Requirements for G.RoF

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FSAN, Operator only
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Location: Kuala Lumpur, Malaysia
Answer to the CFC item

**CFC for Operators**

- Requirements for the G.RoF standard
- Requirements for XGS-PON
  - What are the minimum set of diagnostics for Optical Supervision
  - Any new requirements for XGS-PON beyond those captured in the joint Operator contribution made in Atlanta
- From a service perspective:
  - what are the use-cases of coexistence of XG-PON1 and XGS-PON?
  - what are the preferred coexistence methods?
  - what are the trade-offs for TDMA coexistence of XG-PON1 and XGS-PON?
- High-rate services
  - Requirements for services in excess of 10 Gbit/s per client
  - Operational perspectives of TWDM channel bonding, increased line rate per wavelength channel pair, and other possible support methods
Outline

- For existing fronthaul interface (eg. CPRI)
  - green field
  - existing ODN
- For new functional split (ex. NGFI)
  - existing ODN
- G.RoF understanding
The existing Fronthaul (eg. CPRI) for green field

- WR ODN is the preferred solution
CWDM single fiber working (bidirectional)

Requirements:
- outdoor compatible
- single fiber working
- optical budget
- OAM with AMCC or OMCI

<table>
<thead>
<tr>
<th>O-band</th>
<th>E-band</th>
<th>S-band</th>
<th>C-band</th>
<th>L-band</th>
<th>U-band</th>
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</thead>
</table>

1260nm 1675nm

CWDM

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Uncooled DWDM single fiber working (bidirectional)

Requirements:
- outdoor compatible
- single fiber working
- optical budget
- OAM with AMCC or OMCI

CWDM Mux/DeMux

transceiver

single fiber working

1260nm

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Requirements:
- outdoor compatible
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PtP WDM: Expanded Spectrum

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1260nm to 1675nm

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PtP WDM (G.989.x) 2/3

Requirements:
- outdoor compatible
- single fiber working
- optical budget
- OAM with AMCC or OMCI

Issue:
- No technology available to achieve colorless ONU for the full band 1524 to 1625 nm
PtP WDM (G.989.x) 3/3

Requirements:
- outdoor compatible
- single fiber working
- optical budget
- OAM with AMCC or OMCI
- Colorless by sub-band

PtP: Expanded Spectrum

50/100/200 GHz wavelength spacing

Colorless by CWDM band

C-band | L-band
The existing Fronthaul (eg. CPRI) with deployed ODN

- Only WS ODN must be considered
- PON generations:
  - G-PON: limited in bit rate capacity
  - XG-PON1: too much asymmetry between up and down-stream
  - XGS-PON:
    - one CPRI possible per ODN (with FBA or low latency DBA) in order to preserve bandwidth capacity for other customers
    - with compression, maybe up to “3” ORI-CPRIIs per ODN
  - TWDM: possible with dedicated Channel Pair but only one fiber interface (one ONU)
    - One CP 10Gbps symmetrical = 4 x CPRI3 (more with CPRI compression)
    - Two CPs at one ODN end face = ONU capable bundle CPs (???)
The existing Fronthaul (eg. CPRI) with deployed ODN

- WS ODN must be considered
- PON generation:
  - PtP WDM: too much optical budget when considering WS + WR ODN
The existing Fronthaul (eg. CPRI) with deployed ODN

- WS ODN must be considered
- PON generation:
  - PtP WDM: One PtP WDM ONU need to support all CPRI links (only one ODN end face)
    - 10Gbps: 4 x CPRI3 or more with compression
    - do we required 25Gbps or 40Gbps PtP WDM CP?
Outline

- For existing fronthaul interface (eg. CPRI)
  - green field
  - existing ODN
- For new functional split (ex. NGFI)
  - existing ODN
- G.RoF understanding
For new functional split (eg. NGFI) with deployed ODN

- Only WS ODN is considered

- **Hypothesis**: The Cell site aggregator network interface should need +20% of bit rate compared to traditional backhaul. So here we consider minimum 1Gbps (macro/micro cell use cases) and maximum 10Gbps (hot spot with Massive MIMO).

- PON generation:
  - G-PON and XG-PON1: limited in bit rate capacity
  - XGS-PON: possible to collect 1 to 8 “1Gbps” (with or without coexistence with residential customers)
  - TWDM: possible with either shared or dedicated Channel Pair but only one fiber interface (one ONU)
    - with TDM shared 10Gbps symmetrical Channel Pair
    - possible with dedicated Channel Pair
      - One CP: 8 x “1Gbit/s” or one “10Gbps”
Outline

- For existing fronthaul interface (eg. CPRI)
  - green field
  - existing ODN
- For new functional split (ex. NGFI)
  - existing ODN
- G.RoF understanding
G.RoF and G.Suppl.RoF

- **G.Suppl.RoF** concerns **Digital** and **Analog RoF** description
- **G.RoF** concerns only **Analog RoF**. Why?

**scope of G.RoF**: (copy from G.RoF draft 18th August 2015)

This recommendation develops a new type of optical access network based on radio-over-fiber (RoF) technologies. In general, RoF technologies can be classified into two groups, analog RoF and digital RoF. The digital RoF requirements may be satisfied by elements of the G.989 series with necessary enhancements. The analog RoF system is currently unspecified in any other recommendation. The recommendation will include consideration of the common applications, the requirements that stem from these, the specification of the analog optical link and/or the necessary functions to digitally carry the radio signals over various optical access systems, the associated signal processing, and the management aspects of the systems.

Wording “function to digitally carry…” is related to:
- Digital aggregation of analog RoF: section 7.3.1.2 of G.Suppl.RoF
- Digital-signal-processing-assisted (DSP-assisted) analog RoF techniques: section 7.4 of G.Suppl.RoF

**It is not about Digital RoF (CPRI, ORI, OBSAI,.....)**
Conclusion

- Proposition of fronthaul standardization actions:
  - Stimulate vendors for providing PtP WDM: test event?
  - Generalization of PtP WDM (G.989) solution based on AMCC and OMCI for PHY layer based:
    - CWDM bidirectional (single fiber working)
    - Uncooled DWDM bidirectional (single fiber working)
  - Amendment of G.989.2 for PtP WDM
    - Colorless by CWDM sub-band
  - For TDM or TWDM PON: description of FBA and low latency DBA
  - If operators agree with some of these actions:
    - include them in read out
    - present them to NG-PON plenary session

- G.RoF:
  - Do we have the same understanding of G.RoF scope: Not about digital RoF?
  - If yes, do operator agree?
Thank you
Merci
Gràcies
Danke
Grazie
Tack
谢谢
감사합니다
ありがとうございました

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