

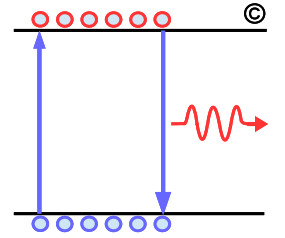
# C2M AUI Options

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**100GEL Task Force Adhoc Meeting**

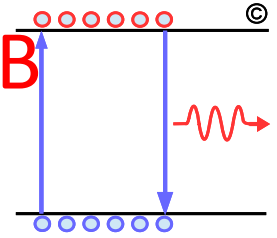
**May 9, 2018**

# Overview



- ❑ To support 2 m of Cu cable the host/MDI loss needs to be ~11 dB
- ❑ An 11 dB loss has significant implication on the C2M by requiring many retimers
- ❑ The contribution explores options not penalizing C2M applications while supporting 2 m Cu cable objective
  - Asymmetric switch-NIC link budget
  - Define 10-11 dB for Cu host/MDI loss while defining ~15 dB for C2M
    - A host requiring Cu cable support must have loss <10-11 dB
    - But host supporting optics/AOC/Active Cu may have channel with up to ~15 dB
- ❑ Each of the above 3 options have pros and cons, but what is clear we no longer have the luxury of assuming a common ports meets all applications with no power-cost penalty!

# Lim Proposal Ball-Ball Loss Needs to be Reduced to 28 dB Based on 100GEL Objective



[http://www.ieee802.org/3/100GEL/public/18\\_03/lim\\_100GEL\\_01b\\_0318.pdf](http://www.ieee802.org/3/100GEL/public/18_03/lim_100GEL_01b_0318.pdf)

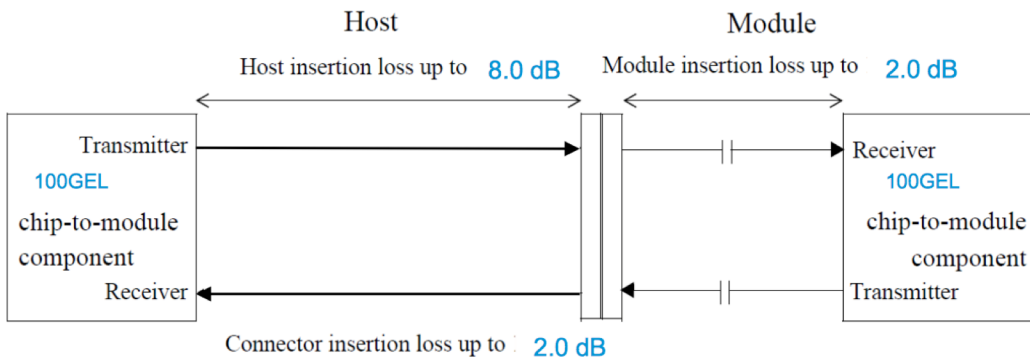


Figure 1: 100GEL C2M insertion loss budget at 26.56 GHz

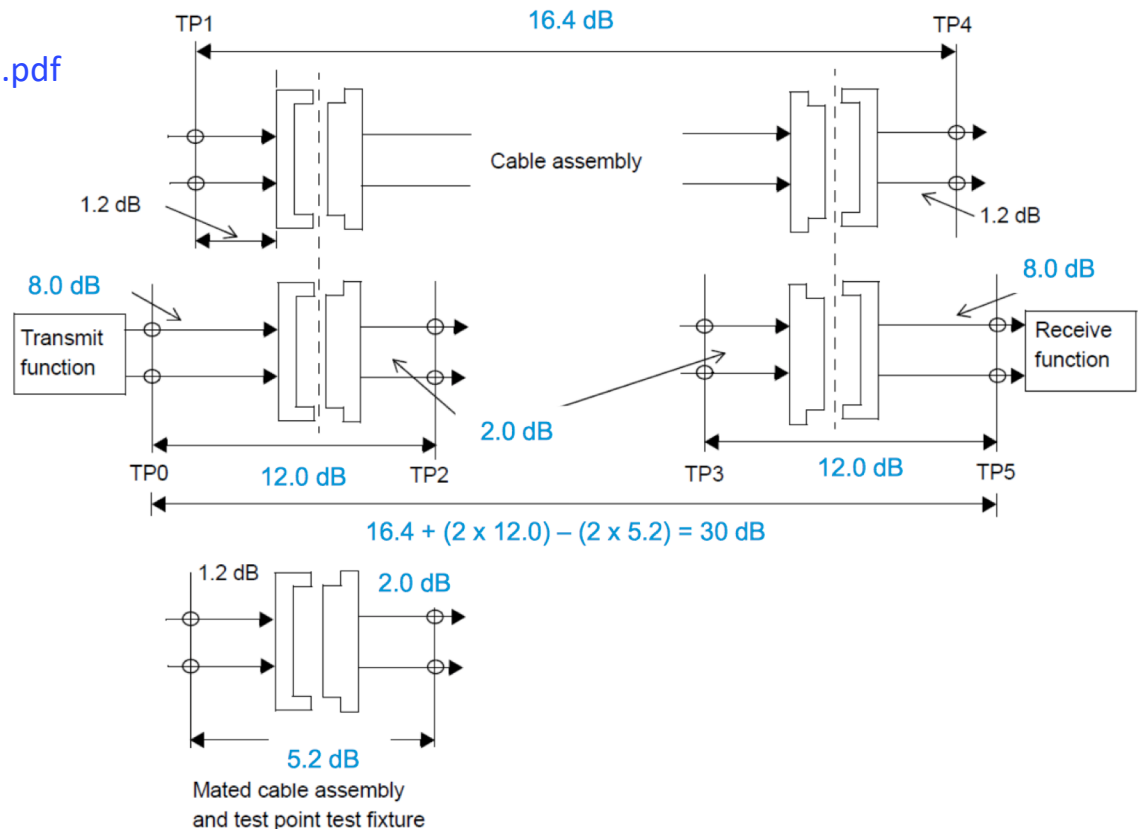
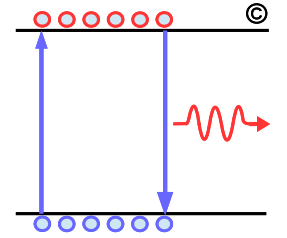


Figure 2: 100GEL CR 30dB insertion loss budget at 26.56 GHz

# 10G SFP+



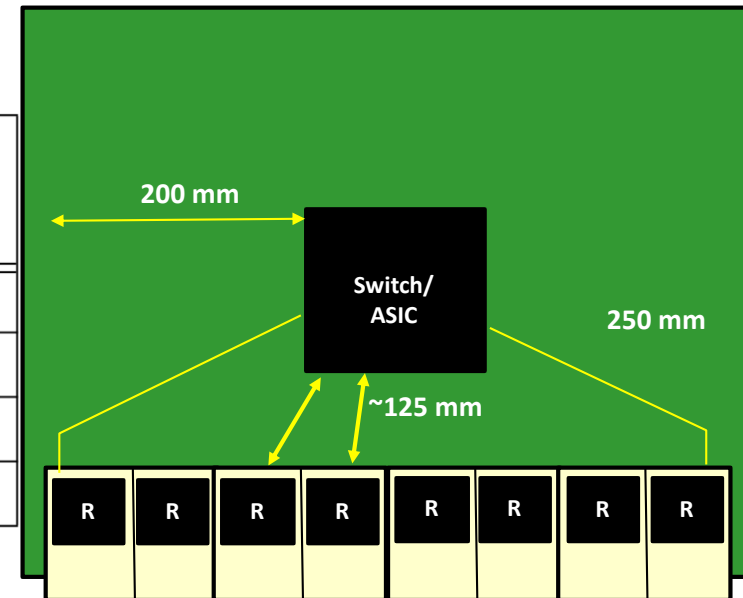
**10G SFP+ was the first Ubiquitous port supporting optical and passive Cu**

- 10G SFP+ supported 200-300 mm of host PCB trace on mid-grade material
- 10GSFP+ Cu DAC did not burden or reduce the host PCB trace
- lim\_100GEL\_01b\_0318.pdf in order to support Cu cable even with best material Megtron 7NE PCB limited to 5-6”.

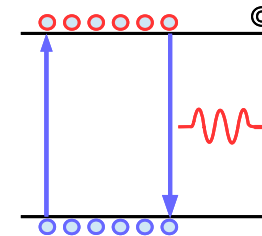
**Table 2 Host Board Achievable Trace Length (SFP+)**

Type	Material	Trace Width (mm)	Loss Tangent	Copper Thickness (oz) see 1	Copper Thickness (μm)	Trace Length (mm)
Microstrip	FR4-6/8	0.3	0.022	1	35	200
	Nelco 4000-13	0.3	0.016	1	35	300
Stripline	FR4-6/8	0.125	0.022	0.5	17.5	150
	Nelco 4000-13	0.125	0.016	0.5	17.5	200

1. Copper (oz) is defined as an ounce of copper over one square foot of laminate.



# C2M Channel Reach



## □ PCB loss estimate assumptions and tools for calculation

- Rogers Corp impedance calculator (free download but require registration)  
<https://www.rogerscorp.com/acm/technology/index.aspx>
- The IEEE tool if updated could be another option to estimate channel reach  
[http://www.ieee802.org/3/bj/public/tools/Reference\\_DkDf\\_AlegbraicModel\\_v2.04.pdf](http://www.ieee802.org/3/bj/public/tools/Reference_DkDf_AlegbraicModel_v2.04.pdf)
- Stripline ~ 50 Ω, trace width is 5.5 mils, and with ½ oz Cu
- Isola 408HR DK=3.65, DF=0.0095, RO=2.5 μm, Meg-6 DK=3.4, DF=0.005, RO 1.2 μm, Tachyon100 DK=3.02, DF=0.0021, RO=1.2 μm
- To support equivalent PCB traces for C2M need at least 15 dB end-end channel loss consistent with tracy\_100GEL\_01a\_0118

Host Trace Length (in)	Total Loss (dB)	Host Loss(dB)	Isola 408HR	Megtron 6	Tachyon100
Nominal PCB Loss/in at 5.15 GHz	N/A	N/A	0.65	0.52	0.46
Nominal PCB Loss/in at 13 GHz	N/A	N/A	1.27	0.98	0.83
Nominal PCB Loss/in at 27 GHz	N/A	N/A	2.18	1.60	1.28
10GSFP+ with one connector & HCB*	6.5	5	7.7	9.6	10.9
28G-VSR with one connector & HCB*	10.5	6.81	5.4	6.9	8.2
Cisco Lim proposal adjusted for 28 dB**	11.1	7.1	3.3	4.4	5.5 X
100G NIC + HCB ***	8	4	1.8	2.5	3.1
100G C2M by Scaling 28G + connector + HCB***	14.5	10.5	4.8	6.6	8.2

Reach Inches Too Short

\* Assumes connector loss is 1.69 dB and HCB loss is 2.0 dB at 12.89 GHz

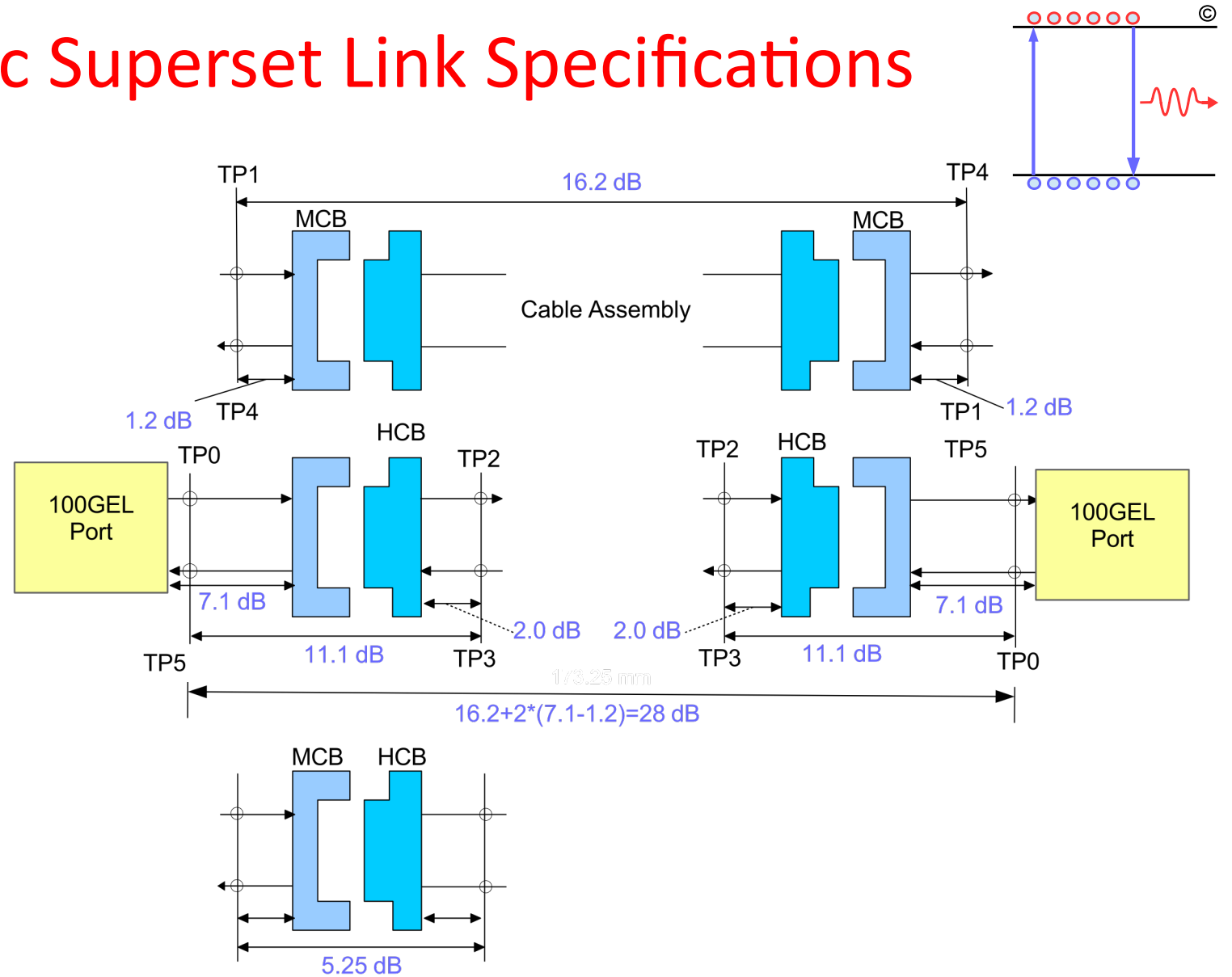
\*\* lim\_100GEL\_01b\_0318.pdf proposal adjusted for 28 dB assuming Cu cable loss is 16.1 dB.

\*\*\* Assumes connector loss is 2.0 dB and HCB loss also 2.0 dB at 26.55 GHz.

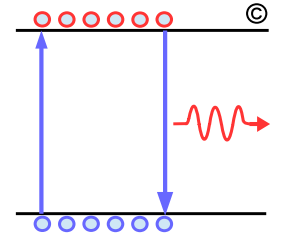
# Option I: Symmetric Superset Link Specifications

## Proposed symmetric link budget assumes 28 dB ball-ball

- Cable assembly loss is 16.2 dB
- Switch PCB loss 7.1 dB
- 7.1 dB only supports 5.5”!



# Option II: Asymmetric Link Specifications

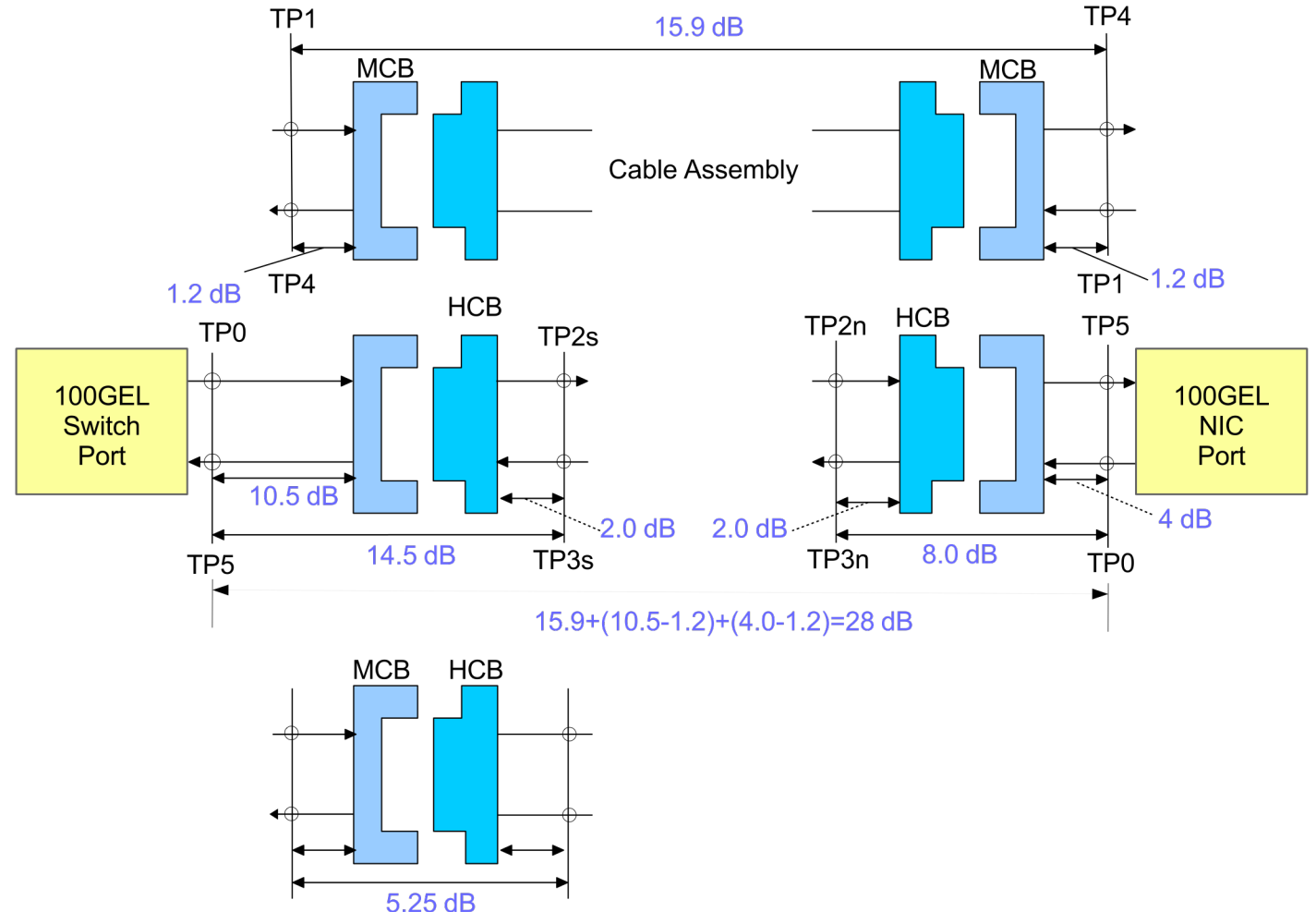


❑ **Proposed asymmetric link budget assumes 28 dB ball-ball**

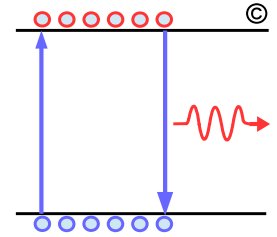
- Cable assembly loss is 16.1 dB
- Switch PCB loss 10.5 dB
- NIC PCB loss 4.0 dB

❑ **To support asymmetric link following test points are introduced**

- TP2s and TP3s for switch output/input
- TP2n and TP3s for NIC output/input.



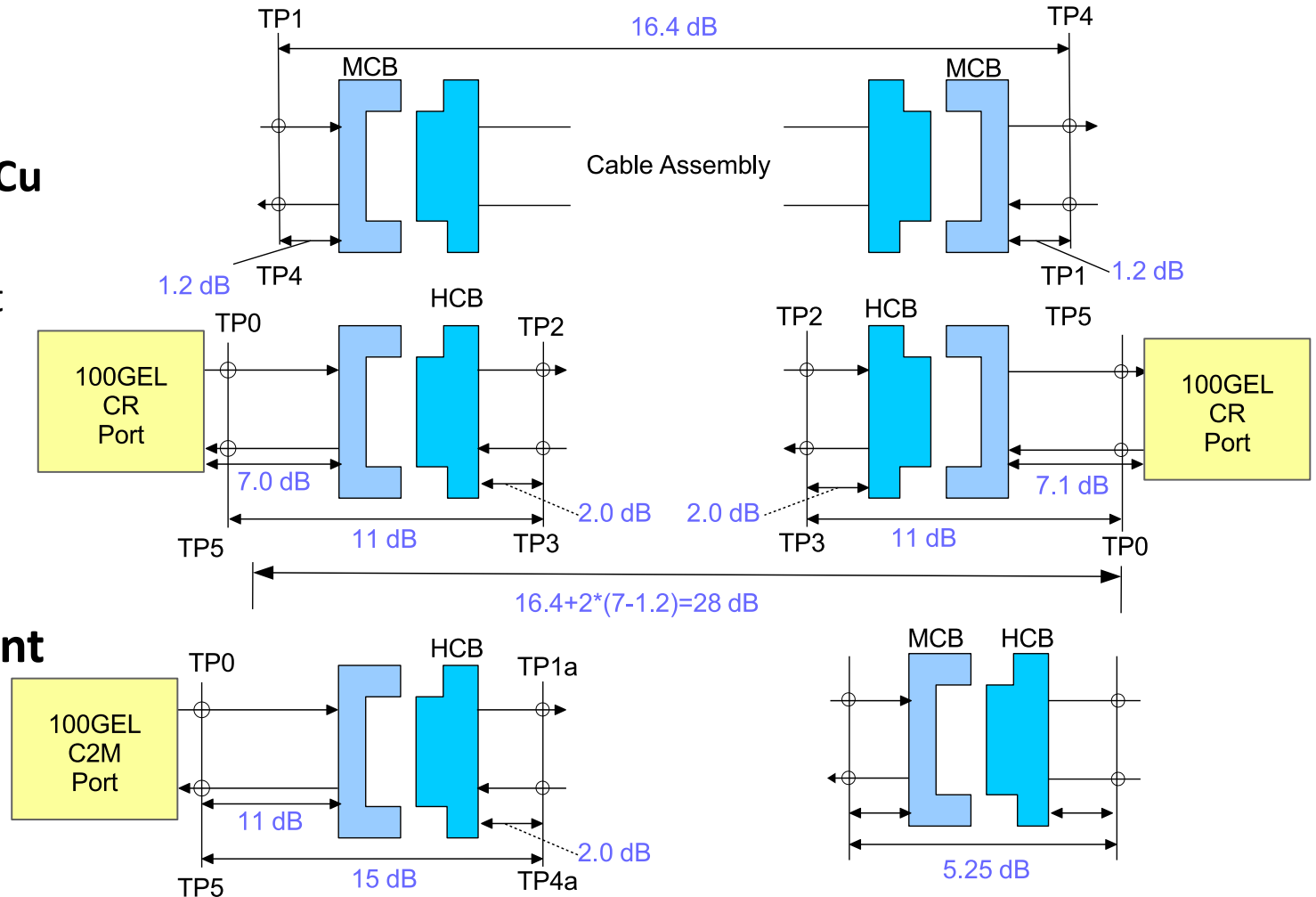
# Option III: Dual Link with Superset Specifications



- Dual link with superset specification allow building Cu/optical ports or build optical/AOC/Active Cu ports if Cu support not required

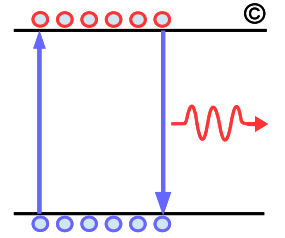
- Dual link offer more generous budget for Cu cable
- With 28 dB ball-ball not guaranteed one could reduce Cu host channel further

- C2M budget is set based on the application needs and independent of the CR ball to ball loss.



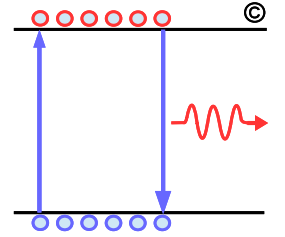


# Options Moving Forward



Options	Applications Supported	PHY-Less Support on High Radix Switch	Supports 2 m Cu	C2M Applications
<b>I- Symmetric ~ 11 dB</b>	Switch-Switch, and Switch-NIC	No ( ~half the ports require retimers)	Yes	Penalized by Cu cable use case by forcing retimers on ~ half the ports on a system never using Cu
<b>II- Asymmetric 14.5 dB switch 8.5 dB NIC</b>	Switch-NIC	Yes	Yes	Not penalized by the Cu cable
<b>III- Cu ports 10-11 dB C2M ports 15 dB</b>	Switch-Switch, and Switch-NIC (10-11 dB ports can support both Cu/optics but 15 dB only optics/AOC)	Optional (~half the ports require retimers to support Cu cables but could choose not to support)	Yes (on the 10-11 dB ports)	Not penalized by the Cu cable

# Summary



- ❑ **The proposed lim\_01b\_0318.pdf based on 30 dB need to be adjusted for 28 dB ball to ball loss even further penalizing large ASICs by requiring retimers potentially on half the ports**
- ❑ **This contributions investigates**
  - Option I - Symmetric based on ~11 dB
  - Option II - Asymmetric based on 14.5 dB for switch and 8.0 dB for NIC
  - Option III - Dual superset specification based on ~11 dB for CR and 15 dB for C2M
- ❑ **Each of the above scheme have some pros-cons, but symmetric with ~ 11 dB penalizes every C2M ports by requiring adding many power hungry retiemrs on the linecard where many of these ports will not be using Cu cabling**
  - The 100GEL task force need to investigate also option II and option III.