1000BASE-T Transmitter PSDs and 2.5/5G Salz SNR

(aka 1000BASE-T PSDs Through the Ages)

IEEE P802.3bz 2.5/5GBASE-T Task Force

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Bonita Springs, FL – September 2015

Purpose & Summary

- A “comment” in support of the 1000BASE-T PSD approximation presented in the P802.3bz 2.5/5GBASE-T TF Architecture Ad Hoc
  - See “Salz SNR Text and Procedure,” zimmerman_3bzah_01a_0815.pdf
- Measurements of multiple legacy 1000BASE-T devices support the proposed 1000BASE-T approximation
  - 125 MSPS zero-order hold, specified pulse shaping filter, 1st order LPF at 100 MHz, 3.2dBm TX power

From “Salz SNR Text and Procedure”

1000BASE-T

- A bit more difficult, specified as voltage mask w/rise and fall, not as a PSD, and uses pulse shaping filter: $0.75 + 0.25z^{-1}$
- Approximation: (request for comment/revision)
  - 125 MSPS zero-order hold, specified pulse shaping filter, 1st order LPF at 100 MHz, 3.2dBm TX power

$$PSD(f) =$$

$$-72.38 + 20\log_{10}\left[\frac{\left|\sin\left(\frac{\pi f}{125}\right)\right|}{\frac{\pi f}{125}}\right] - 10\log_{10}\left[1 + \left(\frac{f}{100}\right)^2\right] + 10\log_{10}\left[0.625 + 0.375\cos\frac{2\pi f}{125}\right] \text{ dBm/Hz}$$

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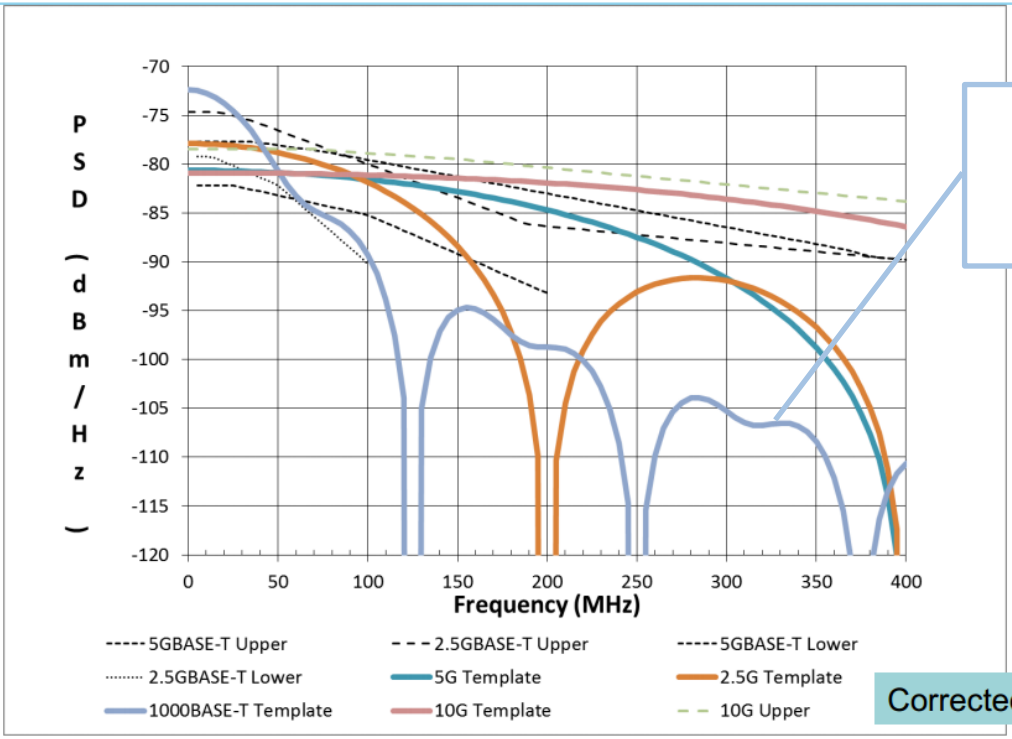
See zimmerman_3bz_02a_0915.pdf

Focus of this comment

Proposed Template PSDs



Proposed 1000BASE-T Approximation

Corrected 8/24

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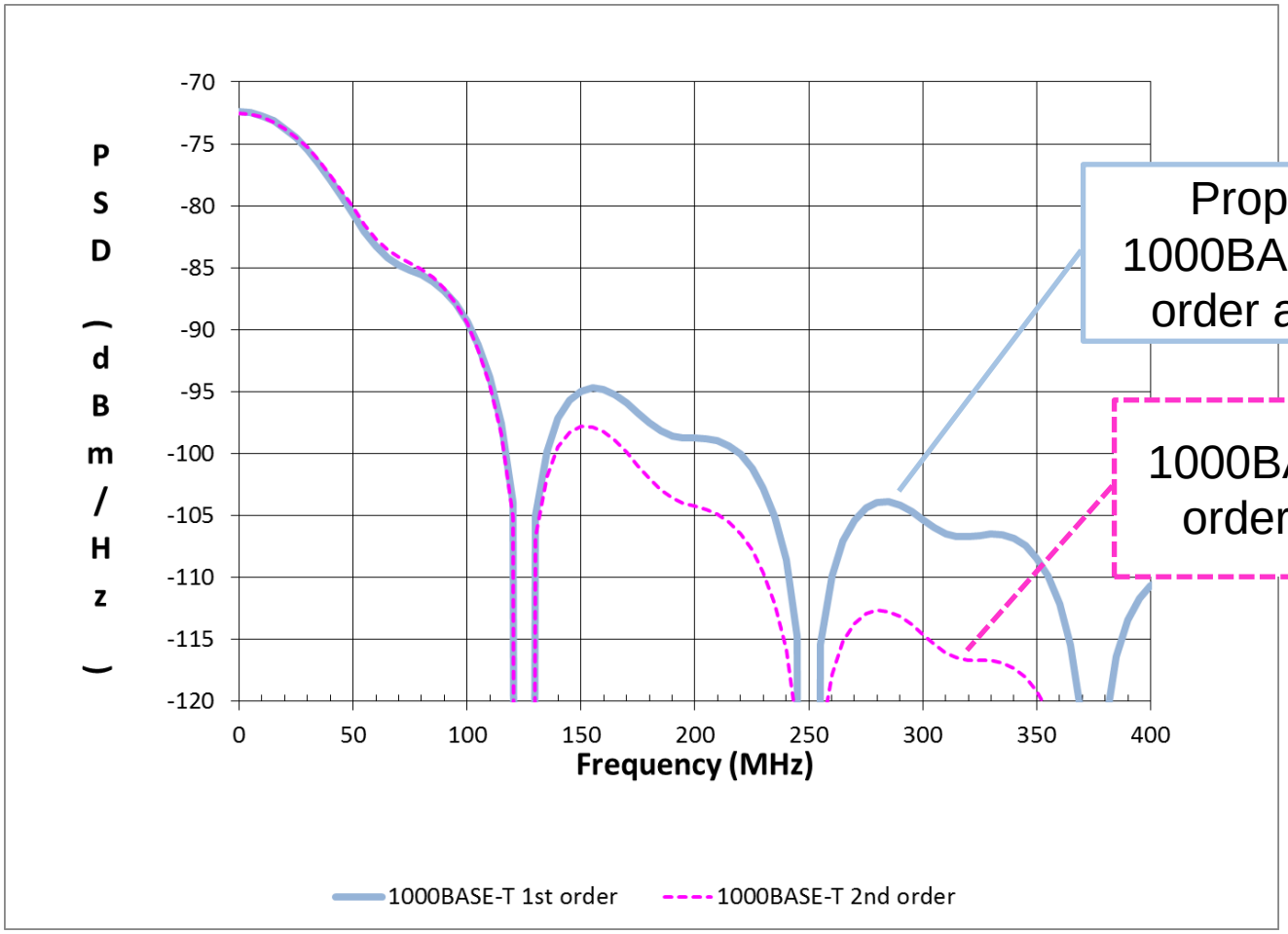
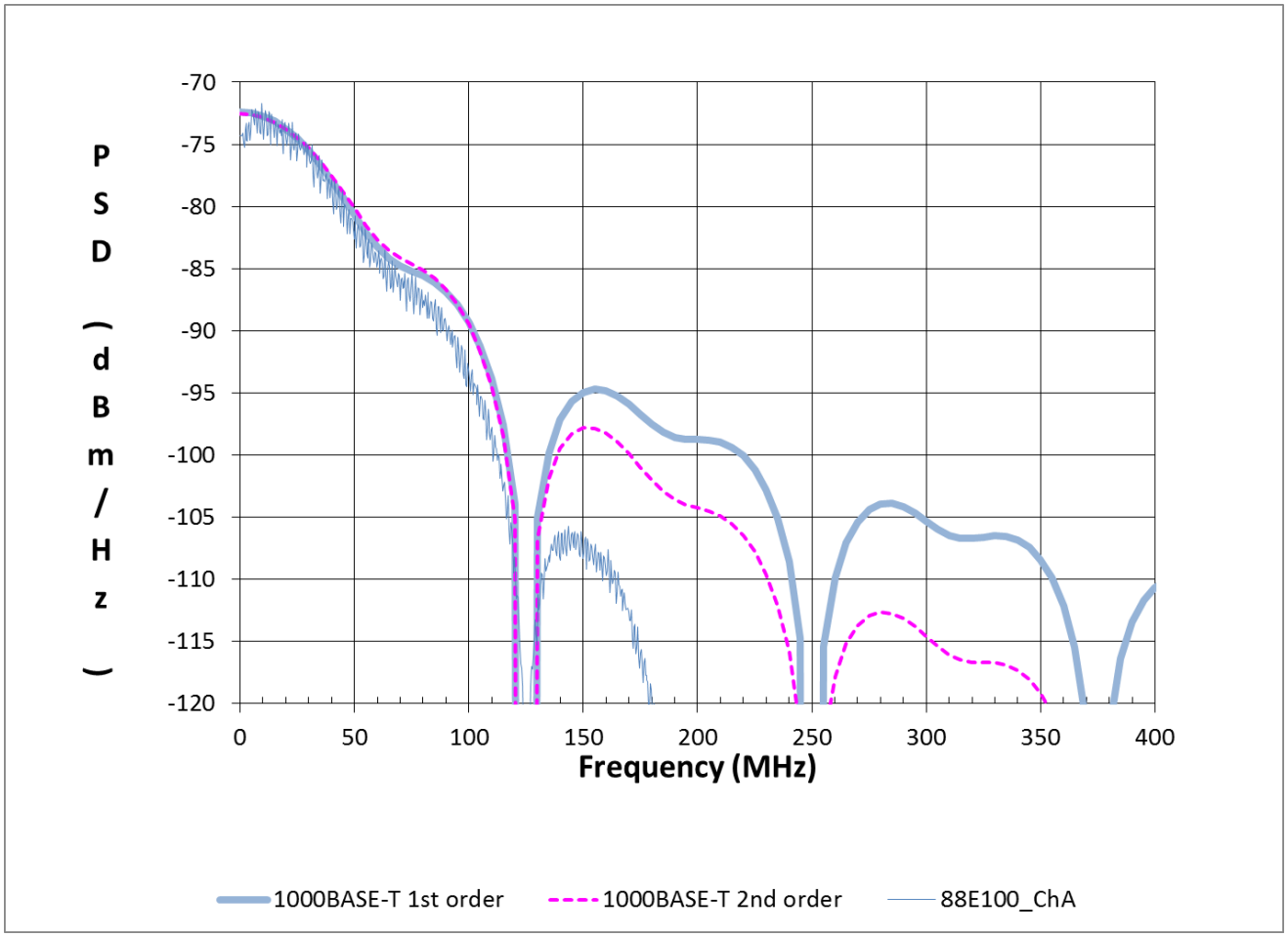
1000BASE-T PSDs



Proposed Template PSDs

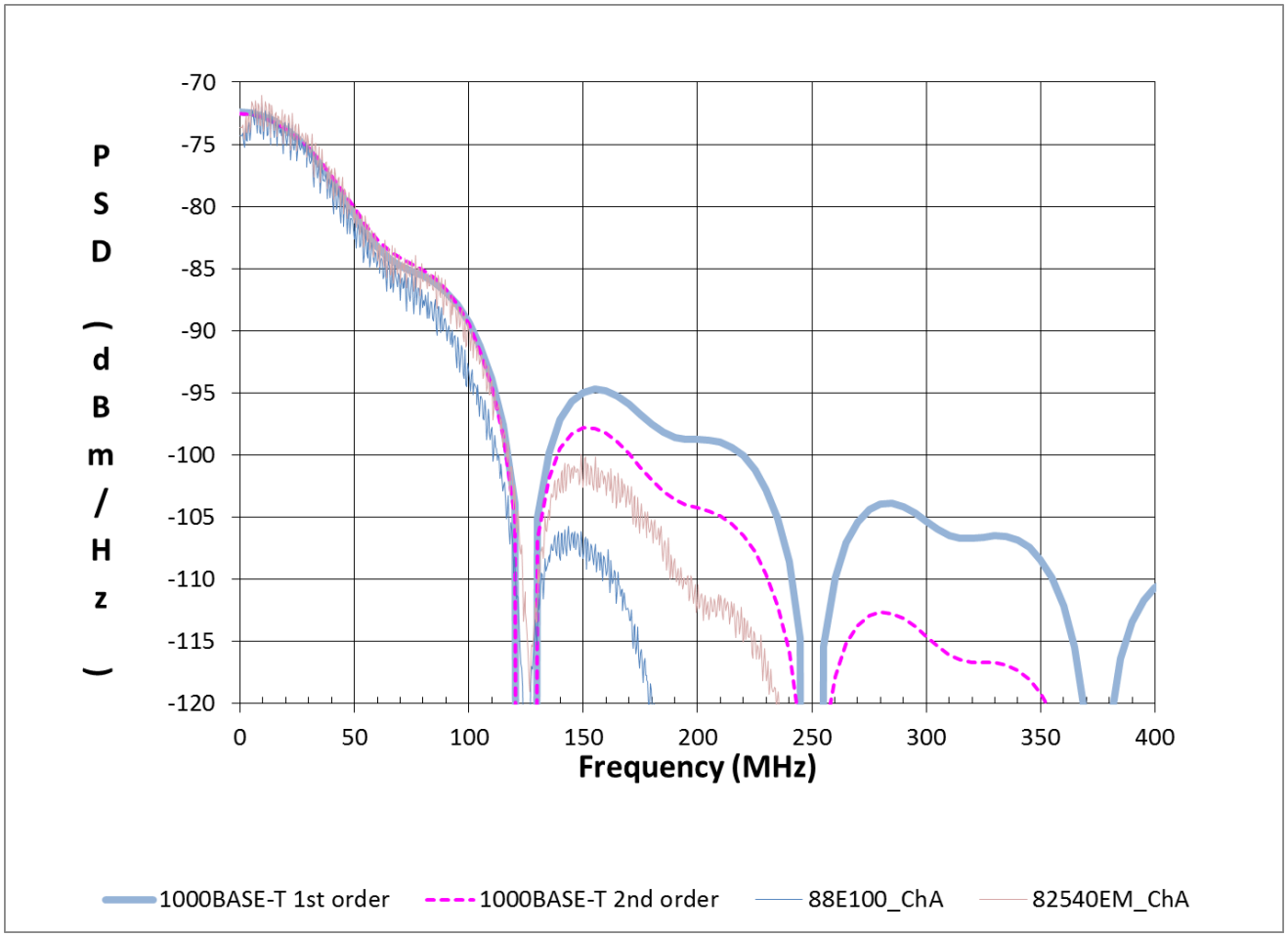
2nd order included for information only

1000BASE-T PSDs



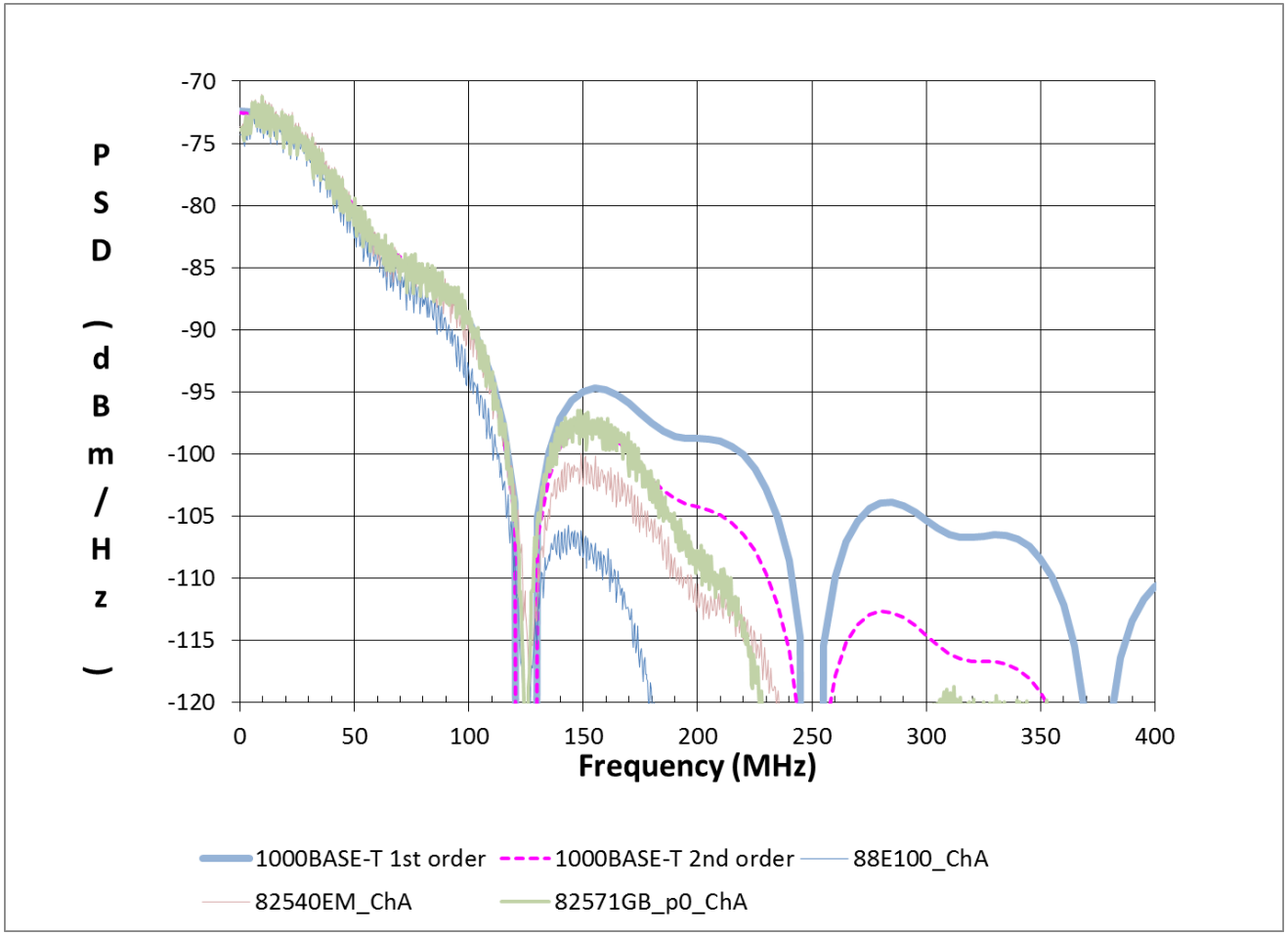
+88E1000 (c 2001)

1000BASE-T PSDs



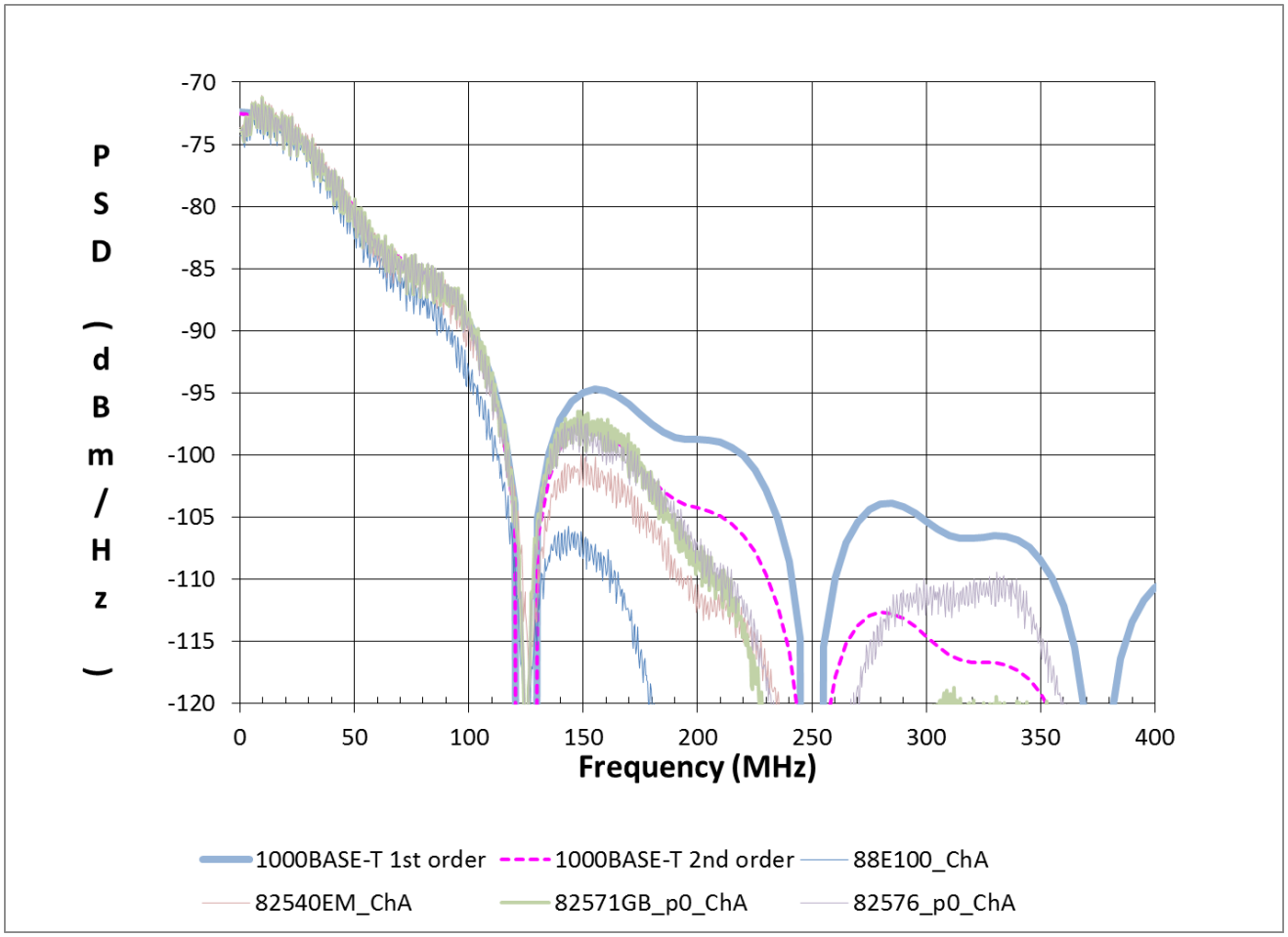
+82540EM (c 2003)

1000BASE-T PSDs



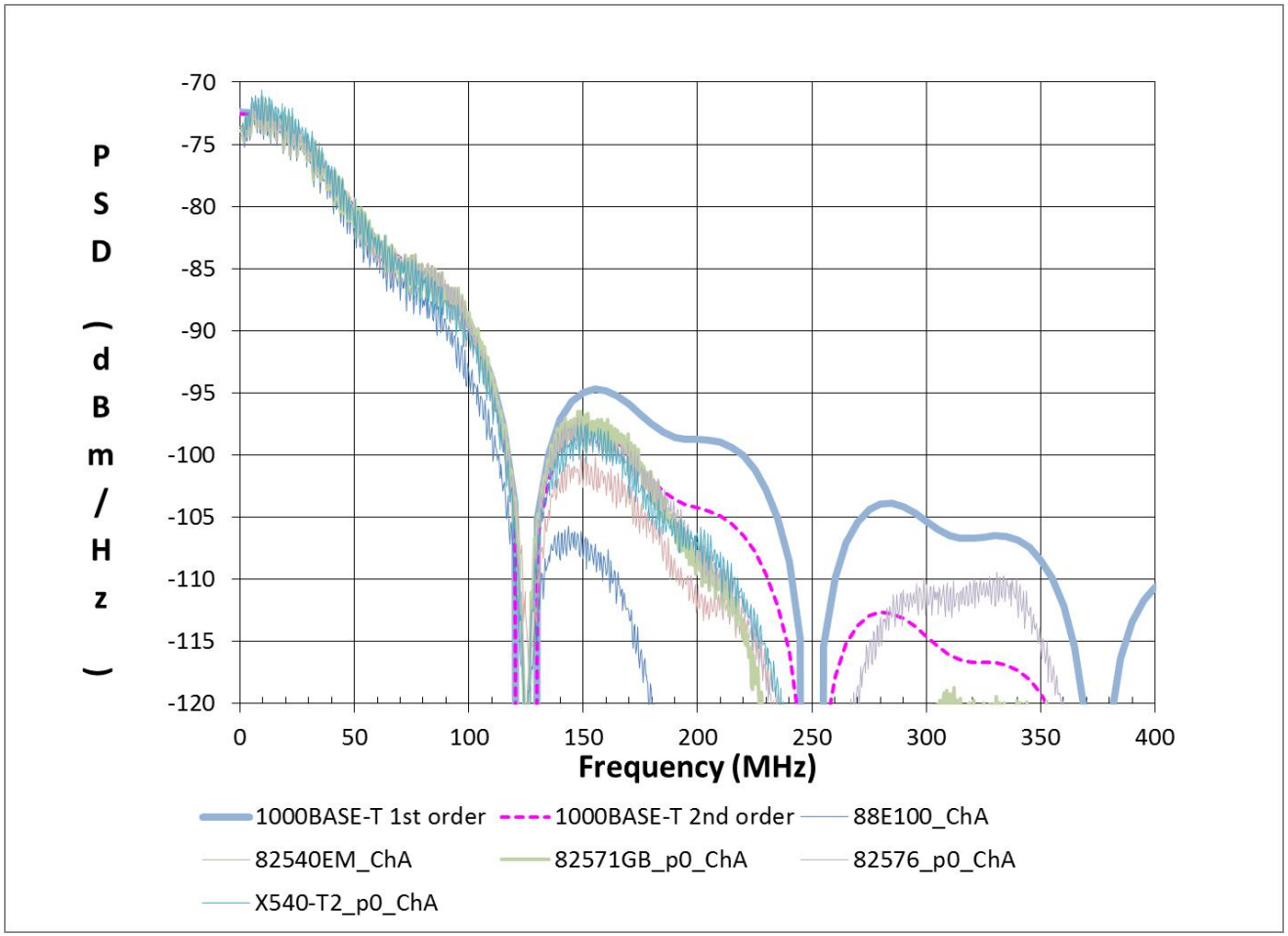
+82571GB (c 2005)

1000BASE-T PSDs



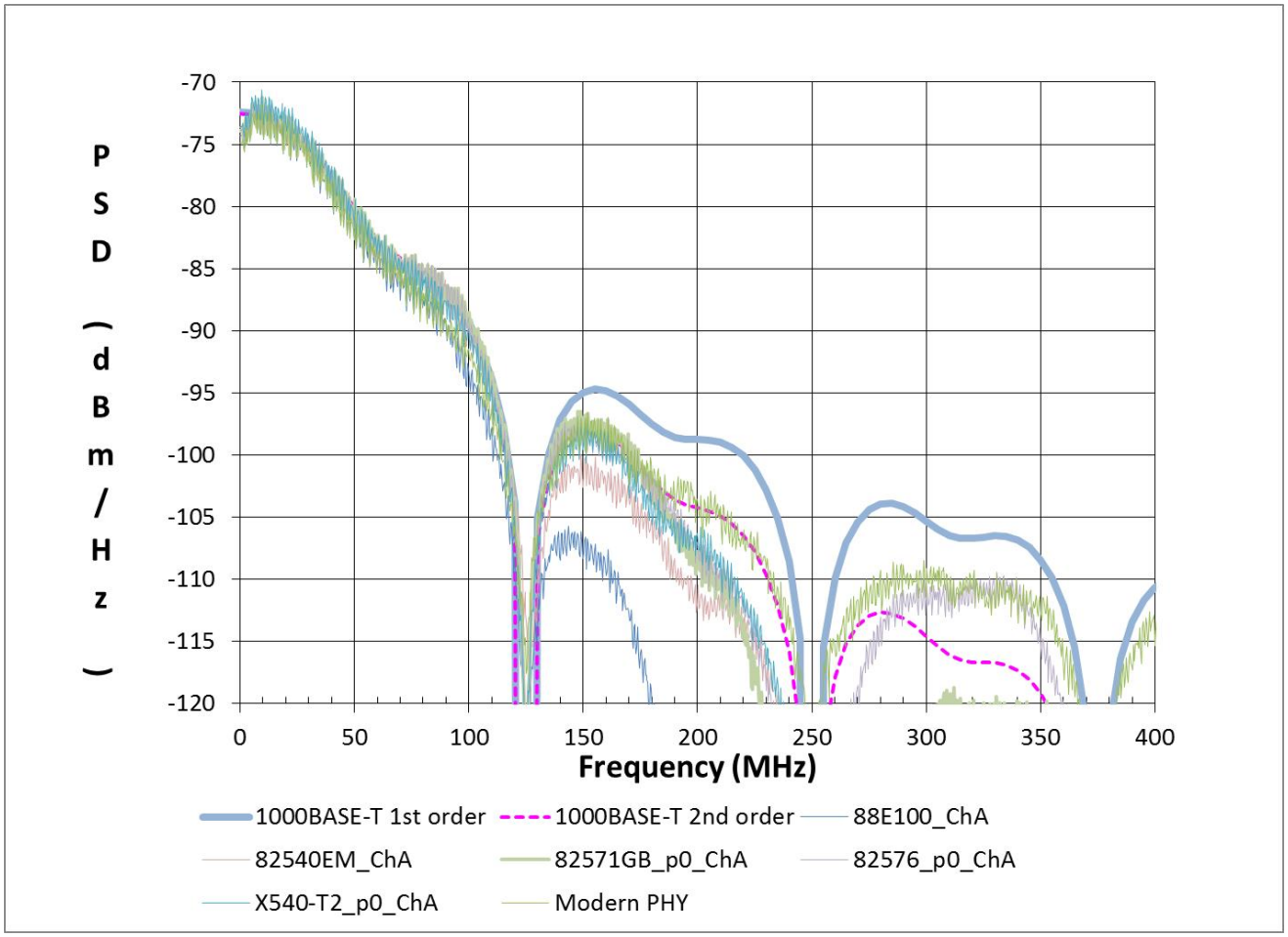
+82576 (c 2007)

1000BASE-T PSDs



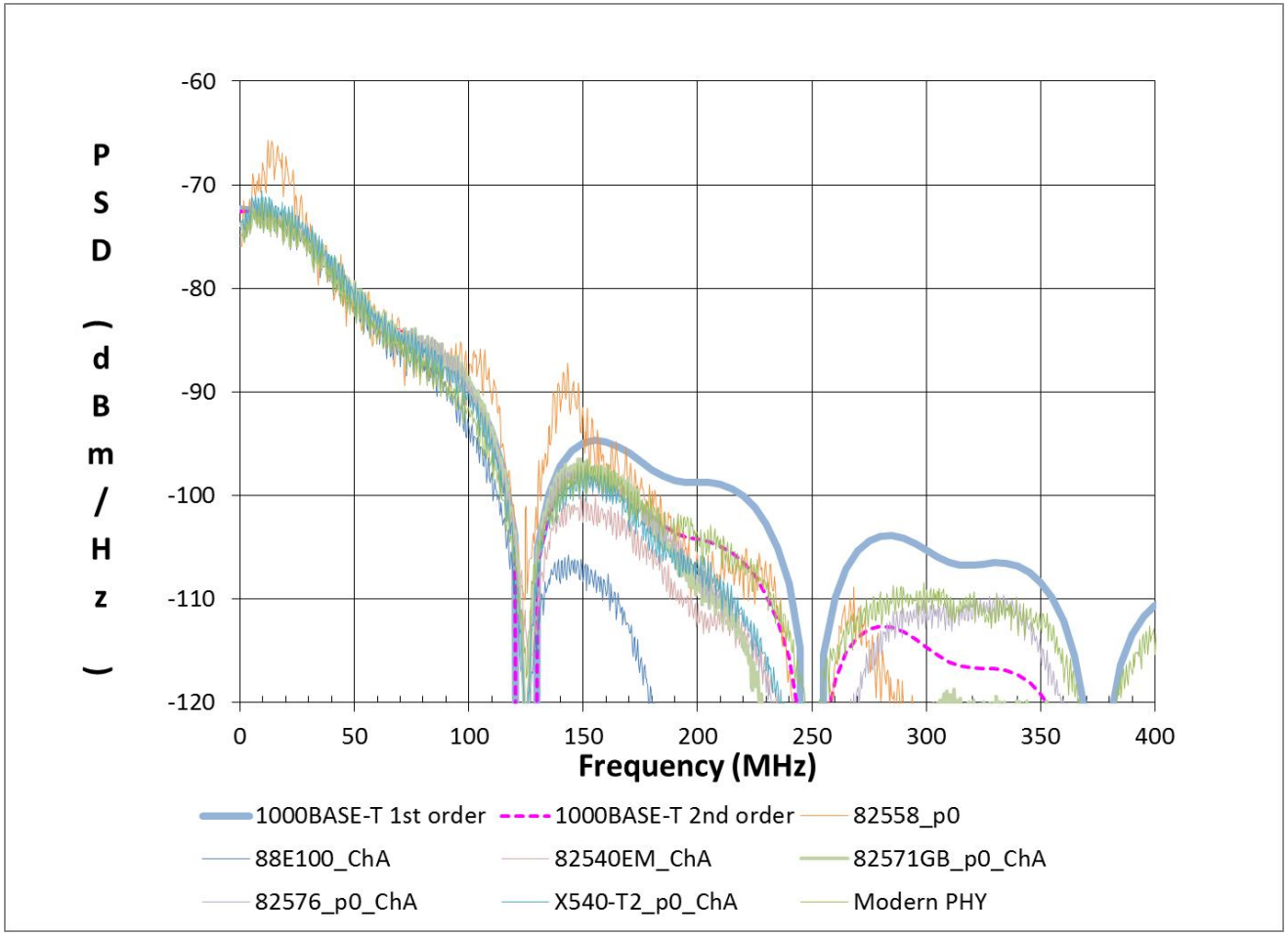
+X540T2 (c 2011)

1000BASE-T PSDs



+ “Modern PHY” (c 2015)

1000BASE-T PSDs



+ 100BASE-TX (c 1998) – Is this a concern?

PHY Tx Power

- Measured 1000BASE-T PHY Tx power compares favorably with the assumed 3.2dBm in the proposed 1000BASE-T template PSD

Device	1000BASE-T Power (3GHz BW)	Comment (Year is a guess)
82558_p0	*5.72 dBm*	Integrated 10/100 controller, 1998
88E100_ChA	*2.11 dBm*	1st gen 1000BASE-T PHY, 2001
82540EM_ChA	*2.92 dBm*	2nd gen integrated 10/100/1000 controller, 2003
82571GB_p0_ChA	*2.72 dBm*	3rd gen dual-port integrated 10/100/1000 controller, 2005
82576_p0_ChA	*2.71 dBm*	4th gen dual-port integrated 10/100/1000 controller, 2007
X540-T2_p0_ChA	*3.25 dBm*	1st gen dual-port integrated 100/1Gb/10Gb controller, 2011
Modern PHY	*2.11 dBm*	2st gen dual-port integrated 100/1Gb/10Gb controller, 2015

Summary

- Measurements of multiple legacy 1000BASE-T devices support the proposed 1000BASE-T approximation for Salz SNR computation
  - 125 MSPS zero-order hold, specified pulse shaping filter, 1st order LPF at 100 MHz, 3.2dBm TX power

Thank You!