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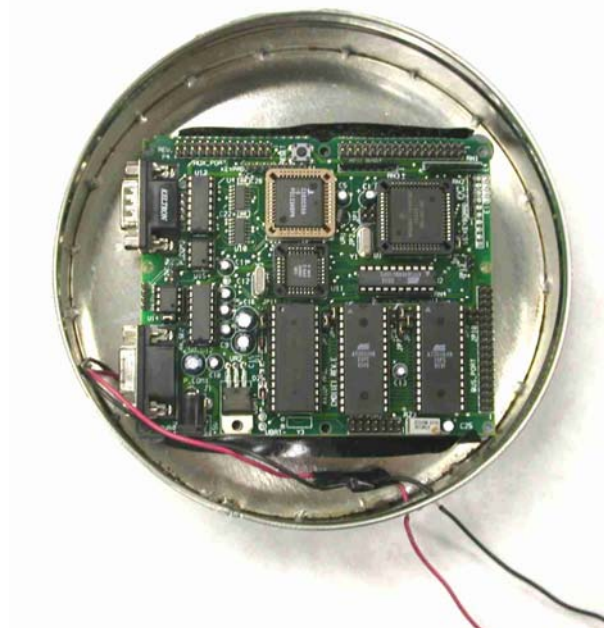
Presented by: Dale L. Sanders

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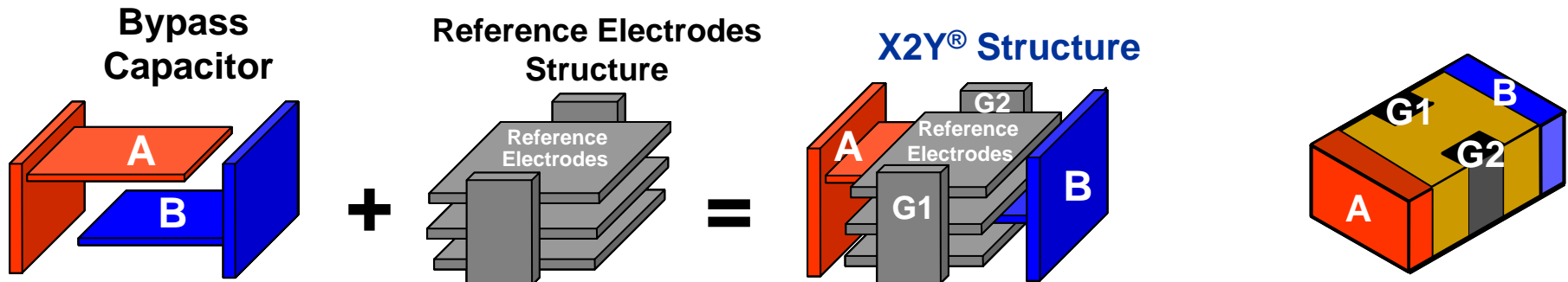
# A Better Approach to DC Power Filtering

Presented at 2004 IEEE International EMC Symposium  
in Santa Clara, CA

- Place a microprocessor inside a shielded enclosure and evaluate the performance of different combinations of power filters against X2Y<sup>®</sup> Technology.

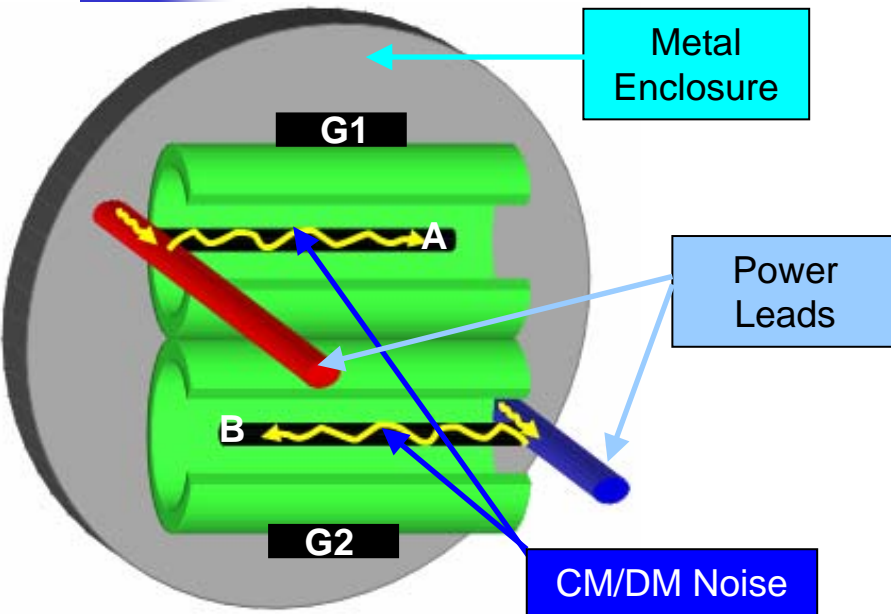


- Symmetrically Balanced Capacitive Circuit.
  - Has same MLCC standard component sizes and capacitance values
  - Has same dielectric, electrode, and termination materials
- Different internal structure
  - A & B electrodes share common reference electrode
  - Reference electrode structure form “quasi” Faraday Cage
  - Structure cancels internal mutual inductance similar to dual coaxial transmission line
  - Several modes of operation (For this paper – CIRCUIT 1)

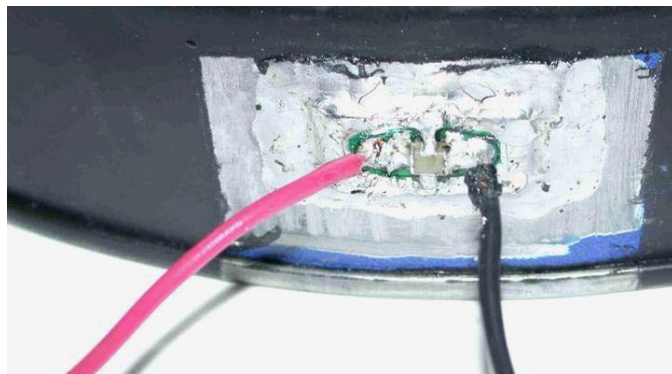


# What is X2Y® Technology? (continued)

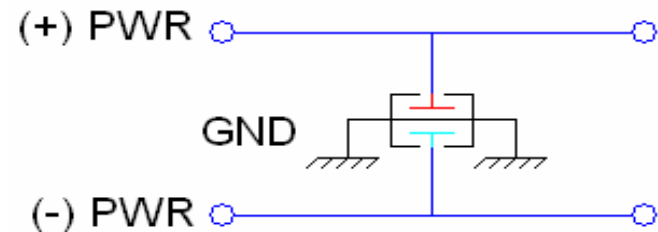
Note: G1/G2 attached to Metal Enclosure



- Circuit 1 – Attached differentially across power leads while referenced (G1/G2) to the enclosure.
- Both CM & DM noise enter the structure in opposing directions which cancel on reference electrodes.
- Unless otherwise noted, this is the X2Y comparison configuration.



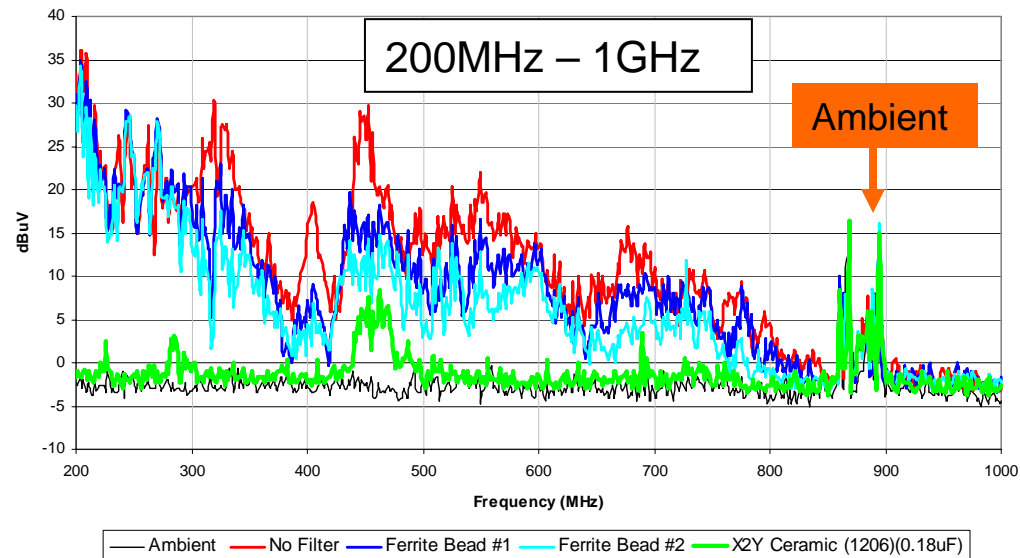
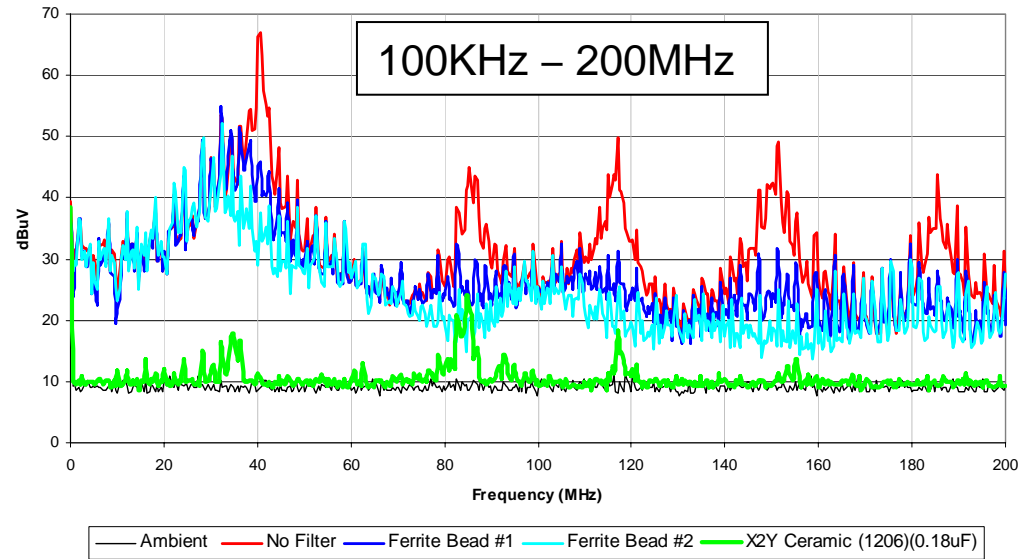
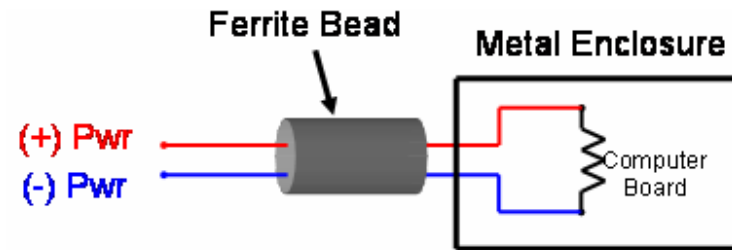
## Circuit 1 Schematic



- DUT and power supply are connected by 3 meter harness.
- RE are measured in a GTEM and recorded with a spectrum analyzer.
- 100kHz – 200MHz a 30dB external pre-amp was used.

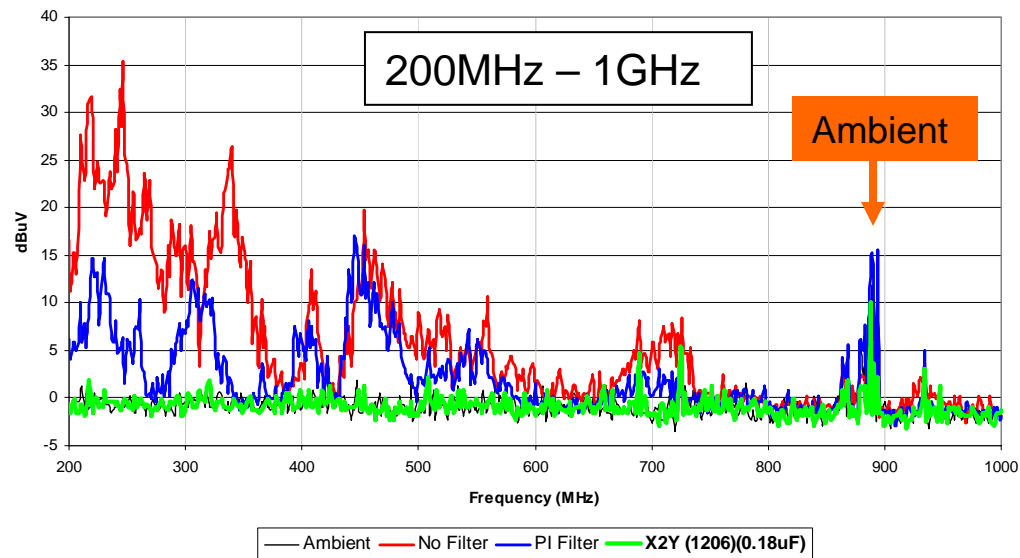
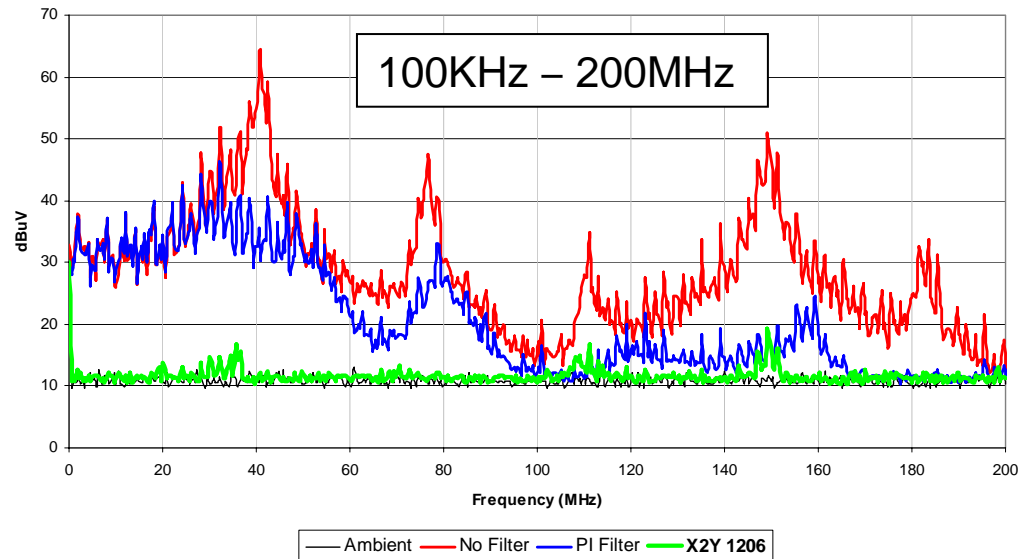
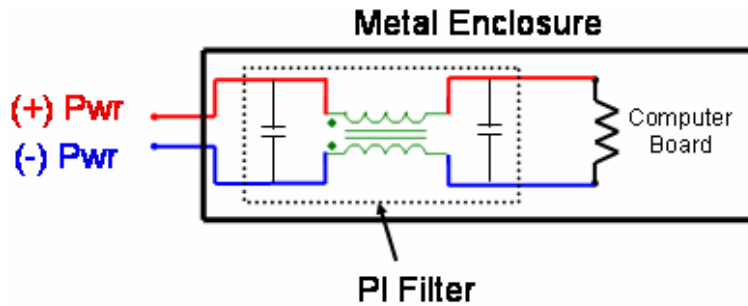


- Bead 1 = 160 ohms @ 25MHz;  
258 ohms @ 100MHz.
- Bead 2 = 66 ohms @ 25MHz;  
110 ohms @ 100MHz.



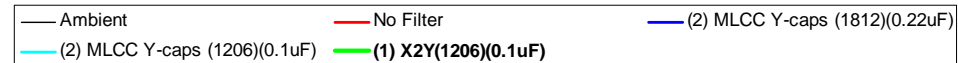
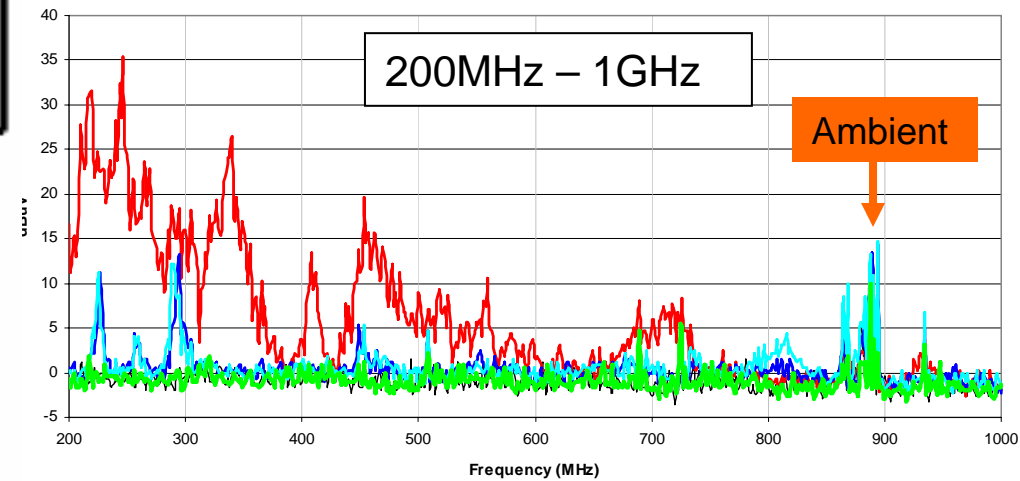
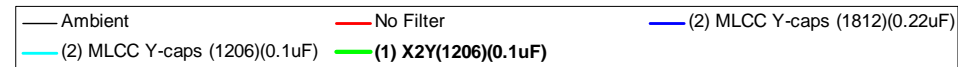
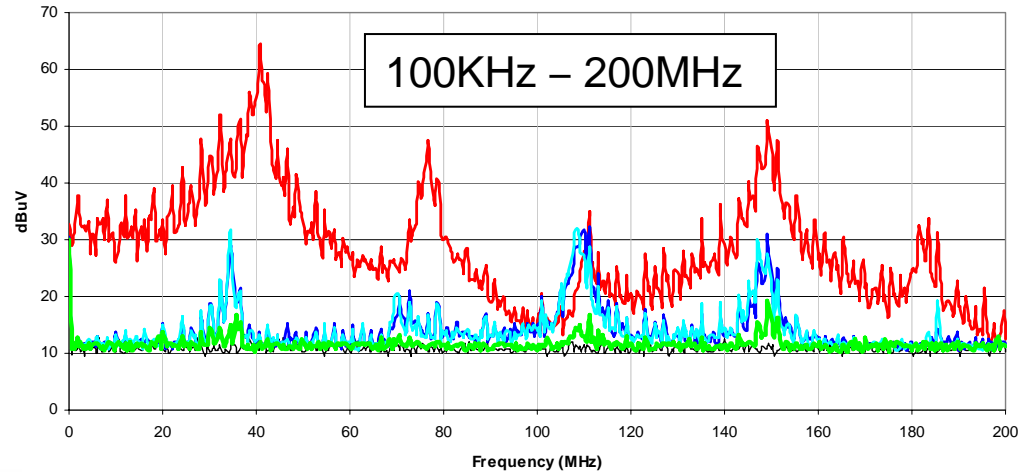


- Pi Filter = X-caps - 1206 (0.1uF) and 1812 (0.22uF); CMC = (0.5nH)

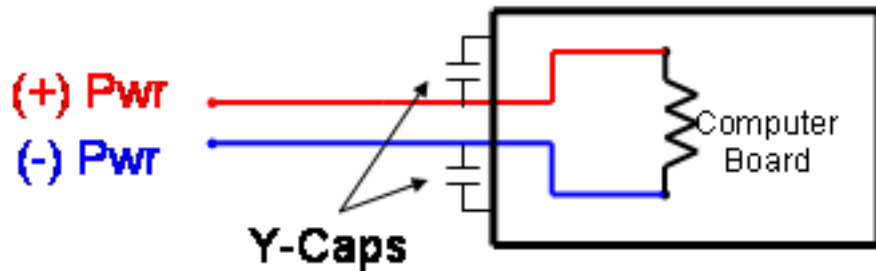


## (2) Y-caps vs. X2Y<sup>®</sup>

- Y-caps = 1812 (0.22uF)
- Y-caps = 1206 (0.1uF)



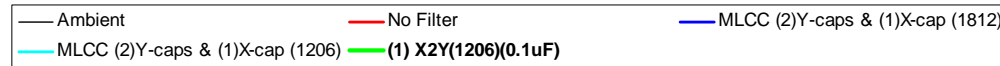
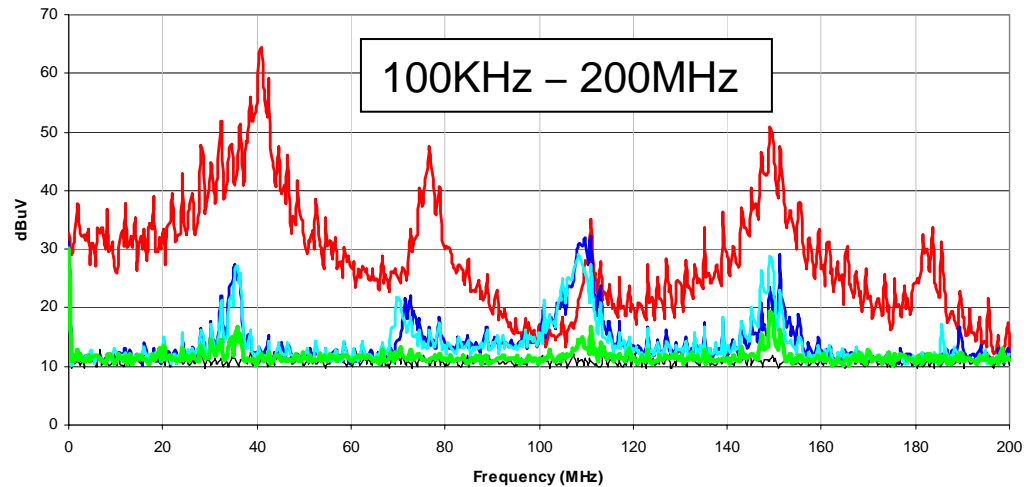
Metal Enclosure



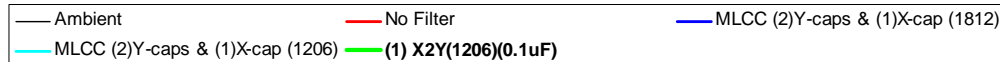
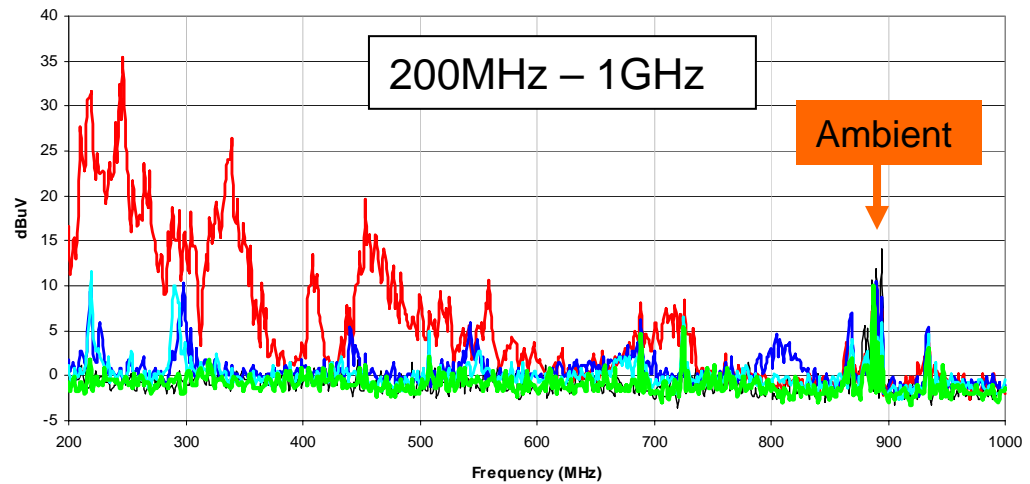
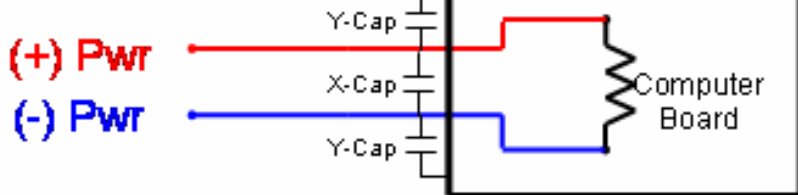


# X-cap & (2) Y-caps vs. X2Y<sup>®</sup>

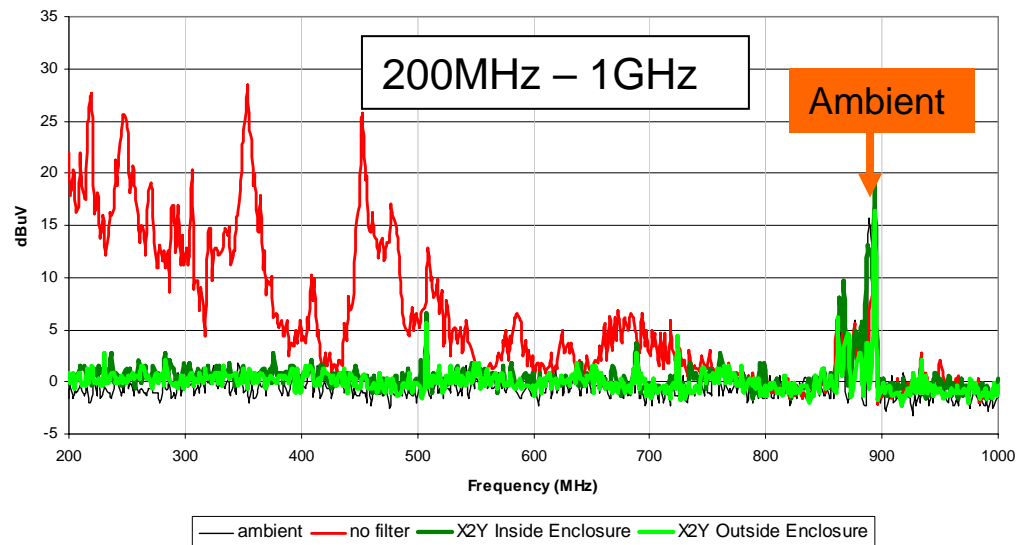
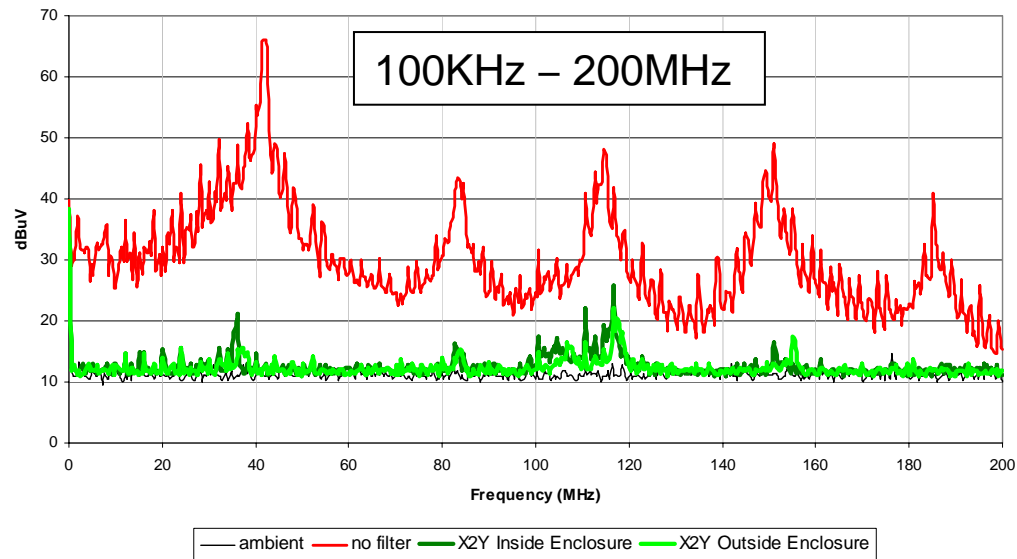
- X/2Y = Y-cap 1812 (0.22uF);  
x-cap 1812 (0.12uF)
- X/2Y = Y-cap 1206 (0.1uF);  
x-cap 1206 (0.47uF)



## Metal Enclosure

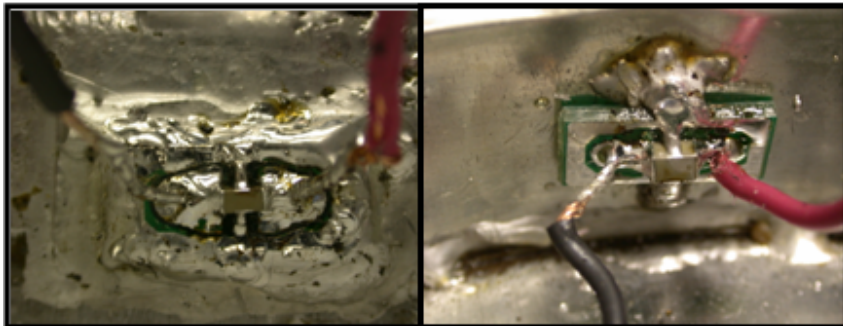


- Nominal difference inside vs. outside.



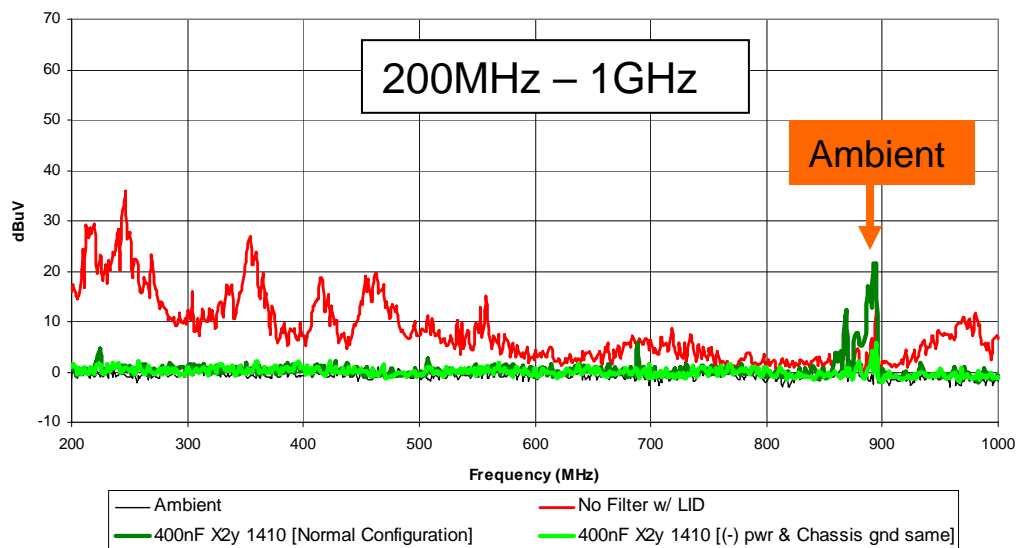
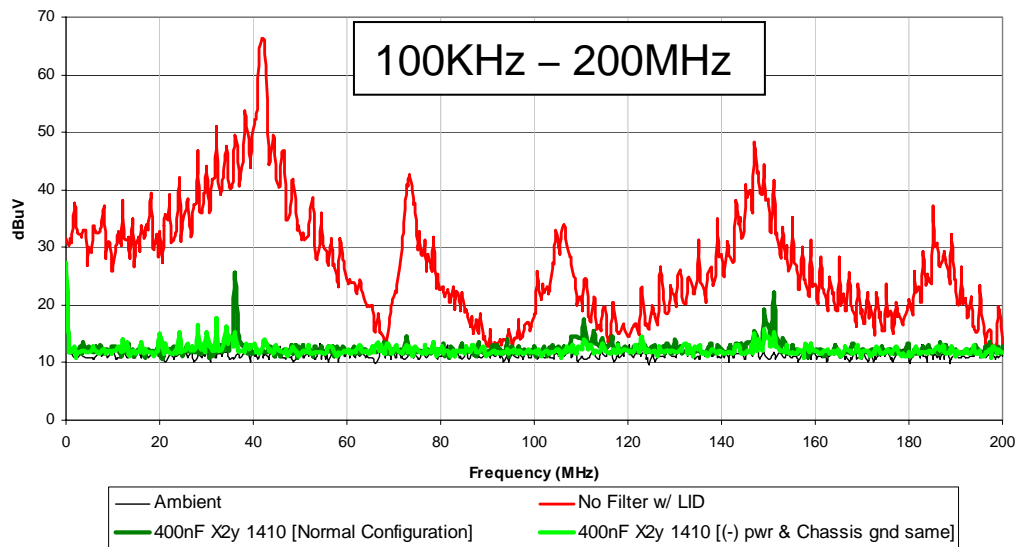
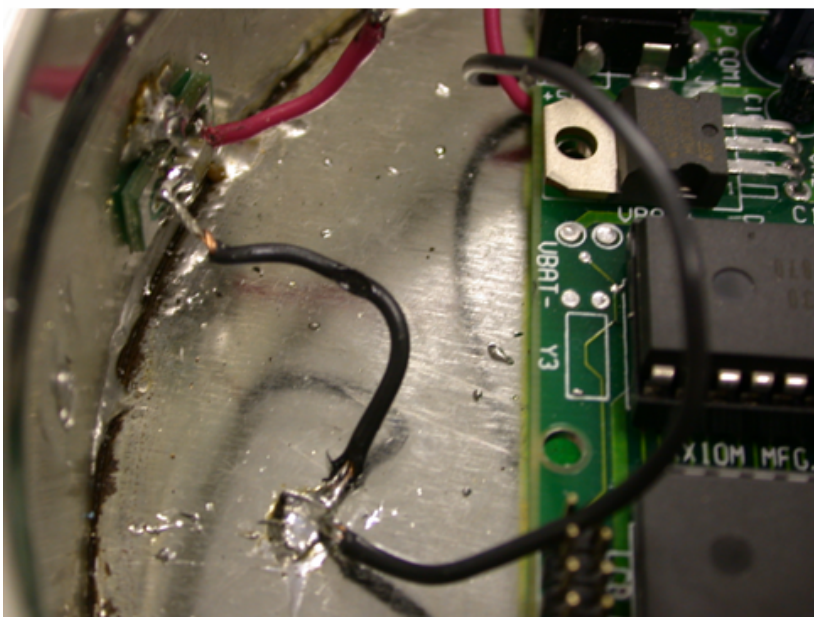
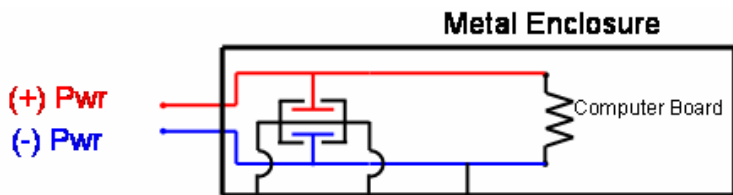
Outside Enclosure


Inside Enclosure



# X2Y<sup>®</sup> (-) Power lead attach to Enclosure vs. Isolated

- Nominal difference when (-) power and chassis are the same.



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- X2Y<sup>®</sup> vs. the 4 conventional filters
    - Best filtering performance in reducing radiated emissions.
    - Smallest layout space to implement.
    - Cheapest production cost.
    - X2Y<sup>®</sup> offered 3 different implementation configurations for designers.

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# Questions?

Acknowledgements: We would like to thank Dave Anthony, Ken Musil, Mary Haldi, and William Anthony for their comments and time.