Overload Cases for Co-existence with Extended EPON

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Agenda

➤ Background and Overview

➤ PX40 OLT with PX10/PX20/PX30/PX40 ONU

➤ PR40 OLT with PR10/PR20/PR30/PR40 ONU

➤ PRX40 OLT with PRX10/PRX20/PRX30/PRX40 ONU

➤ Conclusions

Background and Overview

- At the March 2012 meeting, we showed that ExEPON OLT can coexist with ONUs meeting already existing power budgets on the same ODN.

- At the May 2012 meeting, we examined the worst case scenario in which different power budget ONUs connect to the same ODN and most of them can operate correctly under these conditions.

- At this meeting, we need to examine the overload case of coexistence, under which ExEPON OLT is connected to minimum loss ODN, and see whether the existing ONUs are damaged in such a set-up.

The minimum ODN loss

- The minimum loss ODN features a minimum Channel insertion loss, as shown in the table below. All calculations in this slide-deck are based on the minimum loss ODN and apply to 1G-EPON and 10G-EPON.

- The PMD data of PX30/PX40 and PR(X)40 come from P802.3bk D1.0, and other PMD data come from 802.3-2008 and 802.3av
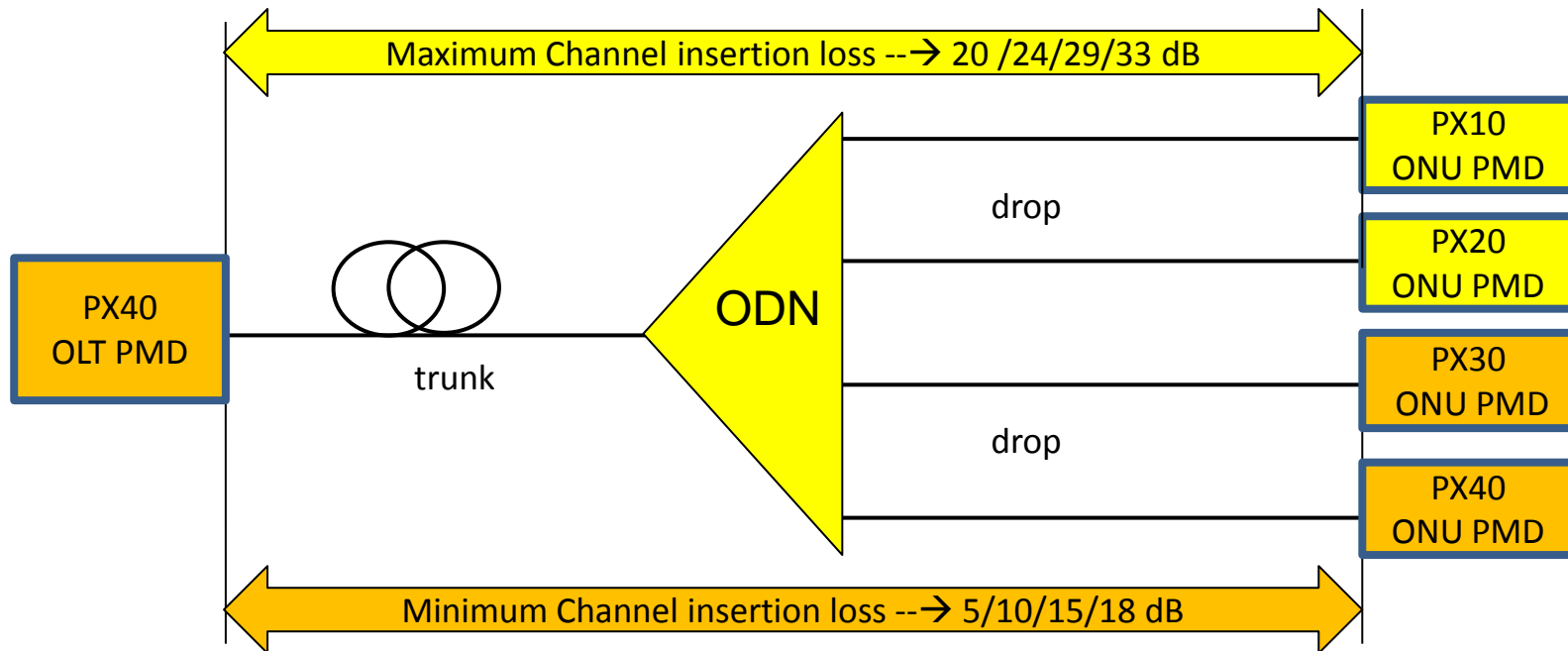
Description	Low Power Budget		Medium Power Budget		High Power Budget		Extended Power Budget		Units
	PX10	PR(X)10	PX20	PR(X)20	PX30	PR(X)30	PX40	PR(X)40	
Maximum Channel Insertion loss	20		24		29		33		dB
Minimum Channel insertion loss	5		10		15		18		dB

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PX40 OLT with PX10/PX20/PX30/PX40 ONU in the minimum ODN loss system

- The situation with the maximum insertion loss ODN was already examined during the March and May meetings.
- The situation for the minimum loss ODN (5/10/15/18 dB) for PX40 OLT with PX10/PX20/PX30/PX40 ONU is examined on the following pages

- **PX10 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: +7 − 1.0 − 5.0 = +1 dBm
    - Damage threshold of ONU Rx: +2 dBm > +1 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 − 2.8 − 5.0 = -3.8 dBm
    - Damage threshold of OLT Rx: −3.0 dBm > −3.8 dBm
- **PX20 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: +7 − 1.0 − 5.0 = +1 dBm
    - Damage threshold of ONU Rx: +7 dBm > +1 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 − 1.8 − 5.0 = -2.8 dBm
    - Damage threshold of OLT Rx: −3.0 dBm < −2.8 dBm
- **PX30 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: +7 − 1.0 − 5.0 = +1 dBm
    - Damage threshold of ONU Rx: +4 dBm > +1 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +5.62 − 1.4 − 5.0 = -0.78 dBm
    - Damage threshold of OLT Rx: −5 dBm < −0.78 dBm
- **PX40 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: +7 − 1.0 − 5.0 = +1 dBm
    - Damage threshold of ONU Rx: -3 dBm < +1 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +7 − 1.0 − 5.0 = +1 dBm
    - Damage threshold of OLT Rx: −3 dBm < +1 dBm

- **Conclusion:**
  - **In this ODN situation only PX40@PX10 can survive, other will be damaged in the system.**
  - **If we insert a splitter in this ODN, other combination can still work well.**
    - **PX40@PX20 require 1:2 Splitter**
    - **PX40@PX30 require 1:4 Splitter**
    - **PX40@PX40 require 1:4 Splitter**

- **PX10 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: +7 – 1.0 – 10 = -4 dBm
    - Damage threshold of ONU Rx: +2 dBm > -4 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 – 2.8 – 10 = -8.8 dBm
    - Damage threshold of OLT Rx: −3.0 dBm > −8.8 dBm
- **PX20 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: +7 – 1.0 –10 = -4 dBm
    - Damage threshold of ONU Rx: +7 dBm > > -4 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 – 1.8 – 10 = -7.8 dBm
    - Damage threshold of OLT Rx: −3.0 dBm > −7.8 dBm
- **PX30 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: +7 – 1.0 – 10 = -4 dBm
    - Damage threshold of ONU Rx: +4 dBm > -4 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +5.62– 1.4 – 10 = -5.78 dBm
    - Damage threshold of OLT Rx: −5 dBm > −5.78 dBm
- **PX40 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: +7 – 1.0 – 10 = -4 dBm
    - Damage threshold of ONU Rx: -3 dBm > -4 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +7 – 1.0 – 10 = --4 dBm
    - Damage threshold of OLT Rx: −3 dBm > -4 dBm

- **Conclusion:**
  - **In this ODN situation, all combinations can survive, without any splitter.**
  - **But the upstream of PX40@PX30 is very close to the damage threshold, it is only 0.78 dB over, so it should be very carefully to apply this combination.**

- **PX10 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: +7 − 1.0 − 15 = -9 dBm
    - Damage threshold of ONU Rx: +2 dBm > > -9 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 − 2.8 − 15 = -13.8 dBm
    - Damage threshold of OLT Rx: −3.0 dBm >> −13.8 dBm
- **PX20 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: +7 − 1.0 −15 = -9 dBm
    - Damage threshold of ONU Rx: +7 dBm > > -9 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 − 1.8 − 15 = -12.8 dBm
    - Damage threshold of OLT Rx: −3.0 dBm >> −12.8 dBm
- **PX30 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: +7 − 1.0 − 15 = -9 dBm
    - Damage threshold of ONU Rx: +4 dBm >> -9 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +5.62− 1.4 − 15 = -10.78 dBm
    - Damage threshold of OLT Rx: −5 dBm > −10.78 dBm
- **PX40 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: +7 − 1.0 − 15 = -9 dBm
    - Damage threshold of ONU Rx: -3 dBm > -9 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +7 − 1.0 − 15 = -9 dBm
    - Damage threshold of OLT Rx: −3 dBm > -9 dBm

- **Conclusion:**
  - **In this ODN situation, all combinations can survive, without any splitter.**

In 18dB ODN loss

- **PX10 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: $+7 - 1.0 - 18 = -12$ dBm
    - Damage threshold of ONU Rx: $+2$ dBm $> > -12$ dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: $+4 - 2.8 - 18 = -16.8$ dBm
    - Damage threshold of OLT Rx: -3.0 dBm $>> -16.8$ dBm
- **PX20 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: $+7 - 1.0 - 18 = -12$ dBm
    - Damage threshold of ONU Rx: $+7$ dBm $> > -12$ dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: $+4 - 1.8 - 18 = -15.8$ dBm
    - Damage threshold of OLT Rx: -3.0 dBm $>> -15.8$ dBm
- **PX30 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: $+7 - 1.0 - 18 = -12$ dBm
    - Damage threshold of ONU Rx: $+4$ dBm $>> -12$ dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: $+5.62 - 1.4 - 18 = -13.78$ dBm
    - Damage threshold of OLT Rx: -5 dBm > -13.78 dBm
- **PX40 class ONUs with PX40 class OLT**
  - **Downstream (1G)**
    - Maximum power level at ONU Rx: $+7 - 1.0 - 18 = -12$ dBm
    - Damage threshold of ONU Rx: -3 dBm > -12 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: $+7 - 1.0 - 18 = -12$ dBm
    - Damage threshold of OLT Rx: -3 dBm > -12 dBm
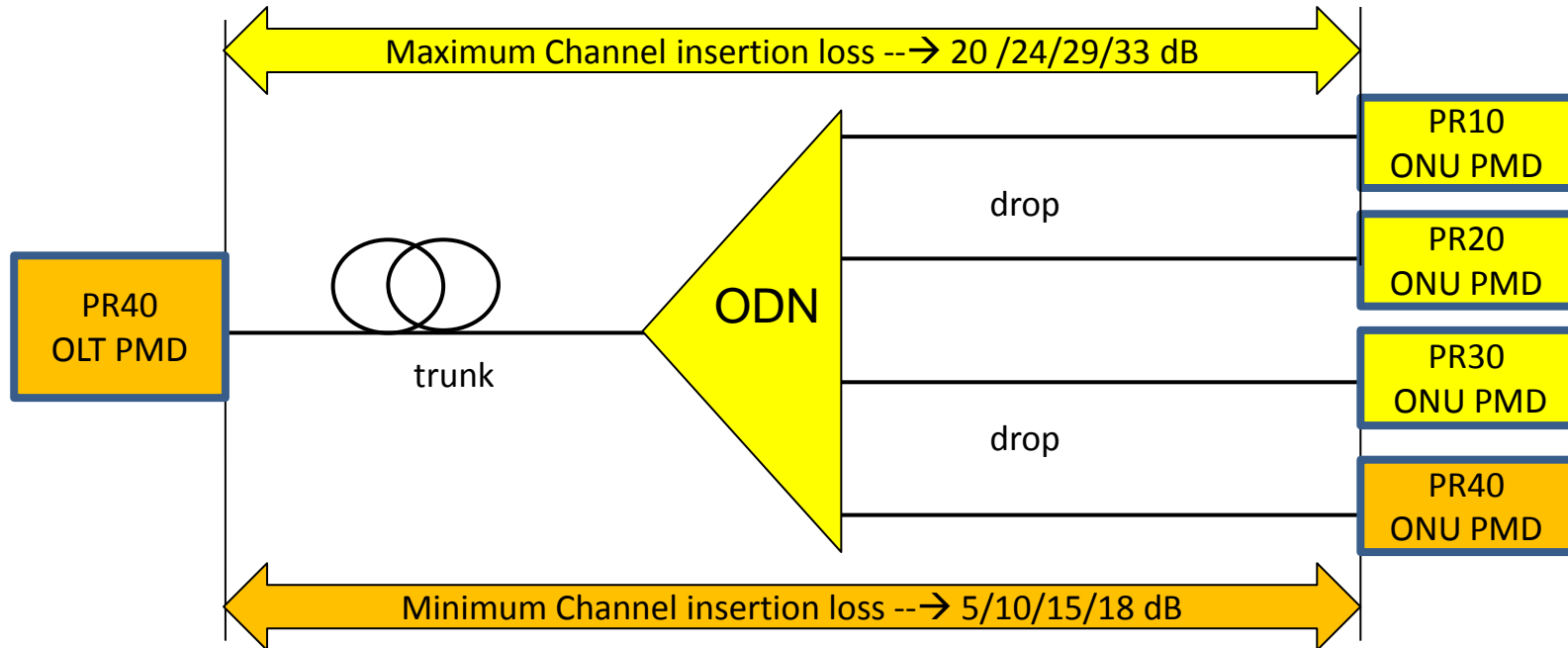
- **Conclusion:**
  - **In this ODN situation, all combinations can survive, without any splitter.**

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➢ PRX40 OLT with PRX10/PRX20/PRX30/PRX40 ONU

➢ Conclusions

PR40 OLT with PR10/PR20/PR30/PR40 ONUs in the minimum ODN loss system

Maximum Channel insertion loss --→ 20 /24/29/33 dB

PR40 OLT PMD

trunk

ODN

drop

drop

PR10 ONU PMD

PR20 ONU PMD

PR30 ONU PMD

PR40 ONU PMD

Minimum Channel insertion loss --→ 5/10/15/18 dB

- The situation with the maximum insertion loss ODN was already examined during the March and May meetings.
- The situation for the minimum loss ODN (5/10/15/18 dB) for PR40 OLT with PR10/PR20/PR30/PR40 ONU is examined on the following pages

In 5dB ODN loss

- **PR10 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 5.0 = +2.5 dBm
    - Damage threshold of ONU Rx: +1 dBm < +2.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +4 − 3.0 − 5.0 = - 4 dBm
    - Damage threshold of OLT Rx: -5 dBm < −4 dBm
- **PR20 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 5.0 = +2.5 dBm
    - Damage threshold of ONU Rx: +1 dBm < +2.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +4 − 3.0 − 5.0 = -4 dBm
    - Damage threshold of OLT Rx: −5 dBm < −4 dBm
- **PR30 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 5.0 = +2.5 dBm
    - Damage threshold of ONU Rx: -9 dBm < +2.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +9− 3.0 − 5.0 = +1 dBm
    - Damage threshold of OLT Rx: −5 dBm < +1 dBm
- **PR40 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 5.0 = +2.5 dBm
    - Damage threshold of ONU Rx: -5 dBm < +2.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +10 − 2.0 − 5.0 = +3 dBm
    - Damage threshold of OLT Rx: −5 dBm < +3 dBm

- **Conclusion:**
  - **In this ODN situation, all combination can't survive,**
  - **If we can insert a splitter in this ODN, all combination can still work well.**
    - **PR40@PR10 require 1:2 Splitter**
    - **PR40@PR20 require 1:2 Splitter**
    - **PR40@PR30 require 1:16 Splitter**
    - **PR40@PR40 require 1:8 Splitter**

- **PR10 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 10 = -2.5 dBm
    - Damage threshold of ONU Rx: +1 dBm > -2.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +4 − 3.0 − 10 = - 9 dBm
    - Damage threshold of OLT Rx: -5 dBm > −9 dBm
- **PR20 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 10 = -2.5 dBm
    - Damage threshold of ONU Rx: +1 dBm > -2.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +4 − 3.0 − 10 = -9 dBm
    - Damage threshold of OLT Rx: −5 dBm > −9 dBm
- **PR30 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 10 = -2.5 dBm
    - Damage threshold of ONU Rx: -9 dBm < -2.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +9− 3.0 − 10 = -4 dBm
    - Damage threshold of OLT Rx: −5 dBm < -4 dBm
- **PR40 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 10 = -2.5 dBm
    - Damage threshold of ONU Rx: -5 dBm < -2.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +10 − 2.0 − 10 = -2 dBm
    - Damage threshold of OLT Rx: −5 dBm < -2 dBm

- **Conclusion:**
  - **In this ODN situation, only PR40@PR10 and PR40@PR20 can be survived.**
  - **If we can insert a splitter in this ODN, other combination can still work well.**
    - **PR40@PR30 require 1:8 Splitter**
    - **PR40@PR40 require 1:4 Splitter**

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- **PR10 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 15 = -7.5 dBm
    - Damage threshold of ONU Rx: +1 dBm > -7.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +4 − 3.0 − 15 = - 14 dBm
    - Damage threshold of OLT Rx: -5 dBm > −14 dBm
- **PR20 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 15 = -7.5 dBm
    - Damage threshold of ONU Rx: +1 dBm > -7.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +4 − 3.0 − 15 = -14 dBm
    - Damage threshold of OLT Rx: −5 dBm > −14 dBm
- **PR30 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 15 = -7.5 dBm
    - Damage threshold of ONU Rx: -9 dBm < -7.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +9− 3.0 − 15 = -9 dBm
    - Damage threshold of OLT Rx: −5 dBm > -9 dBm
- **PR40 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 15 = -7.5 dBm
    - Damage threshold of ONU Rx: -5 dBm > -7.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +10 − 2.0 − 15 = -7 dBm
    - Damage threshold of OLT Rx: −5 dBm > -7 dBm

- **Conclusion:**
  - **In this ODN situation, only PR40@PR30 can't be survived.**
  - **If we can insert a splitter in this ODN, this combination can still work well.**
    - **PR40@PR30 require 1:2 Splitter**

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In 18 dB ODN loss

- **PR10 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 18 = -10.5 dBm
    - Damage threshold of ONU Rx: +1 dBm >> -10.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +4 − 3.0 − 18 = - 17 dBm
    - Damage threshold of OLT Rx: -5 dBm >> −17 dBm
- **PR20 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 18 = -10.5 dBm
    - Damage threshold of ONU Rx: +1 dBm >> -10.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +4 − 3.0 − 18 = -17 dBm
    - Damage threshold of OLT Rx: −5 dBm >> −17 dBm
- **PR30 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 18 = -10.5 dBm
    - Damage threshold of ONU Rx: -9 dBm > -10.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +9− 3.0 − 18 = -12 dBm
    - Damage threshold of OLT Rx: −5 dBm > -12 dBm
- **PR40 class ONUs with PR40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 18 = -10.5 dBm
    - Damage threshold of ONU Rx: -5 dBm > -10.5 dBm
  - **Upstream (10G)**
    - Maximum power level at OLT Rx: +10 − 2.0 − 18 = -10 dBm
    - Damage threshold of OLT Rx: −5 dBm > -10 dBm

- **Conclusion:**
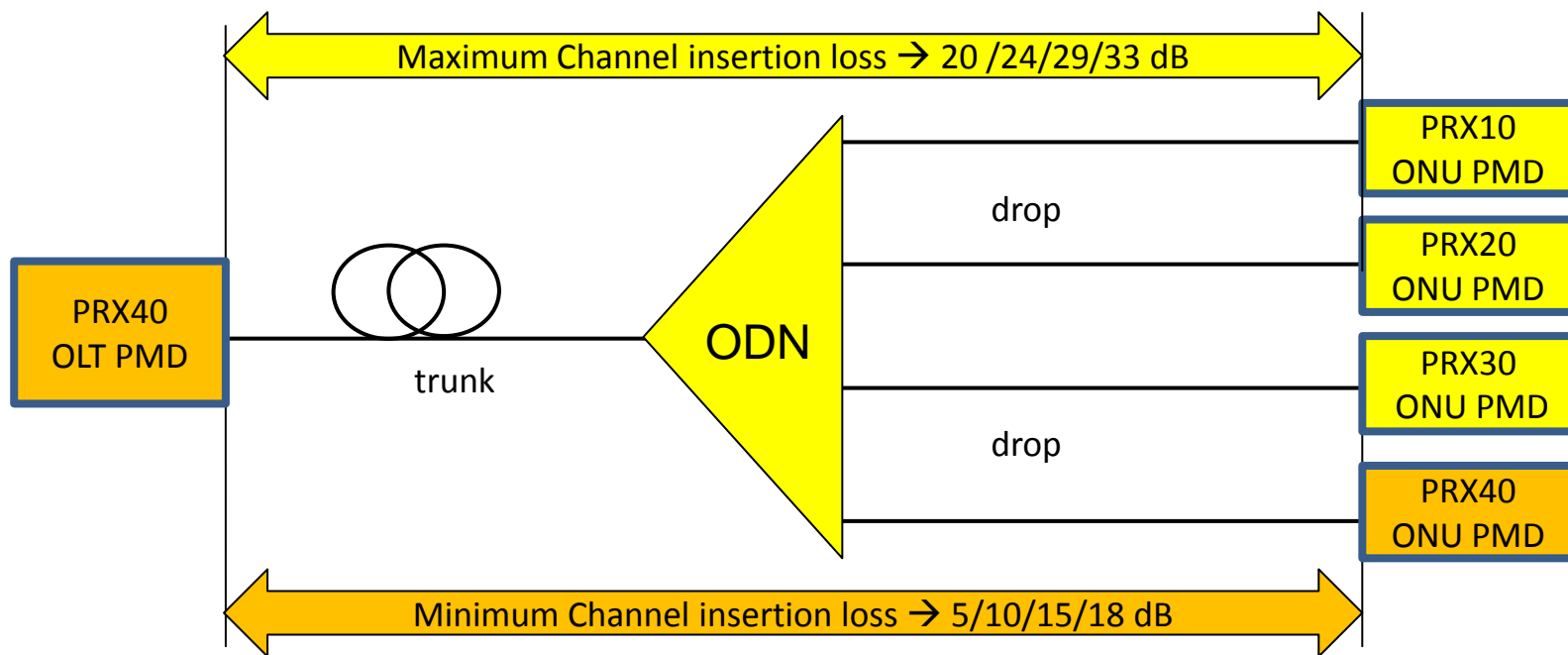 - **In this ODN situation, all combination can work.**

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➢ Conclusions

PRX40 OLT with PRX10/PRX20/PRX30/PRX40 ONU in the minimum ODN Loss system

Maximum Channel insertion loss → 20 /24/29/33 dB

PRX40 OLT PMD

trunk

ODN

drop

drop

PRX10 ONU PMD

PRX20 ONU PMD

PRX30 ONU PMD

PRX40 ONU PMD

Minimum Channel insertion loss → 5/10/15/18 dB

- The situation with the maximum insertion loss ODN was already examined during the March and May meetings.
- The situation for the minimum loss ODN (5/10/15/18 dB) for PRX40 OLT with PRX10/PRX20/PRX30/PRX40 ONU is examined on the following pages

In 5dB ODN loss

- **PRX10 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 5.0 = +2.5 dBm
    - Damage threshold of ONU Rx: +1 dBm < +2.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 − 2.8 − 5.0 = - 3.8 dBm
    - Damage threshold of OLT Rx: +4 dBm > −3.8 dBm
- **PRX20 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 5.0 = +2.5 dBm
    - Damage threshold of ONU Rx: +1 dBm < +2.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 − 1.8 − 5.0 = -2.8 dBm
    - Damage threshold of OLT Rx: +4 dBm > −2.8 dBm
- **PRX30 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 5.0 = +2.5 dBm
    - Damage threshold of ONU Rx: -9 dBm < +2.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +5.62-1.4− 5.0 = -0.78 dBm
    - Damage threshold of OLT Rx: −5 dBm < -0.78 dBm
- **PRX40 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 5.0 = +2.5 dBm
    - Damage threshold of ONU Rx: -5 dBm < +2.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +7 − 1.0 − 5.0 = +1 dBm
    - Damage threshold of OLT Rx: −3 dBm < +1 dBm

- **Conclusion:**
  - **In this ODN situation, all combination can't survive,**
  - **If we can insert a splitter in this ODN, all combination can still work well.**
    - **PR40@PR10 require 1:2 Splitter**
    - **PR40@PR20 require 1:2 Splitter**
    - **PR40@PR30 require 1:16 Splitter**
    - **PR40@PR40 require 1:16 Splitter**

- **PRX10 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 10 = -2.5 dBm
    - Damage threshold of ONU Rx: +1 dBm > -2.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 − 2.8 − 10 = - 8.8 dBm
    - Damage threshold of OLT Rx: +4 dBm > −8.8 dBm
- **PRX20 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 10 = -2.5 dBm
    - Damage threshold of ONU Rx: +1 dBm > -2.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 − 1.8 − 10 = -7.8 dBm
    - Damage threshold of OLT Rx: +4 dBm > −7.8 dBm
- **PRX30 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 10 = -2.5 dBm
    - Damage threshold of ONU Rx: -9 dBm < -2.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +5.62-1.4− 10 = -5.78 dBm
    - Damage threshold of OLT Rx: −5 dBm > -5.78 dBm
- **PRX40 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 10 = -2.5 dBm
    - Damage threshold of ONU Rx: -5 dBm < -2.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +7 − 1.0 − 10 = -4 dBm
    - Damage threshold of OLT Rx: −3 dBm > -4 dBm

- **Conclusion:**
  - **In this ODN situation, only PRX40@PRX10 and PRX40@PRX20 combination can survive, other can't work.**
  - **If we can insert a splitter in this ODN, all combination can still work well.**
    - **PRX40@PRX30 require 1:8 Splitter**
    - **PRX40@PRX40 require 1:4 Splitter**

- **PRX10 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 15 = -7.5 dBm
    - Damage threshold of ONU Rx: +1 dBm > -7.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 − 2.8 − 15 = - 13.8 dBm
    - Damage threshold of OLT Rx: +4 dBm > > −13.8 dBm
- **PRX20 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 15 = -7.5 dBm
    - Damage threshold of ONU Rx: +1 dBm > -7.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 − 1.8 − 15 = -12.8 dBm
    - Damage threshold of OLT Rx: +4 dBm >> −12.8 dBm
- **PRX30 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 15 = -7.5 dBm
    - Damage threshold of ONU Rx: -9 dBm < -7.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +5.62-1.4− 15 = -10.78 dBm
    - Damage threshold of OLT Rx: −5 dBm > -10.78 dBm
- **PRX40 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 − 1.5 − 15 = -7.5 dBm
    - Damage threshold of ONU Rx: -5 dBm > -7.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +7 − 1.0 − 15 = -9 dBm
    - Damage threshold of OLT Rx: −3 dBm > -9 dBm

- **Conclusion:**
  - **In this ODN situation, only PRX40@PRX30 can't survive, all other combination can work.**
  - **If we can insert a splitter in this ODN, this combination can work well.**
    - **PRX40@PRX30 require 1:2 Splitter**

In 18 dB ODN loss

- **PRX10 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 – 1.5 – 18 = -10.5 dBm
    - Damage threshold of ONU Rx: +1 dBm > > -10.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 – 2.8 – 18 = - 16.8 dBm
    - Damage threshold of OLT Rx: +4 dBm > > −16.8 dBm
- **PRX20 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 – 1.5 – 18 = -10.5 dBm
    - Damage threshold of ONU Rx: +1 dBm >> -10.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +4 – 1.8 – 18 = -15.8 dBm
    - Damage threshold of OLT Rx: +4 dBm >> −15.8 dBm
- **PRX30 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 – 1.5 – 18 = -10.5 dBm
    - Damage threshold of ONU Rx: -9 dBm > -10.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +5.62-1.4– 18 = -13.78 dBm
    - Damage threshold of OLT Rx: −5 dBm >> -13.78 dBm
- **PRX40 class ONUs with PRX40 class OLT**
  - **Downstream (10G)**
    - Maximum power level at ONU Rx: +9 – 1.5 – 18 = -10.5 dBm
    - Damage threshold of ONU Rx: -5 dBm > -10.5 dBm
  - **Upstream (1G)**
    - Maximum power level at OLT Rx: +7 – 1.0 – 18 = -12 dBm
    - Damage threshold of OLT Rx: −3 dBm > -12 dBm

- **Conclusion:**
  - **In this ODN situation, all combination can survive.**

Agenda

➢ Background and Overview

➢ PX40 OLT with PX10/PX20/PX30/PX40 ONU

➢ PR40 OLT with PR10/PR20/PR30/PR40 ONU

➢ PRX40 OLT with PRX10/PRX20/PRX30/PRX40 ONU

➢ Conclusions

The co-existence in the overload case

OLT	5dB	10dB	15 dB	18dB	ONU
PX40	√	√	√	√	PX10
	X	√	√	√	PX20
	X	√	√	√	PX30
	X	√	√	√	PX40
PR(X)40	X	√	√	√	PR(X)10
	X	√	√	√	PR(X)20
	X	X	X	√	PR(X)30
	X	X	√	√	PR(X)40

- In 1G-EPON, all coexistence combination can work at the ODN loss of 10dB or above.
- In 10G-EPON, all coexistence combination can work at ODN loss at 18dB or above.

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Conclusions

- For PX40 OLT with PX10/PX20/PX30/PX40 ONU connected to ODN with the loss of 10dB or above, all ONUs can operate well, without receiver overload.

- For PR(X)40 OLT with PR(X)10/PR(X)20/PR(X)30/PR(X)40 ONU connected to ODN with the loss of 18dB or above, all ONUs can operate well, without receiver overload. In other combinations, at least one of the ONUs would suffer from overload and damage to the receiver.

- Operators migrating to new ExEPON OLT PMDs are therefore recommended to observe the minimum loss requirements for new PMDs.