Cabling Developments in Support of 40GBASE-T

Parameters and compatibility

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Supporters

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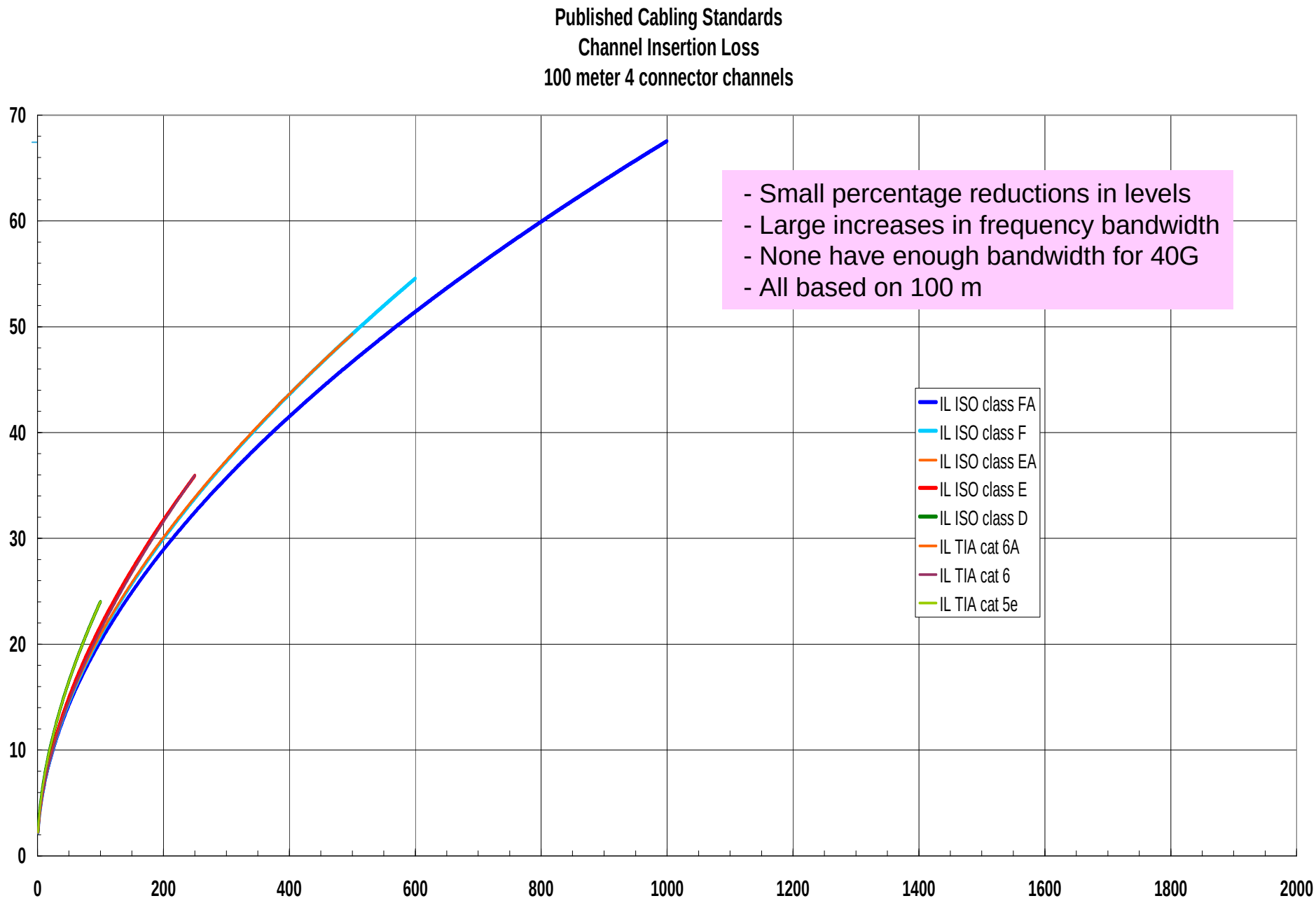
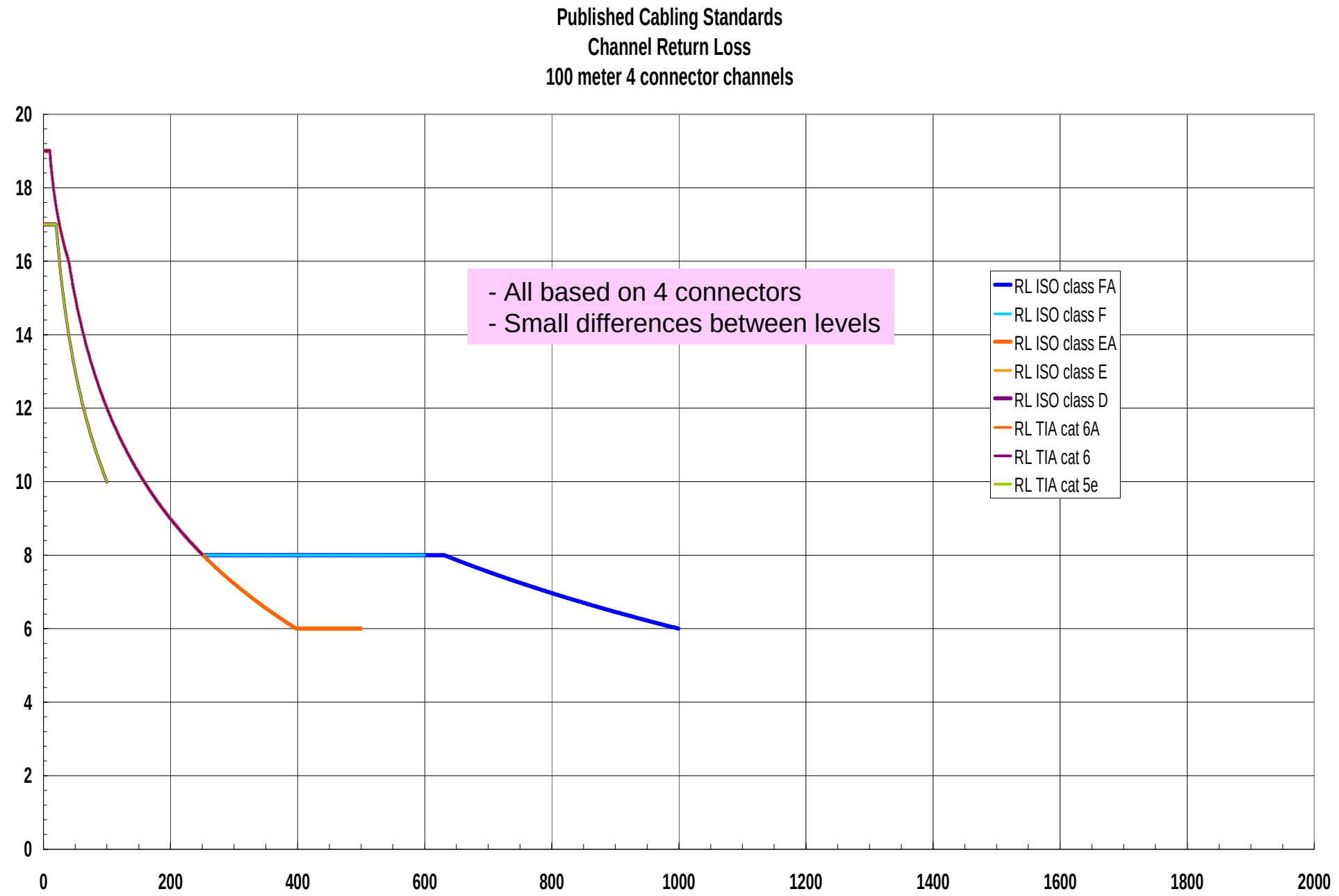
Outline

- Standards from the past, through 6A and 7A
- Standards under development in support of 40GBASE-T

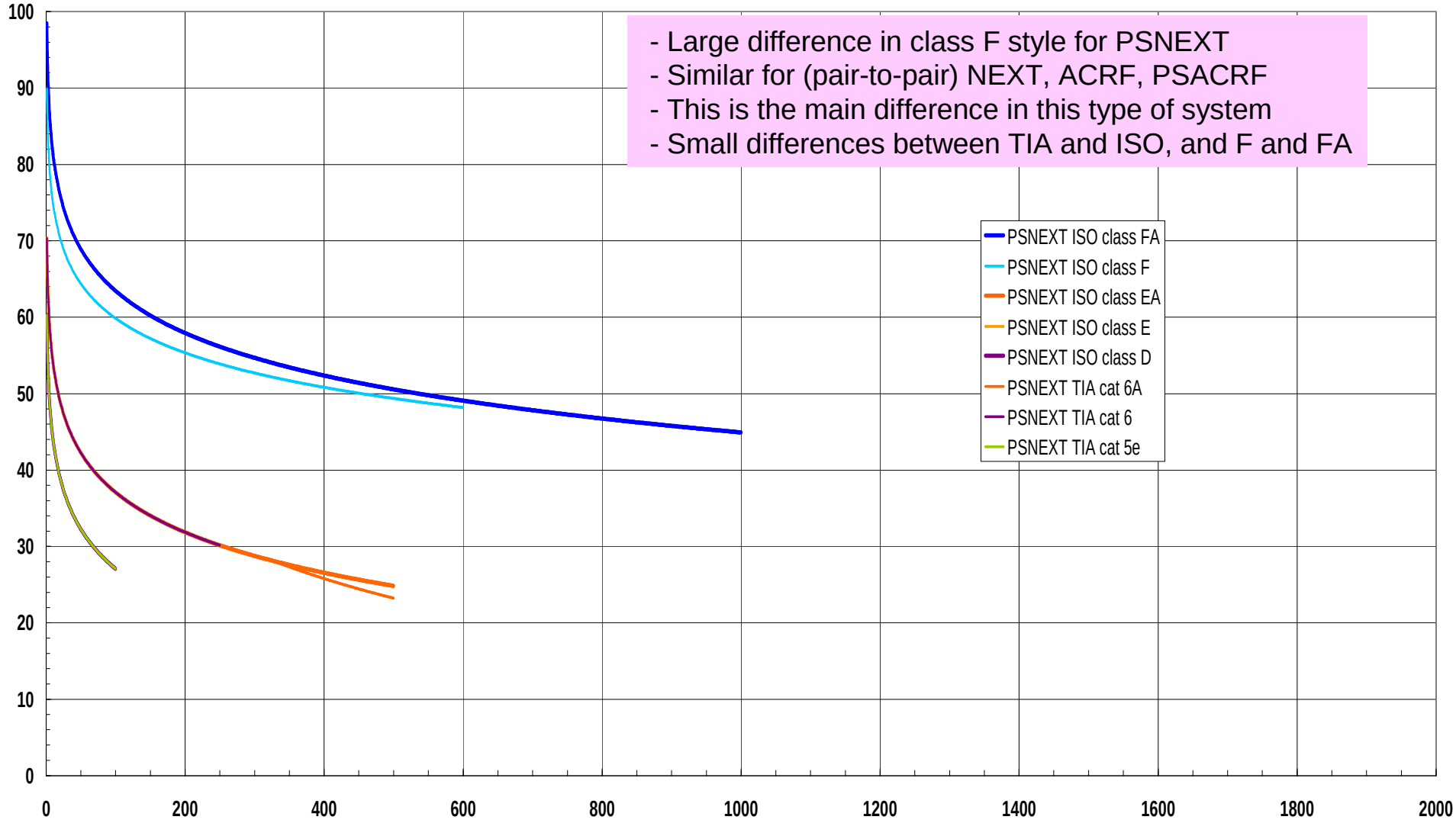
Cabling standards from the past

- Insertion loss, return loss, and NEXT loss
- TIA and ISO channel requirements
  - TIA categories 5e, 6, and 6A
  - ISO classes D, (using category 5 components), E (category 6), E_A (category 6_A), F (category 7) and F_A (category 7_A)


Published Cabling Standards
Channel Insertion Loss
100 meter 4 connector channels
70
60
50
40
30
20
10
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
- Small percentage reductions in levels
- Large increases in frequency bandwidth
- None have enough bandwidth for 40G
- All based on 100 m
IL ISO class FA
IL ISO class F
IL ISO class EA
IL ISO class E
IL ISO class D
IL TIA cat 6A
IL TIA cat 6
IL TIA cat 5e

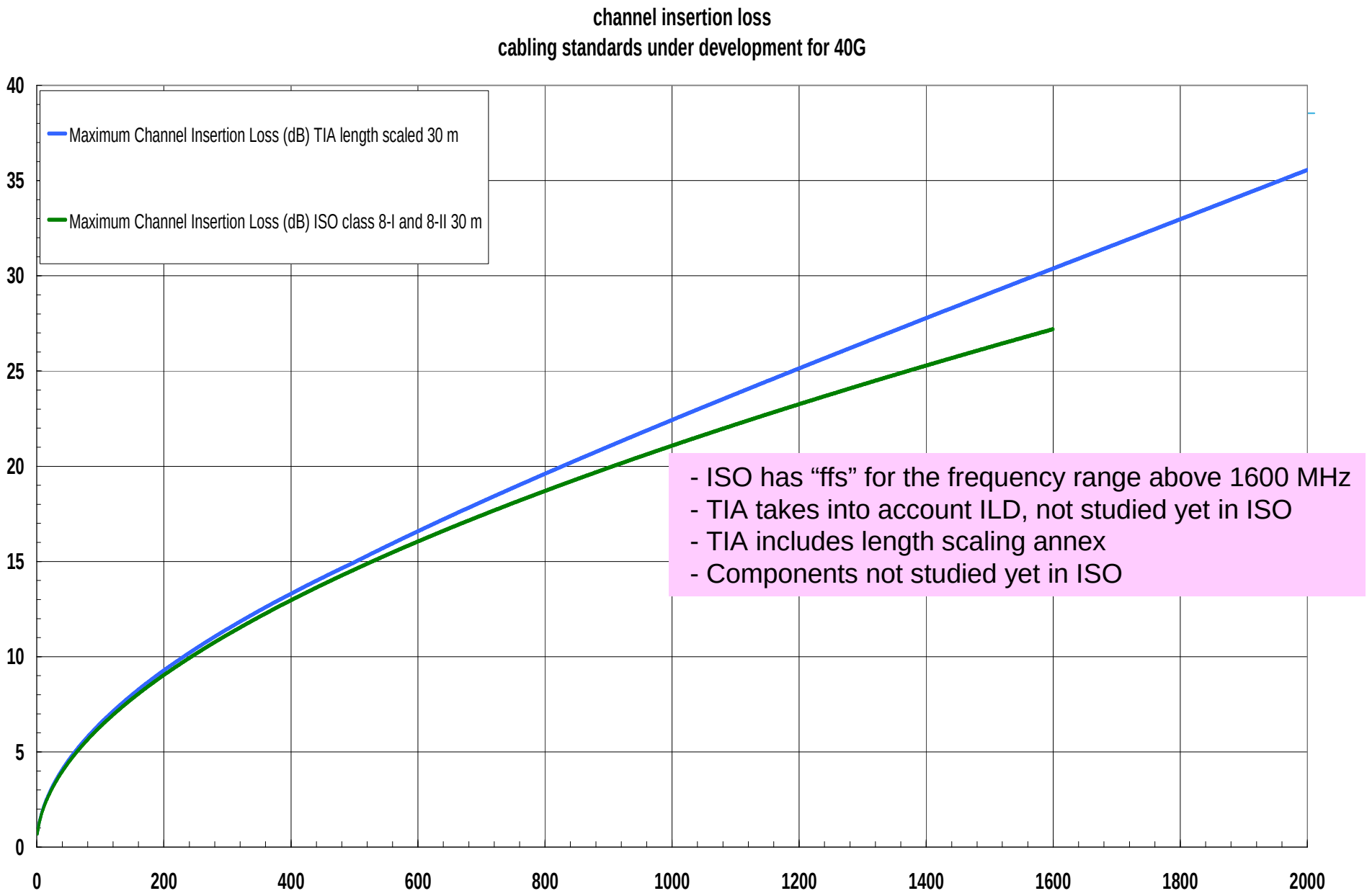

Published Cabling Standards
Channel Return Loss
100 meter 4 connector channels
- All based on 4 connectors
- Small differences between levels
RL ISO class FA
RL ISO class F
RL ISO class EA
RL ISO class E
RL ISO class D
RL TIA cat 6A
RL TIA cat 6
RL TIA cat 5e
20
18
16
14
12
10
8
6
4
2
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000

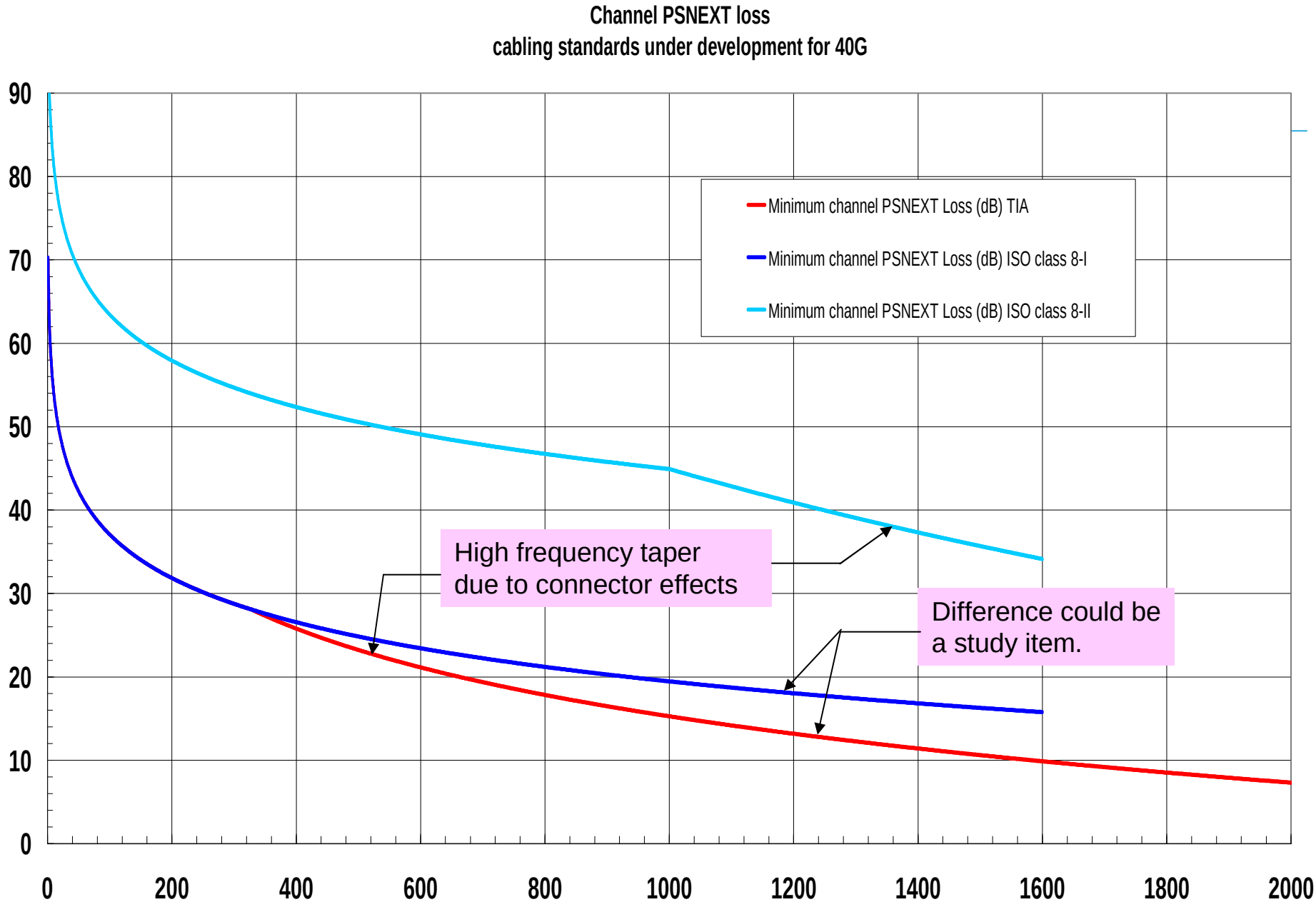
Published Cabling Standards
Channel PSNEXT Loss
100 meter 4 connector channels



Present state of standards under development to support 40GBASE-T

- Insertion loss, and NEXT loss
- TIA category 8, and ISO classes I and II (using category 8-I and 8-II components)
- Return Loss is addressed in a separate contribution.


channel insertion loss
cabling standards under development for 40G
Maximum Channel Insertion Loss (dB) TIA length scaled 30 m
Maximum Channel Insertion Loss (dB) ISO class 8-I and 8-II 30 m
40
35
30
25
20
15
10
5
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
- ISO has “ffs” for the frequency range above 1600 MHz
- TIA takes into account ILD, not studied yet in ISO
- TIA includes length scaling annex
- Components not studied yet in ISO


Channel PSNEXT loss
cabling standards under development for 40G
90
80
70
60
50
40
30
20
10
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Minimum channel PSNEXT Loss (dB) TIA
Minimum channel PSNEXT Loss (dB) ISO class 8-I
Minimum channel PSNEXT Loss (dB) ISO class 8-II
High frequency taper due to connector effects
Difference could be a study item.

TIA Category 8 Channel Limits

From http://www.ieee802.org/3/minutes/mar13/index.html

Attachment C9, PN-568-C.2-1 Draft 0.7

Also including effects of last TIA meeting, not liaised yet.

TIA category 8 channel insertion loss

$$IL := 0.312\cdot\left(1.80\cdot\sqrt{f} + .005\cdot f + \frac{0.25}{\sqrt{f}}\right) + 2\cdot\left(.008\cdot\sqrt{f} + .00029\cdot f + .5\cdot 10^{-6}\cdot f^2\right) + .0324\cdot\sqrt{f}$$

Connector_is_different_from_1 – 500_MHz

TIA category 8 return loss

1 to 10 MHz	$RL := 19.0$
10 to 40 MHz	$RL := 24 - 5\cdot\log(f)$
40 to 130 MHz	$RL := 16.0$
130 to 1000 MHz	$RL := 35 - 9\cdot\log(f)$
1000 to 2000 MHz	$RL := 8.0$

TIA category 8 channel PSNEXT loss

1 to 330 MHz	$PSNEXT := -20\cdot\log\left(10^{\frac{42.3-15\cdot\log\left(\frac{f}{100}\right)}{-20}} + 2\cdot 10^{\frac{50-20\cdot\log\left(\frac{f}{100}\right)}{-20}}\right)$
330 to 2000 MHz	$PSNEXT := \left(28 - 26.43\cdot\log\left(\frac{f}{330}\right)\right)26.43$

Observations and Conclusions

- The standard for TIA category 8 and the technical report for ISO classes 8-I and 8-II are being developed to support 40GBASE-T.
- The PSNEXT (and NEXT) values are different in TIA and ISO 8-I, but attempts may be made to converge them later.
- TIA has taken into account the high frequency properties of the RJ-45 connector, including insertion loss and ILD.
- TIA has provided length scaling equations in an annex.
- Channels nearly compliant to TIA category 8 have already been shown. (http://www.ieee802.org/3/NGBASET/public/nov12/larsen_01a_1112_ngbt.pdf , http://www.ieee802.org/3/NGBASET/public/nov12/larsen_01a_1112_ngbt.pdf)
- TIA allows a total of 6 m of patch cords at the two ends and ISO a total of 4 m.
- In the ISO TR, the values above 1600 MHz are not specified and are ffs.

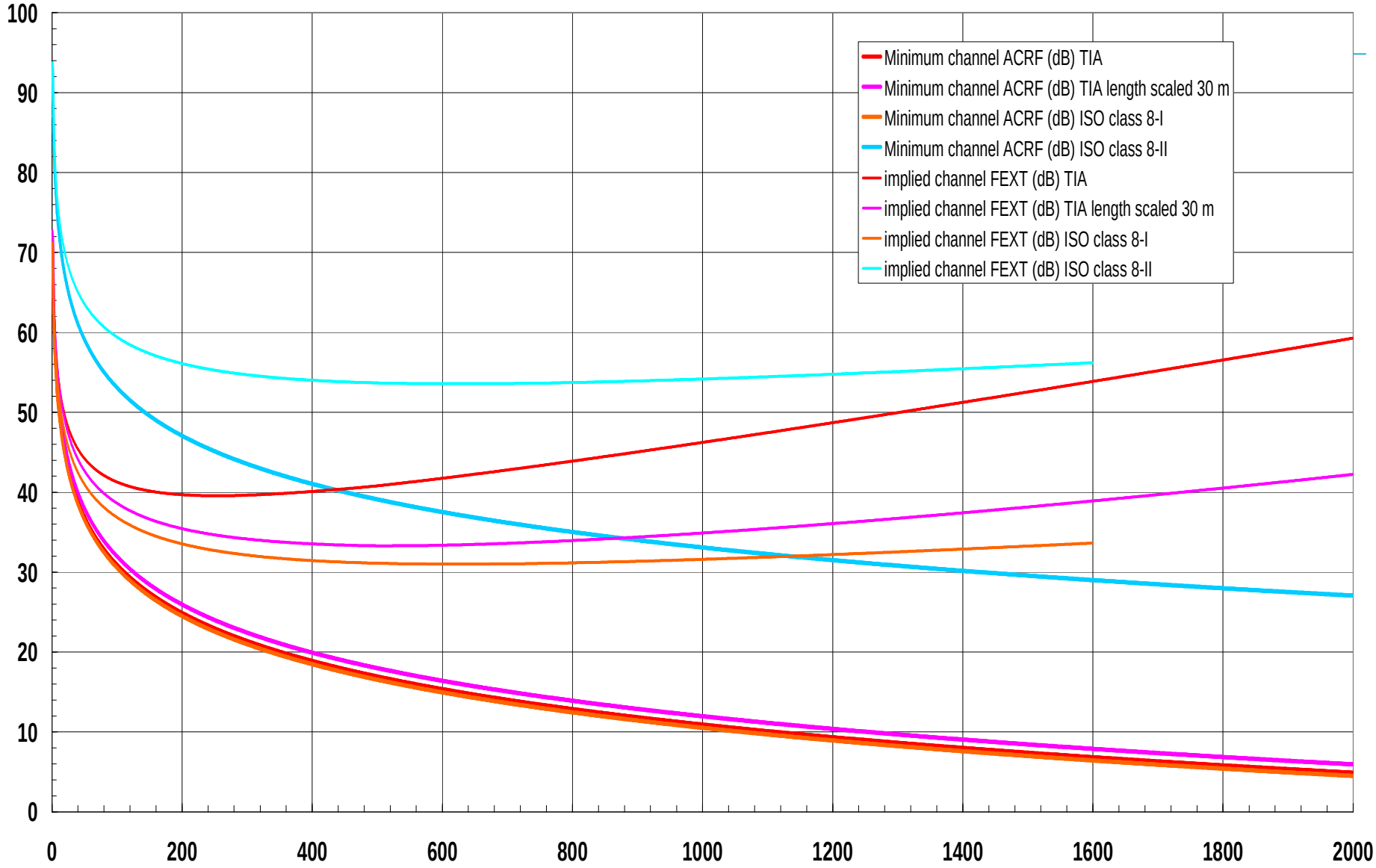
Questions

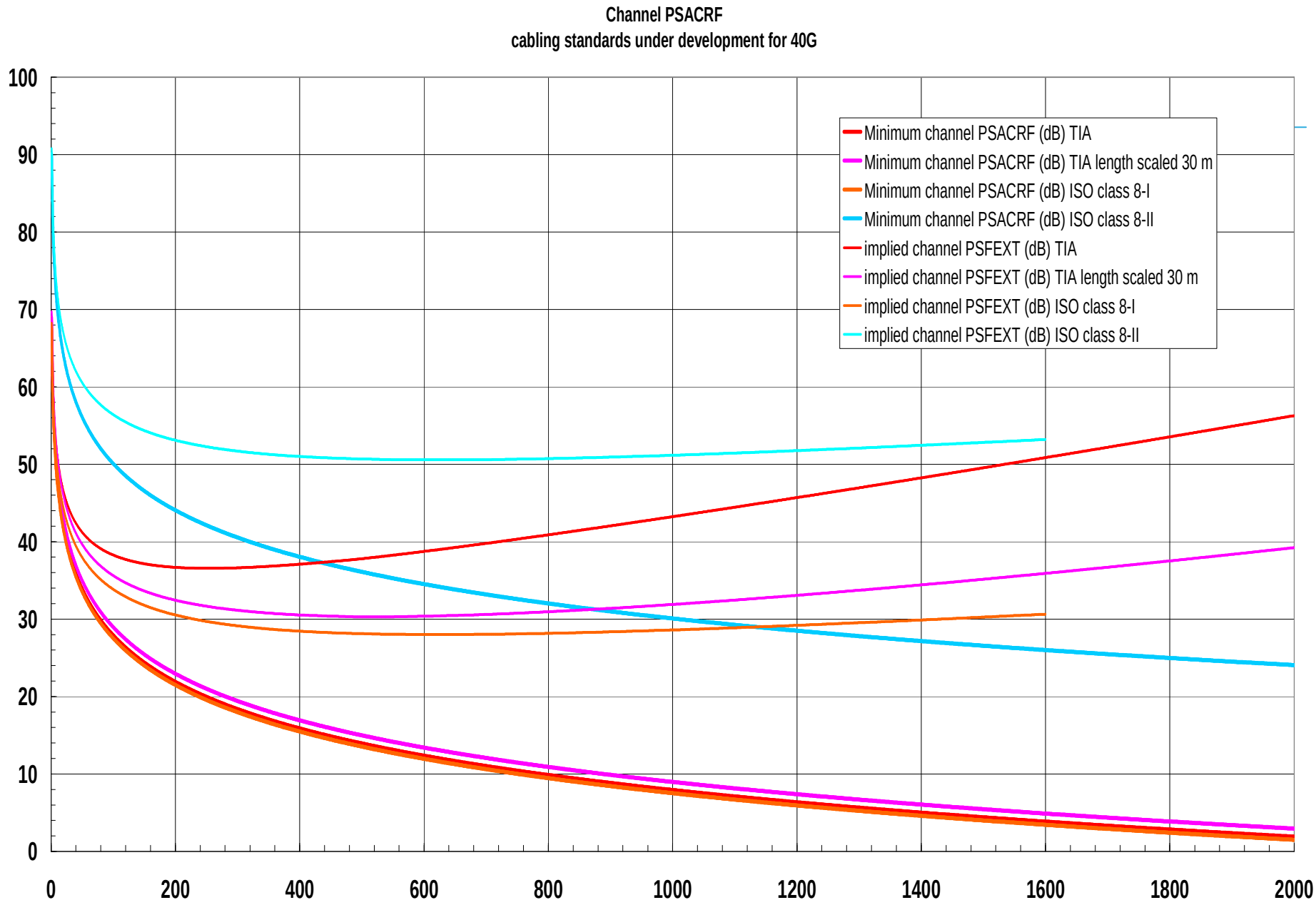
And Answers

Backup

Material

Channel ACRF
cabling standards under development for 40G




Channel PSACRF
cabling standards under development for 40G
100
90
80
70
60
50
40
30
20
10
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Minimum channel PSACRF (dB) TIA
Minimum channel PSACRF (dB) TIA length scaled 30 m
Minimum channel PSACRF (dB) ISO class 8-I
Minimum channel PSACRF (dB) ISO class 8-II
implied channel PSFEXT (dB) TIA
implied channel PSFEXT (dB) TIA length scaled 30 m
implied channel PSFEXT (dB) ISO class 8-I
implied channel PSFEXT (dB) ISO class 8-II