Ferrite Bead Removal

Summary

Laptop computers, digital cameras and other consumer electronic devices currently require the use of a bulky ferrite filter on the power cord to meet FCC Subpart B or equivalent EMC regulations.

The X2Y® filtering revolution offers an alternative that saves space and lowers cost with superior filtering performance. X2Y® components eliminate the need for cumbersome ferrite devices.

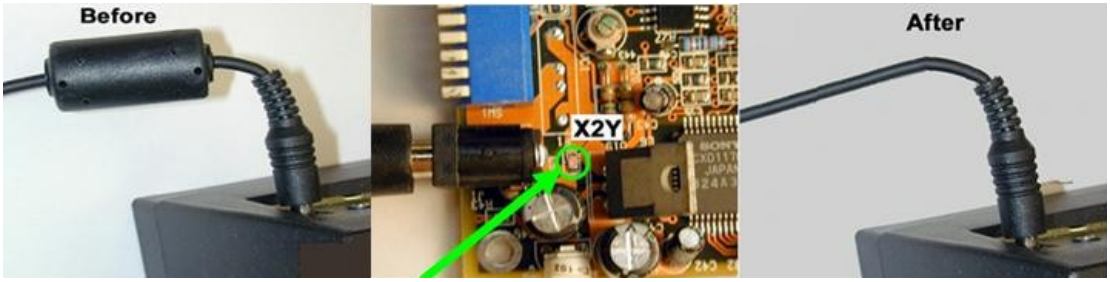

Figure 1. *Example of a ferrite bead being replaced by an X2Y® component.*

This application note outlines a laboratory experiment measuring radiated and conducted emissions of a microprocessor board filtered with an X2Y® component versus a ferrite slug.

Experiment Setup

The experiment protocol will consist of a CMD-11E1 single board computer manufactured by Axiom Manufacturing Inc. Hook-up wire is soldered to the board input power outlet. The single board computer is placed into a metal enclosure (Figure 2). Two small holes are drilled into the enclosure for access to the power leads. An array of D cell batteries is attached to the power leads to provide a 6 volt DC power supply.

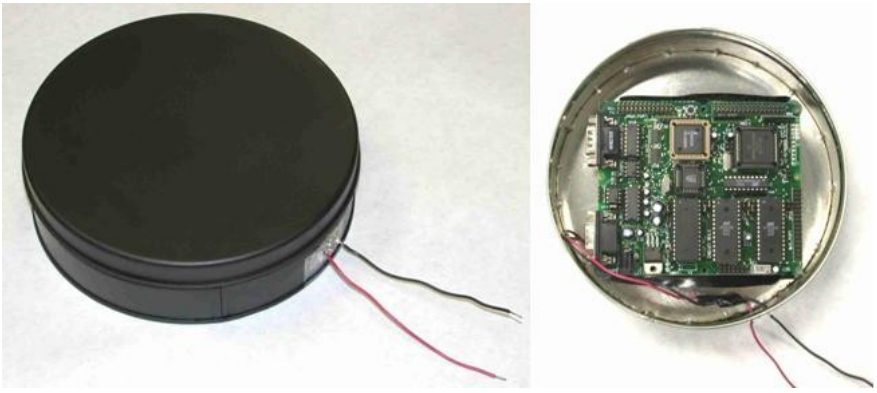

Figure 2. *Metal enclosure closed (Left); CMD-11E1 in metal enclosure.*

The DUT will be (Figure 3):

1. Ferrite Bead 28B0562-200[1]
2. Ferrite Bead 28B0375-100[2]
3. X2Y® 560nf ceramic 1410
4. X2Y® 180nf ceramic 1206
5. X2Y® ferrite 1812
6. X2Y® ferrite 1206

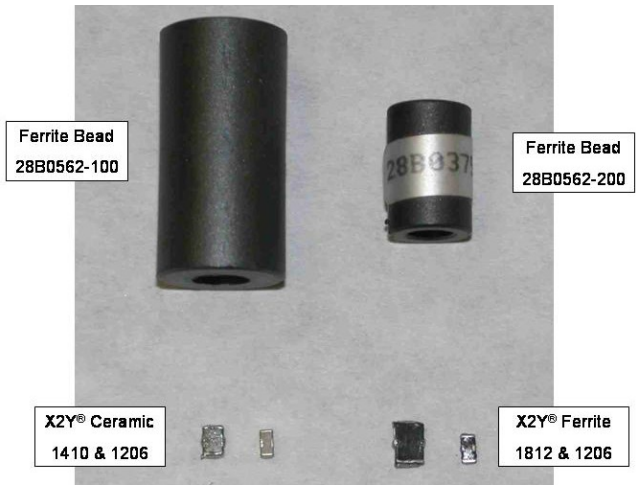

Figure 3. *Ferrite bead (top), X2Y® 1206 ceramic (bottom-left),* X2Y® *1206 ferrite (bottom-right)*.

The ferrite bead will be placed around the positive and negative power leads and as close as possible to the metal enclosure. For the X2Y® component, a small PCB is attached to the metal enclosure with metal tape (3M 1345). The X2Y® component will then be soldered to the PCB (Figure 4).

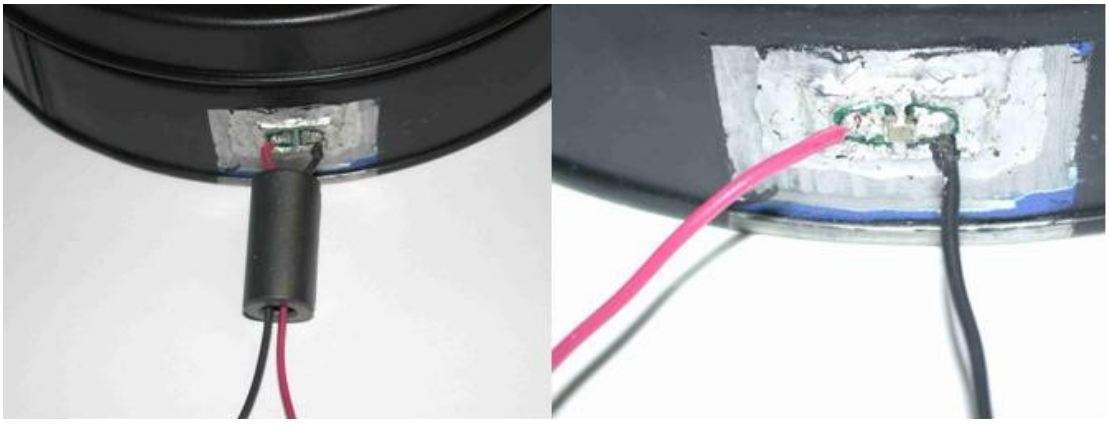

Figure 4. *DUT placement on metal enclosure*.

The laboratory equipment used in this experiment are a GTEM (ETS-Lindgren IC-GTEM 250) (Figure 5), spectrum analyzer (IFR AN920) (Figure 6), preamp (AR LN1000) (Figure 7), a current probe (FCC F-35-4) (Figure 8), and a modified metal toolbox (Figure 9). All radiated emissions tests were performed in the GTEM. All conducted emissions tests were performed in the metal toolbox.

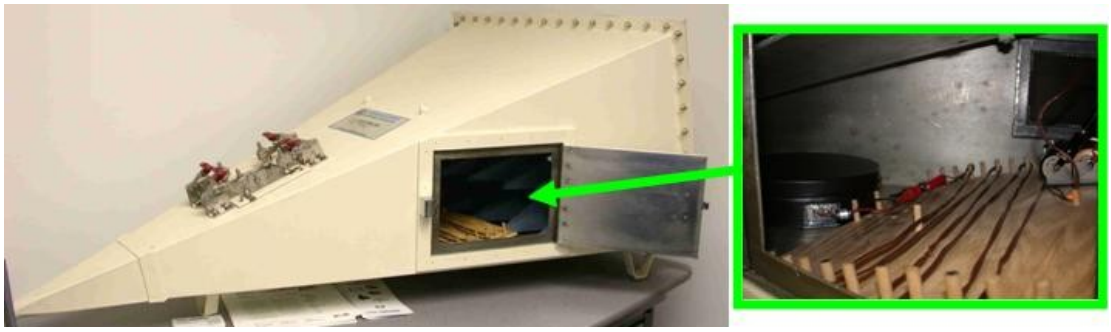

Figure 5. *GTEM (ETS-Lindgren IC-GTEM 250) to measure radiated emissions (left); DUT placement in GTEM (right)*.

Figure 6. *Spectrum analyzer (IFR AN920)*.

Figure 7. *Preamp (AR LN1000) used to amplify the frequencies 200 MHz to 1 GHz*.

Figure 8. *Current Probe (FCC F-35-4).*

Figure 9. *Modified metal toolbox used to measure conducted emissions (left); DUT placement (right).*

Radiated Emissions From 100 KHz to 200 MHz

The first measurement recorded the radiated emissions from 100 KHz to 200 MHz. Figure 10 is a plot of the results.

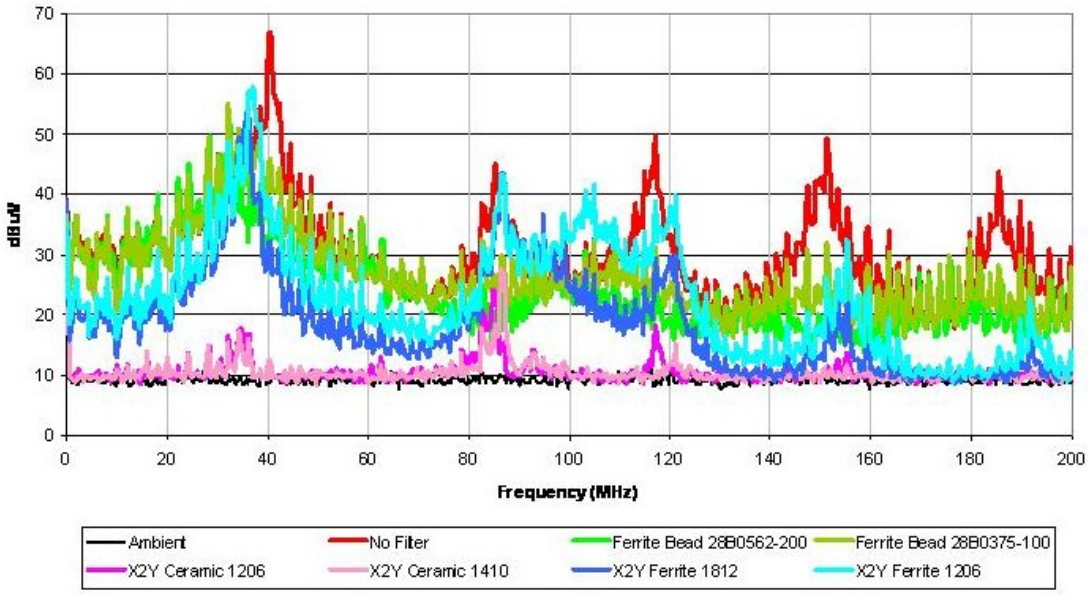

Figure 10. *Plot of Radiated Emissions from 100 KHz to 200 MHz.*

Radiated Emissions From 200 MHz to 1 GHz

The second measurement recorded the radiated emissions from 200 MHz to 1 GHz. Figure 11 is a plot of the results.

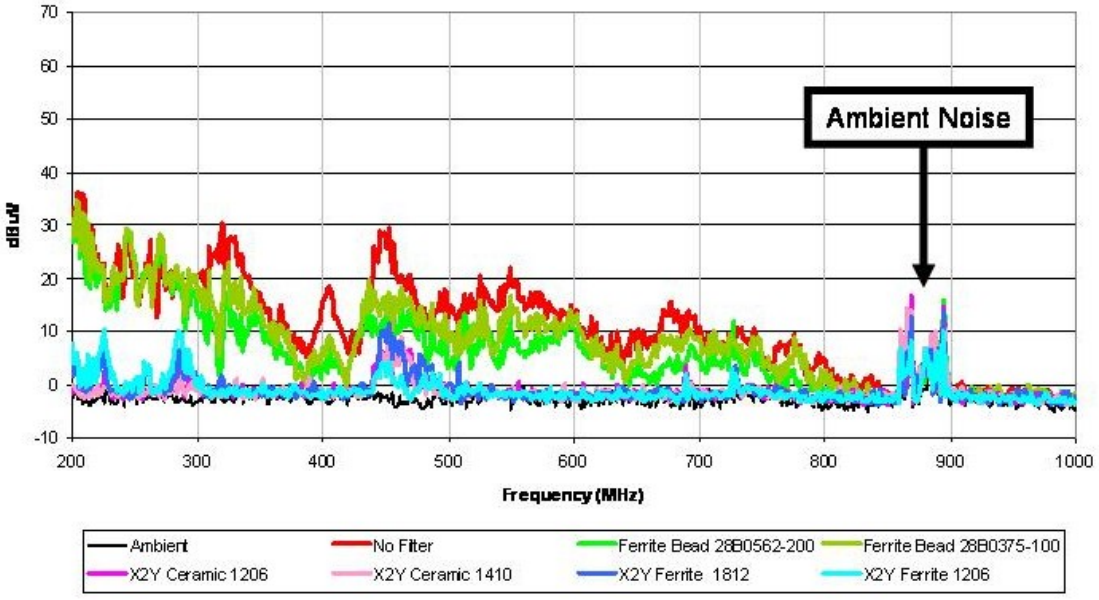

Figure 11. *Plot of Radiated Emissions from 200 MHz to 1 GHz*.

Conducted Emissions From 100 KHz to 200 MHz

The third measurement recorded the conducted emissions from 100 KHz to 200 MHz. **Error! Reference source not found.** is a plot of the results.

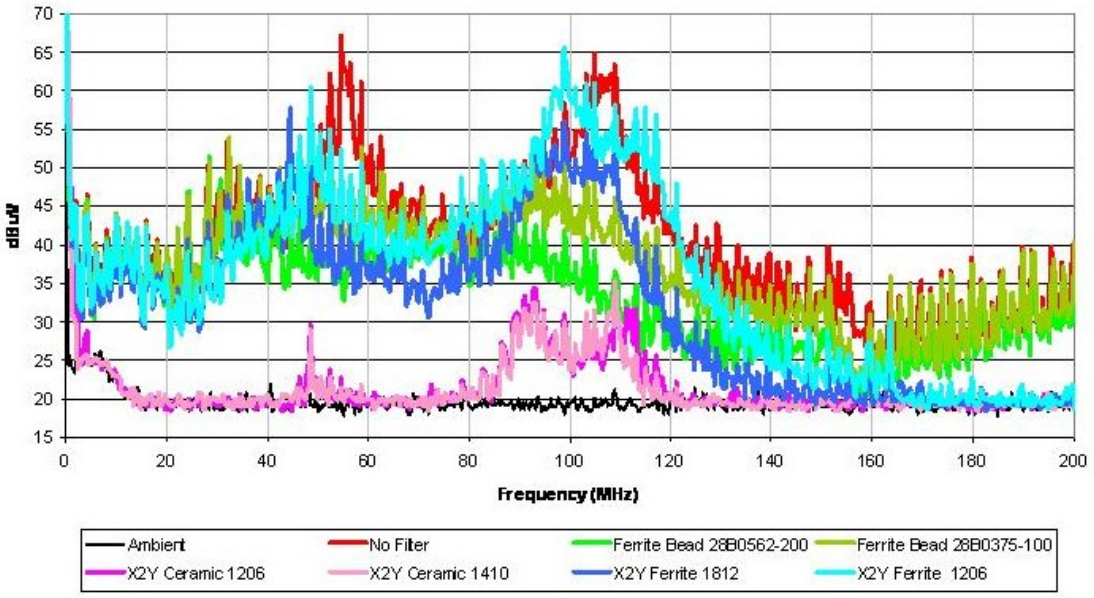

Figure 12. *Plot of Conducted Emissions for 100 KHz to 200 MHz*.

Conclusion

An X2Y® ceramic component offers superior performance over a ferrite bead in reducing radiated and conducted emissions. An X2Y® ferrite component offers comparable results to the ferrite bead, but in a substantially smaller package.

Note: X2Y® ferrite components are currently under development as of June 2003.

Note: Performance results reported in this and other application notes can only be achieved with patented X2Y® components sourced from X2Y® licensed manufacturers or their authorized distribution channels.

References

[1] Steward Ferrites PTE LTD, Hhttp://www.steward.com/H

[2] Steward Ferrites PTE LTD, Hhttp://www.steward.com/H

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