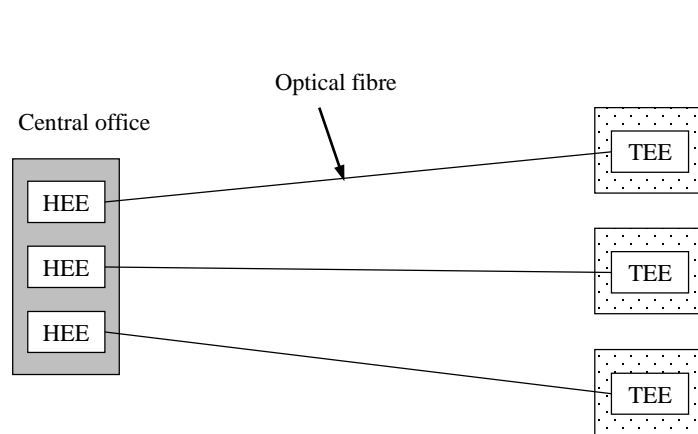


Figure -1 point-to-point networks

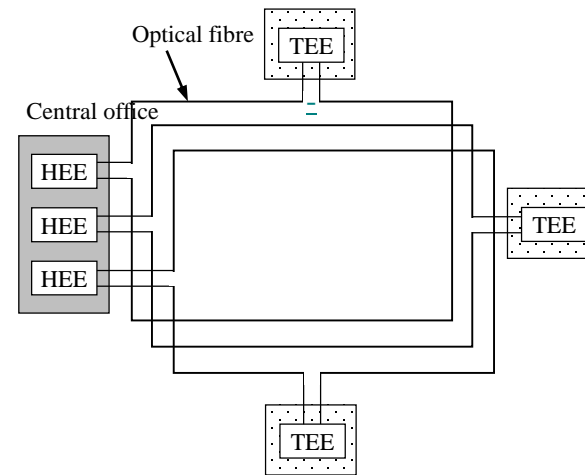


Figure -2 Ring networks

*HEE: Head End Equipment (for 5G)*

*TEE : Tail End Equipment (for 5G)*

- L.250 Recommendation L.250 “Topologies for optical access network” ( Revision of ex.L.90 )
  - Editor Mr. Liu Tai

**New contents: Convergence architecture**

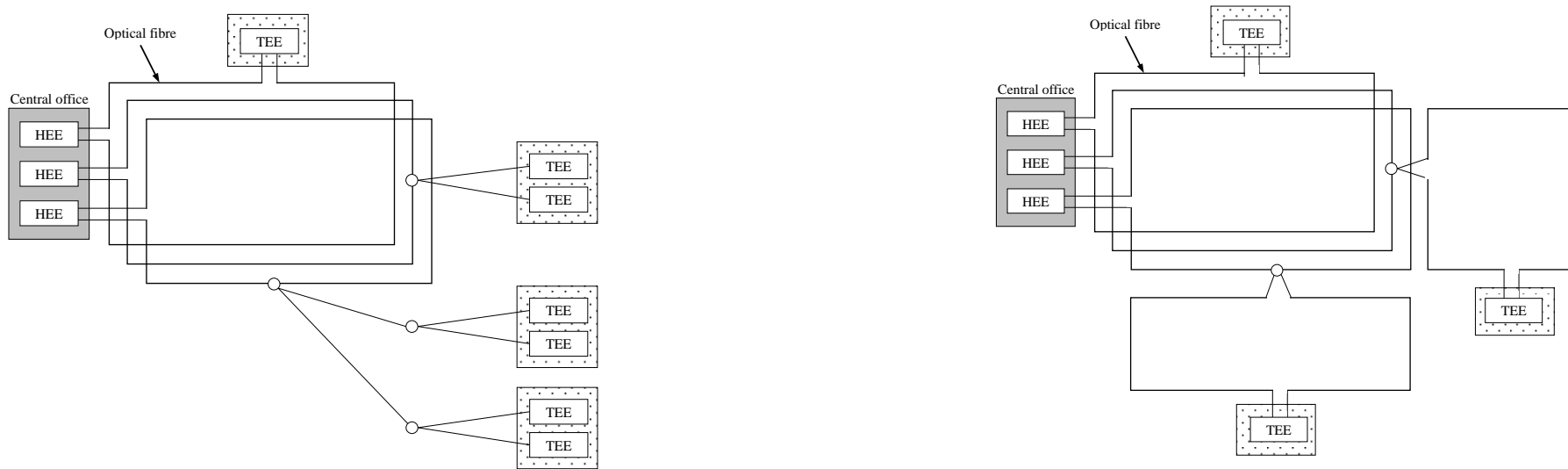


Figure -3 convergence architecture based on point-to-point ring architecture

- L.250 Recommendation L.250 “Topologies for optical access network” ( Revision of ex.L.90 )
  - Editor Mr. Liu Tai

## New contents: Convergence architecture

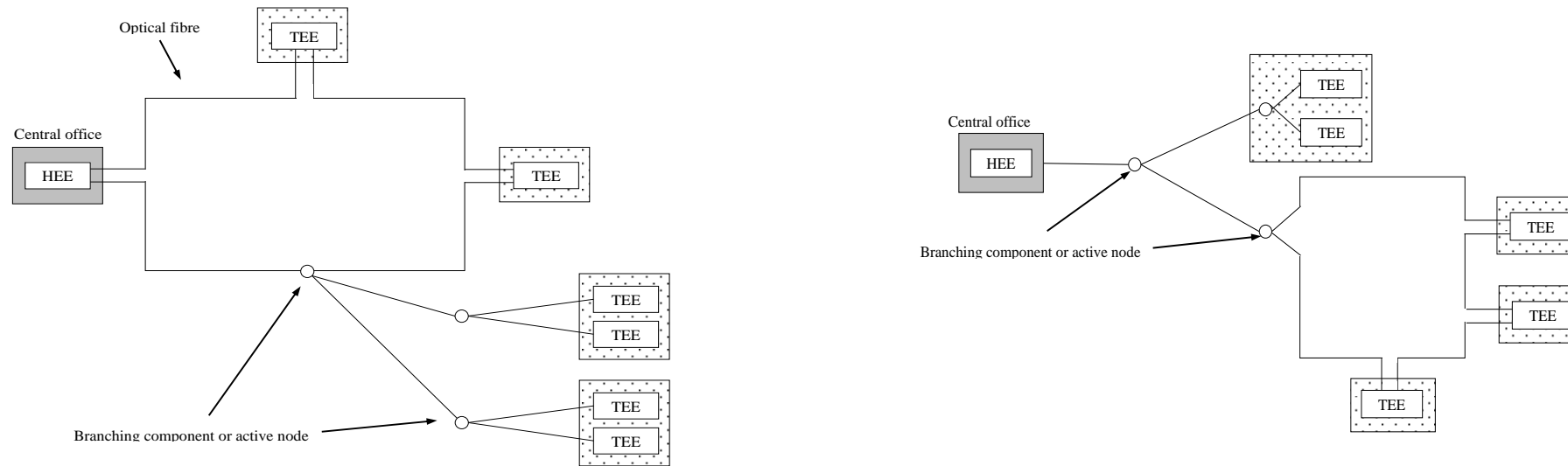


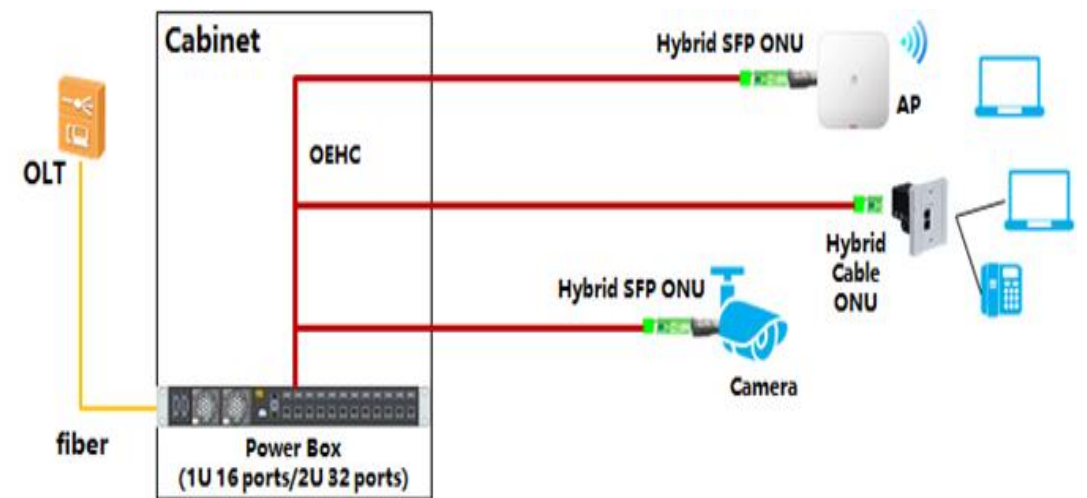
Figure -4 New proposal architecture—ring architecture plus branching architecture

➤ L.OEHC Type-II Optical/Electrical Hybrid Cables for access points and other terminal equipment

Editor Mr. Dekun Liu

New Recommendation

- The OEHC is classified into three classes depending on the purpose of optical and copper pair [ITU-T L.109].
- The OEHC is mainly used **in the drop and access** section of the network, from the Optical electrical hybrid power supply unit to Optical Network Terminals (ONTs), Edge switches, and other application terminals, such as Wireless Access Points (WAPs), cameras, monitors, antennas, and smart manufacturing instruments.

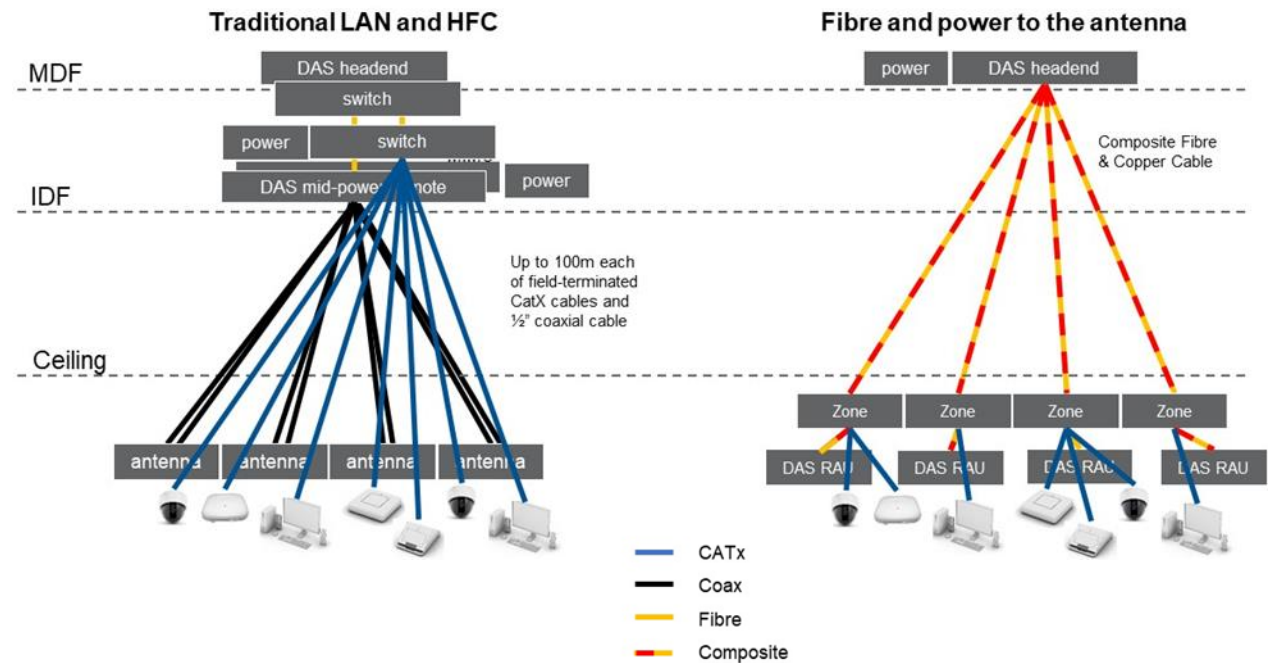


*Power supply networking for the AP and Camera based on OEHC*

➤ L.OEHC Type-II Optical/Electrical Hybrid Cables for access points and other terminal equipment

Editor Mr. Dekun Liu  
New Recommendation

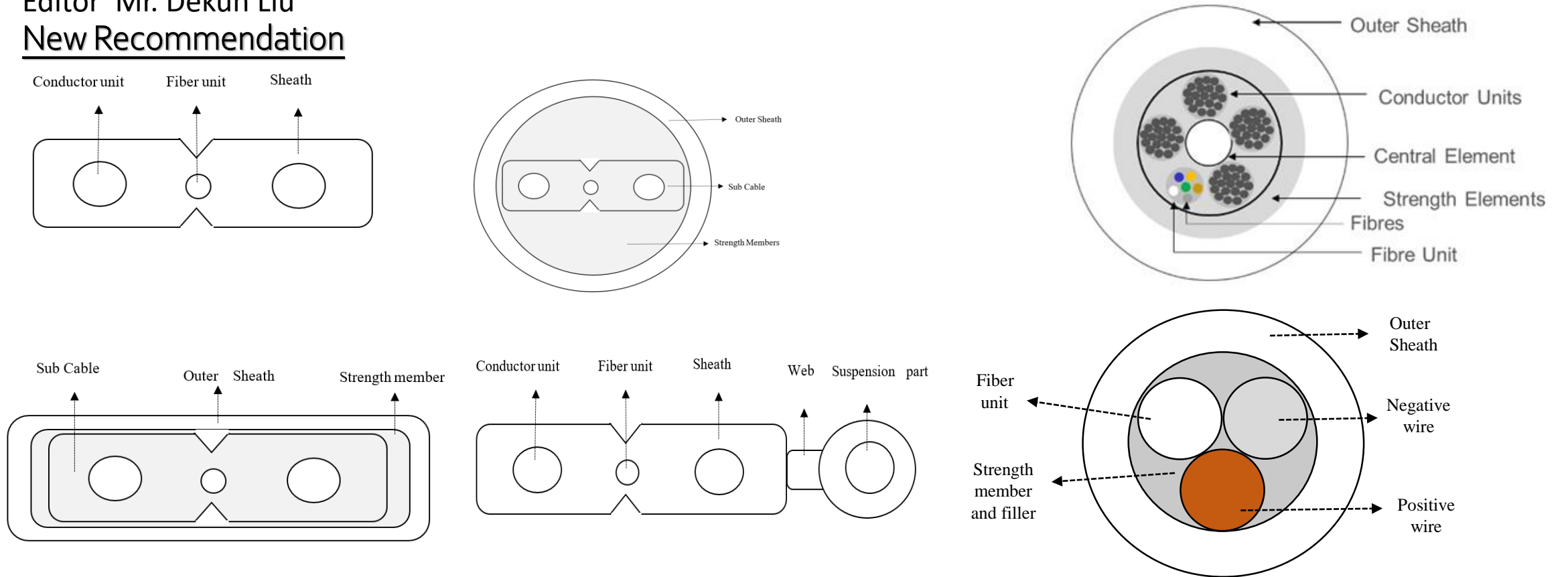
- Through the application of OEHC technology, the optical and electrical connection system of the terminal can become simpler, which will also bring convenience to the future network operation and maintenance.
- The cost is lower.



*OEHC application on the typical scenario*

➤ L.OEHC Type-II Optical/Electrical Hybrid Cables for access points and other terminal equipment

Editor Mr. Dekun Liu  
New Recommendation



Various optical cable structure drawings recommended in the proposal



## □ L.109 ( 11/2018 ) "Construction of optical/metallic hybrid cables" (Published)

This Recommendation describe cables containing both optical fibres and metallic wires and covers the following aspects.

- Optical/metallic hybrid cables for communications systems.
- Construction of optical/metallic hybrid cables. The optical fibre dimensional and transmission characteristics, together with their test methods, should comply with [ITU-T G.652], [ITU-T G.653], [ITU-T G.654], [ITU-T G.655], [ITU-T G.656], [ITU-T G.657] and [IEC 60793-2-10]. Dimensional and transmission characteristics of metallic wires and coaxial units for telecommunication, together with their test methods, should comply with [ITU-T TR-OFCS];
- **Cables designed for outdoor, indoor or indoor-outdoor use: fibre-to-the-antenna (FTTA) or distributed antenna systems (DAS) cables are examples of such hybrid cables.**
- Cables for limited powering applications found in communications systems.
- A recommendation that an optical/metallic hybrid cable should be provided with cable-end sealing and protection during cable delivery and storage, as is usual for metallic or optical cables. If splicing components have been factory installed, they should be adequately protected.
- A recommendation that pulling devices can be fitted to the end of the cable if required.

**Table 1 – Contents of each cable type**

Cable type	Optical fibres	Metallic wires for telecommunication	Metallic wires for power feeding
Type I	Contained	Contained	No
Type II	Contained	No	Contained
Type III	Contained	Contained	Contained

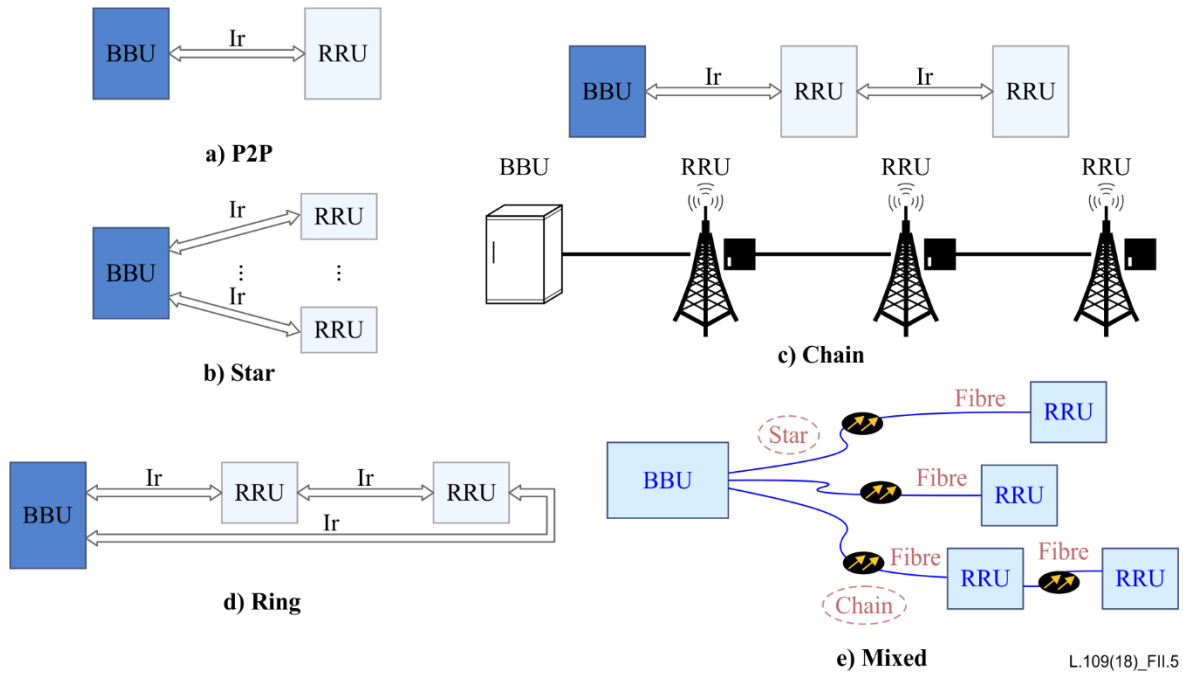
### Key requirements:

#### 7.4 Electrical characteristic test methods

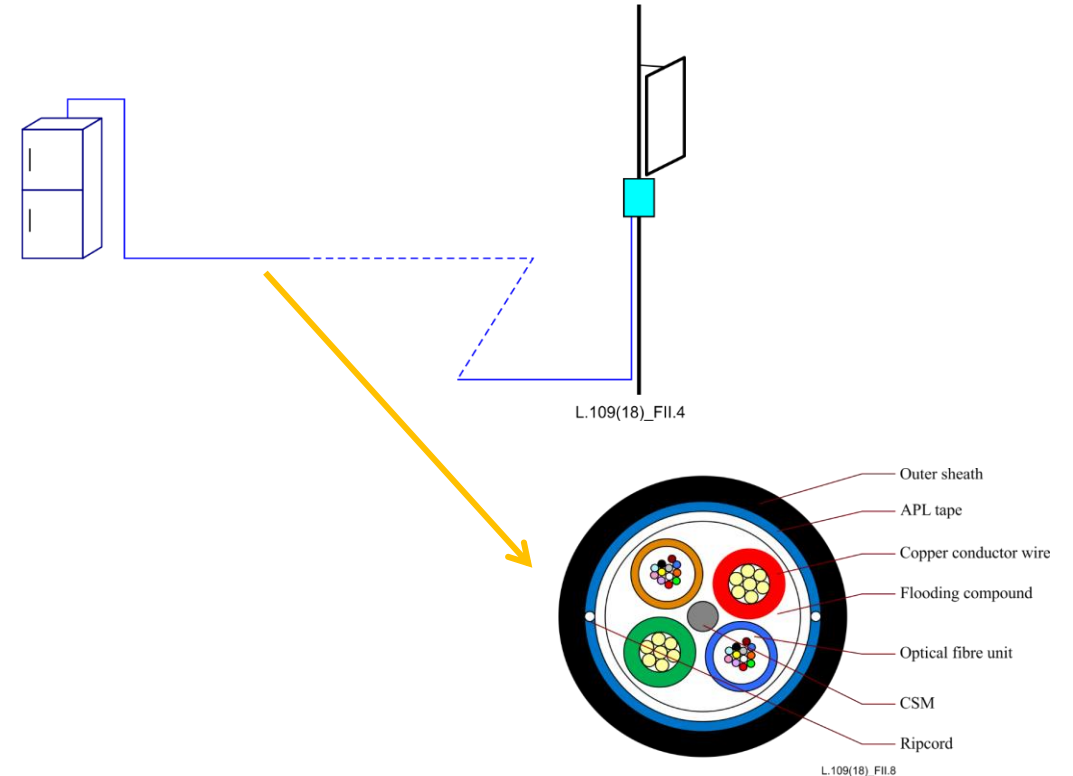
Electrical characteristics of hybrid cable should **include voltage test, insulation resistance, conductor resistance** of power-feeding wires and electrical characteristics of symmetrical metallic pairs listed in clause 6.1.2. Test methods of voltage test, insulation resistance and conductor resistance of power-feeding wires should comply with [IEC 60502-1] or [IEC 60227-1]. Test methods for electrical characteristics of symmetrical pairs should comply with [IEC 61156-1]. Test methods for electrical characteristics of coaxial units should comply with documents in the series [IEC 61196-1-10x].

□ L.109 ( 11/2018 ) "Construction of optical/metallic hybrid cables"

Chinese experience



Topology of a distributed base station

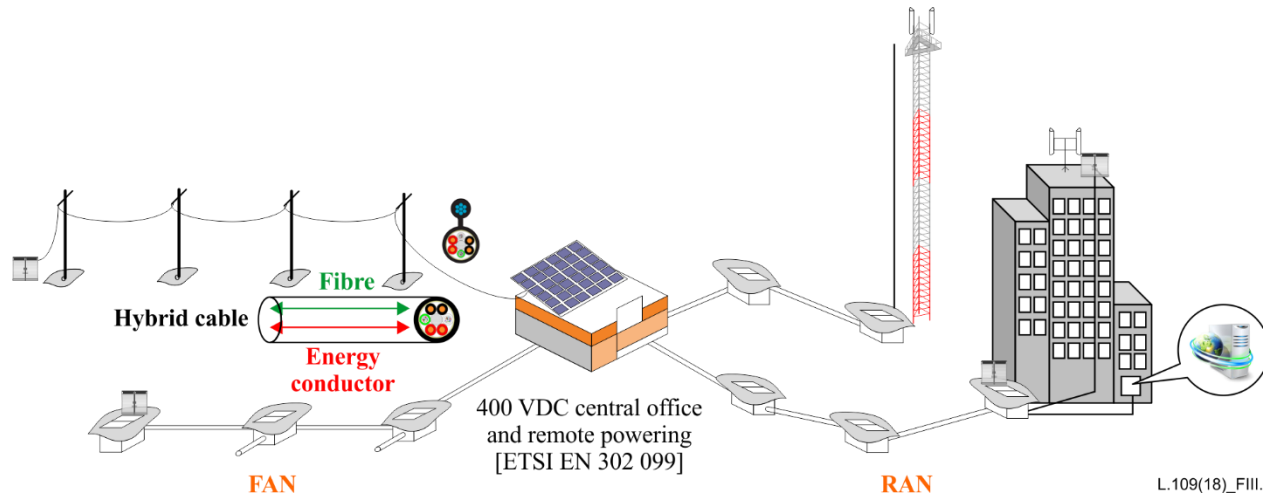


Second generation distributed base station

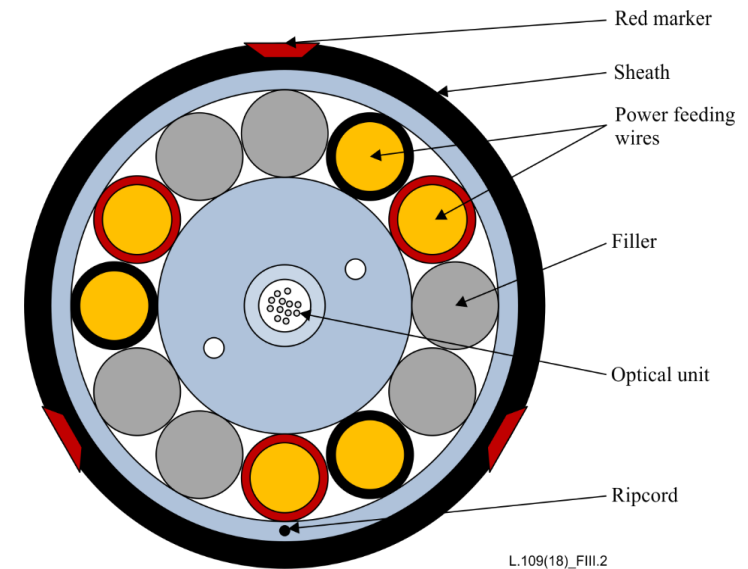


□ L.109 ( 11/2018 ) "Construction of optical/metallic hybrid cables"

French/Polish experience



Example for remote radio head installation



Example cross-section of the hybrid cable

# Conclusion

- ❑ The rapid development of 5G network construction has brought some new network changes, especially the 5G fronthaul network has changed from the separation of fixed and mobile to integration; ;
- ❑ 5G also makes the connection of base stations more extensive .The network management becomes more and more complex. OEHC technology can change this situation and make the fronthaul transmission connection more simpler and convenient;
- ❑ ITU-T Q5 / SG15 closely follows the development of 5G technology and promote the related standardization works of L.109, L.250 and L.oehc, which is conducive to the further popularization and development of technology in the future.



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**Thank you for your attention**

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