



# CAT 7A CHANNEL ANALYSIS

IEEE 802.3 Next Generation BASE-T study group, Phoenix, Jan 2013

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# SUPPORTERS

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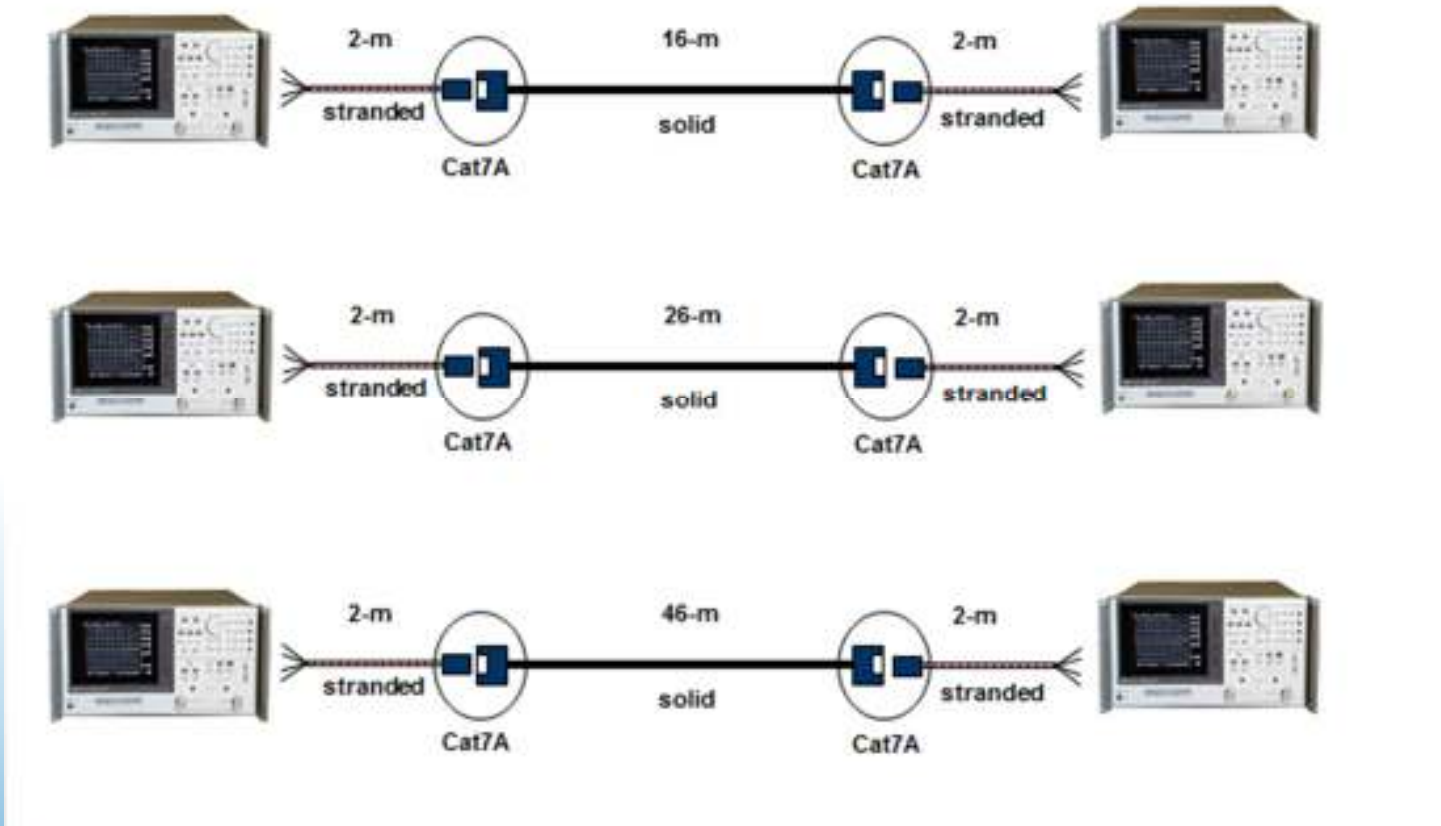
# THE DATASETS

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Measured data for 20, 30 and 50m 2-connector category 7A channels out to 2.5GHz. Data provided by Siemon.

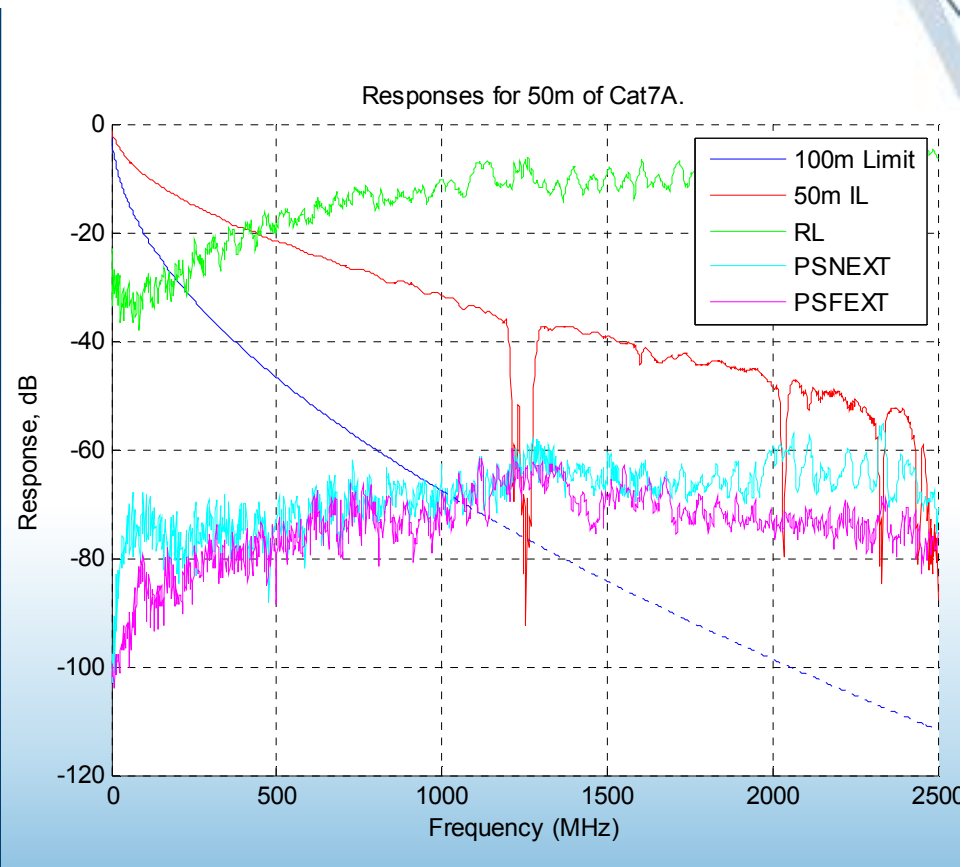
- Insertion Loss
- 100m, 4-connector Channel IL Limit Line (extrapolated from 1 GHz to 2.5 GHz).
- Return Loss
- PSNEXT
- PSFEXT

# CHANNEL CONFIGURATION



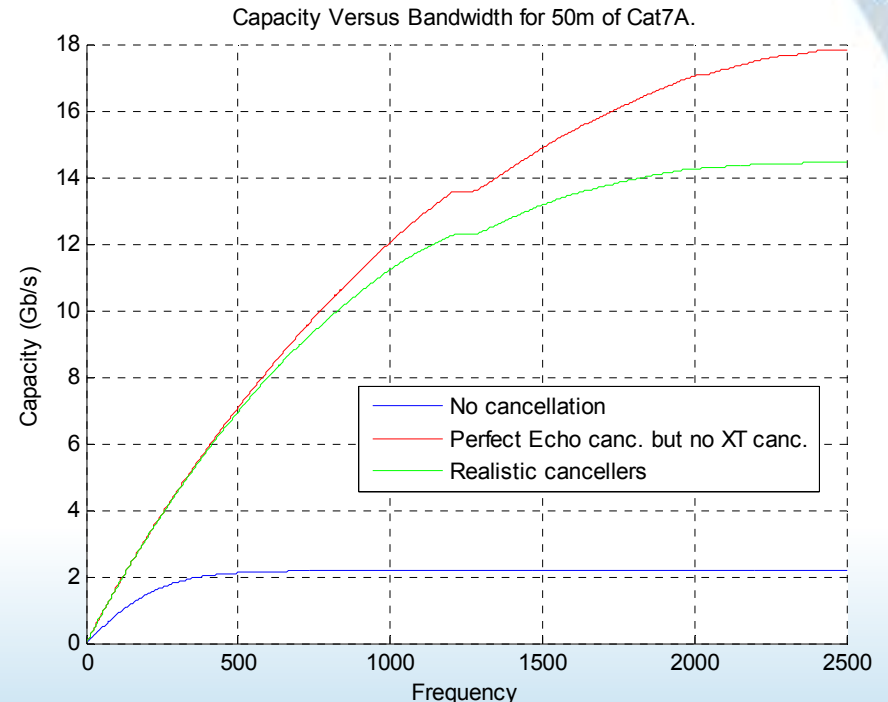
# THE 50M DATA

- The suck out at ~1200MHz means we should avoid putting Nyquist here. Note it violates the 100m IL extrapolated limit line.
- Outer shielding means Alien XT is not a concern.
- Very good PSNEXT and PSFEXT levels (still >20dB down on signal even at 1GHz).
- RL crosses IL at less than 500MHz.
- Implies echo will dominate impairments at receiver.



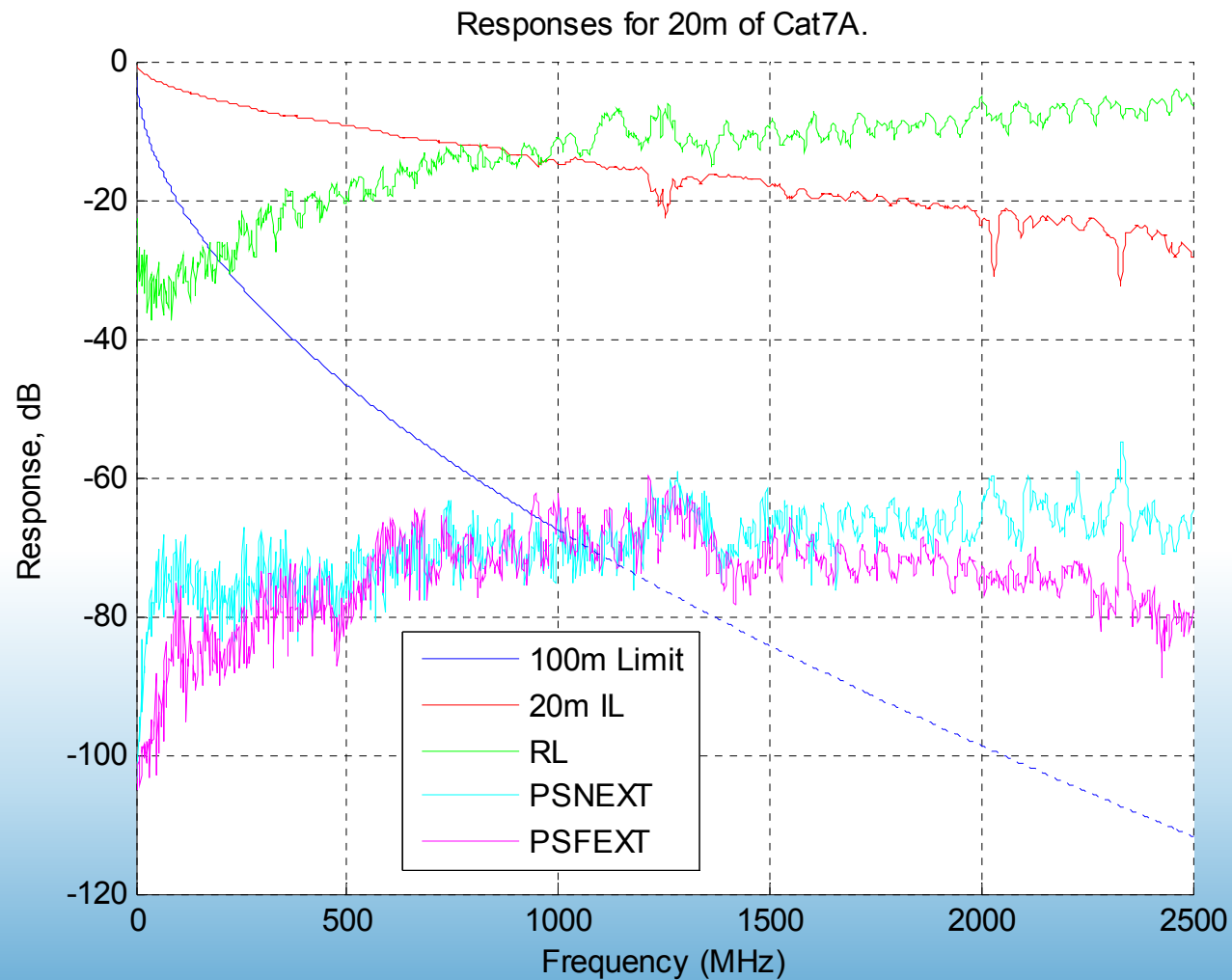
# CAPACITY – 50M

- We can use the Shannon-Hartley equation to determine the capacity assuming a given bandwidth.
- Assume flat-band transmit power spectrum. 3dBm TX power.
- Since we know echo, NEXT and FEXT we can cancel it.
- Note kink at the “suck out”; we can carry no information there.
- **Need 10Gb/s to achieve 40Gb/s over 4 pairs.**
- I would like to target 50% (15Gb/s) more capacity (more than 10GBASE-T).

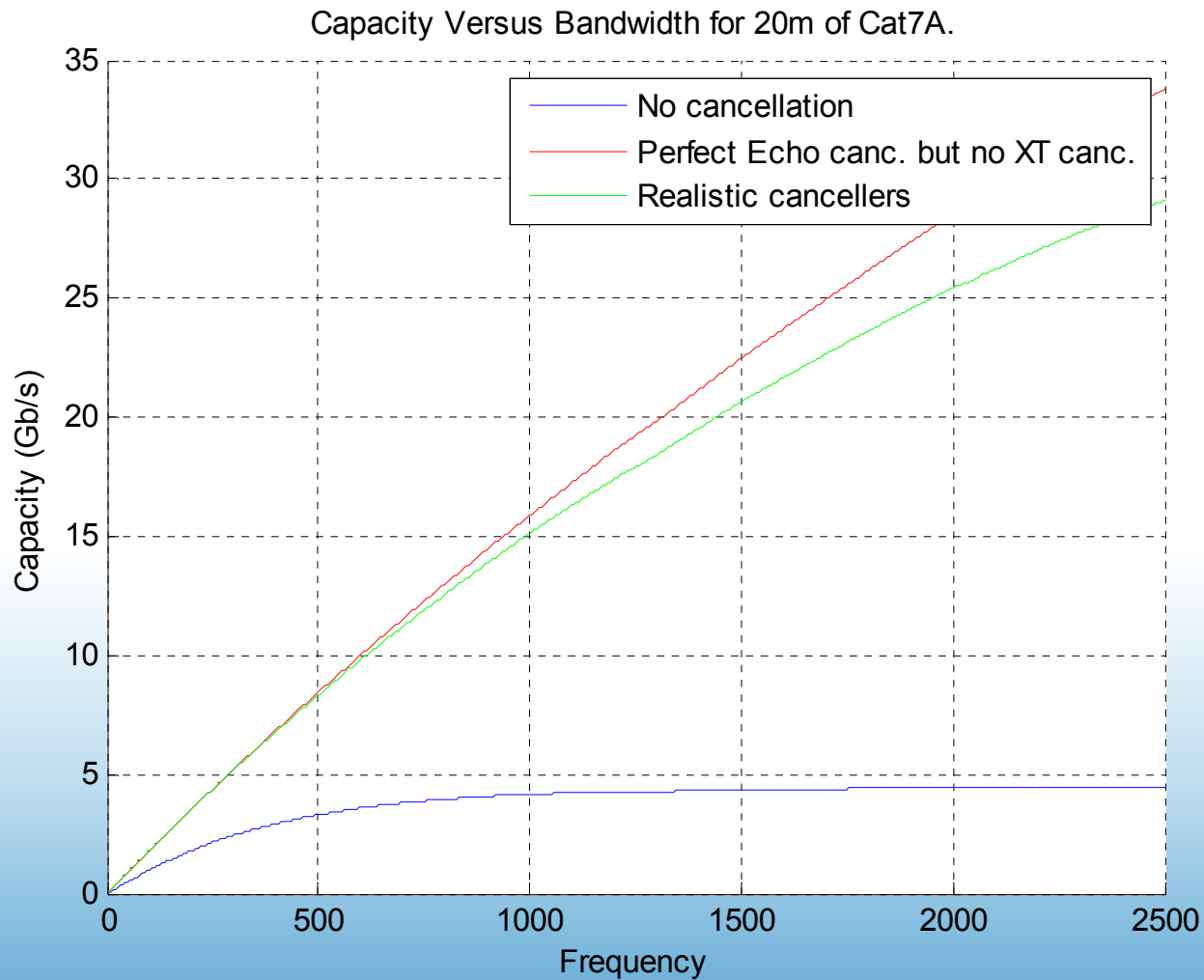


- Note that echo cancellation is mandatory (no surprise there). XT cancellers may not be mandatory.
- “Realistic” assumes we cancel by about 40dB.

# CHANNEL – 20M

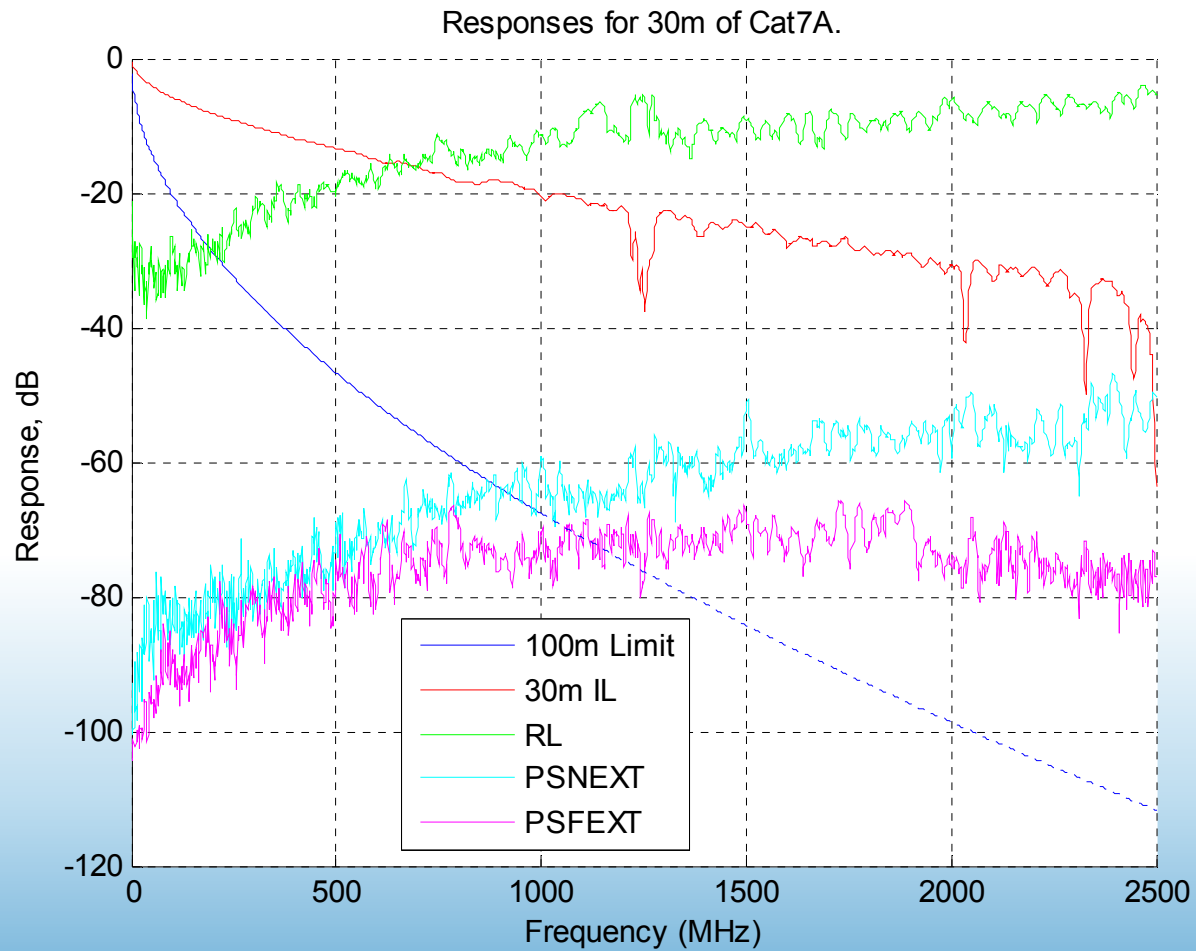


# CAPACITY – 20M

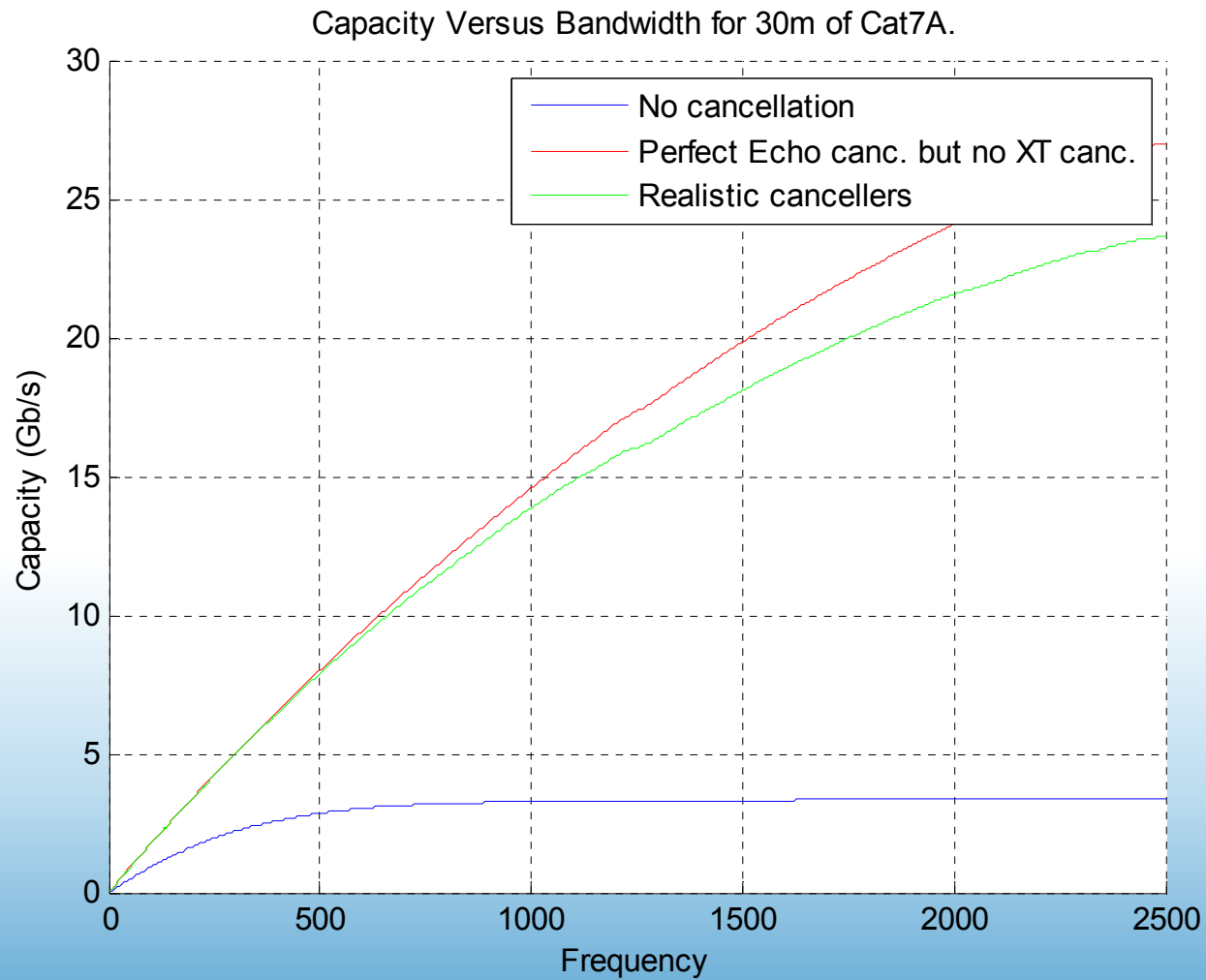




# CHANNEL – 30M



# CAPACITY – 30M



# OBSERVATIONS/CONCLUSIONS

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- 20-30m feasible with realistic cancellers
- 2GBaud makes sense
- Not possible to operate at 50m with 1GHz BW without compromising capacity margin.

# OBSERVATIONS/CONCLUSIONS

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- The lack of Alien XT makes the problem much more tractable. All major noise sources can now be cancelled.
- Significant echo energy implies echo canceller will dominate area of the receiver and will need to do some cancellation before ADC (to reduce dynamic range requirements of ADC).
- With realistic cancellation it appears to make sense to set the BW at about 1GHz. This agrees with conclusions in Will Bliss' presentation from Geneva (Sept 2012). [ See bliss\_01a\_0912.pdf]. This keeps bandwidth below the suck-out.

# OBSERVATIONS/CONCLUSIONS

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- PHY digital power will be dominated by echo cancellers.
- A Baud rate of about 2 GBaud is 2.5 times faster than 10GBASE-T. Implies each sample needs to convey  $4/2.5=1.6$  more bits/Baud. This is non-trivial.
- This analysis is applicable to the installed base of category 7A cabling where an IL artifact is known to exist at approximately 1200 MHz.
- The location and bandwidth of the category 7A artifact is fairly consistently ( $\pm 100$  MHz) between manufacturers
- IL artifacts exist in the installed base of category 6A cabling, but they are inconsistent and can occur between 500 MHz and 1 GHz.
- As currently proposed, CAT8 will have worse PSNEXT and PSFEXT than CAT 7A.