White Paper WP11

EMI Compliant 802.3af PD Design with AS160X & AS1100

Revision 1.4
November 2007

Preliminary Information subjected to future revision and changes

switching FET's have been carefully balanced with matching slew rates to further minimize the effect of switching noise.

Power transformer has been custom designed to meet tough and challenging noise requirements of the POE systems. The transformer uses smallest core size based on Wattage/efficiency requirement of the 802.3af applications and better internal insulation to significantly reduce the inter-winding capacitance, and hence noise injection from primary to secondary ground.

For superior EMI performance, Forward topology with dual switching FETs is recommended for AS1100. This minimizes peak currents and injected noise.

Radiated Emissions Measurement

The results below indicate that the AS1100 exceeds Class B compliance with significant margin. Below plot has been obtained without Ethernet traffic but with fully loaded PD to isolate the effect of Switching Converter sub-system from rest of Ethernet related noise issues.

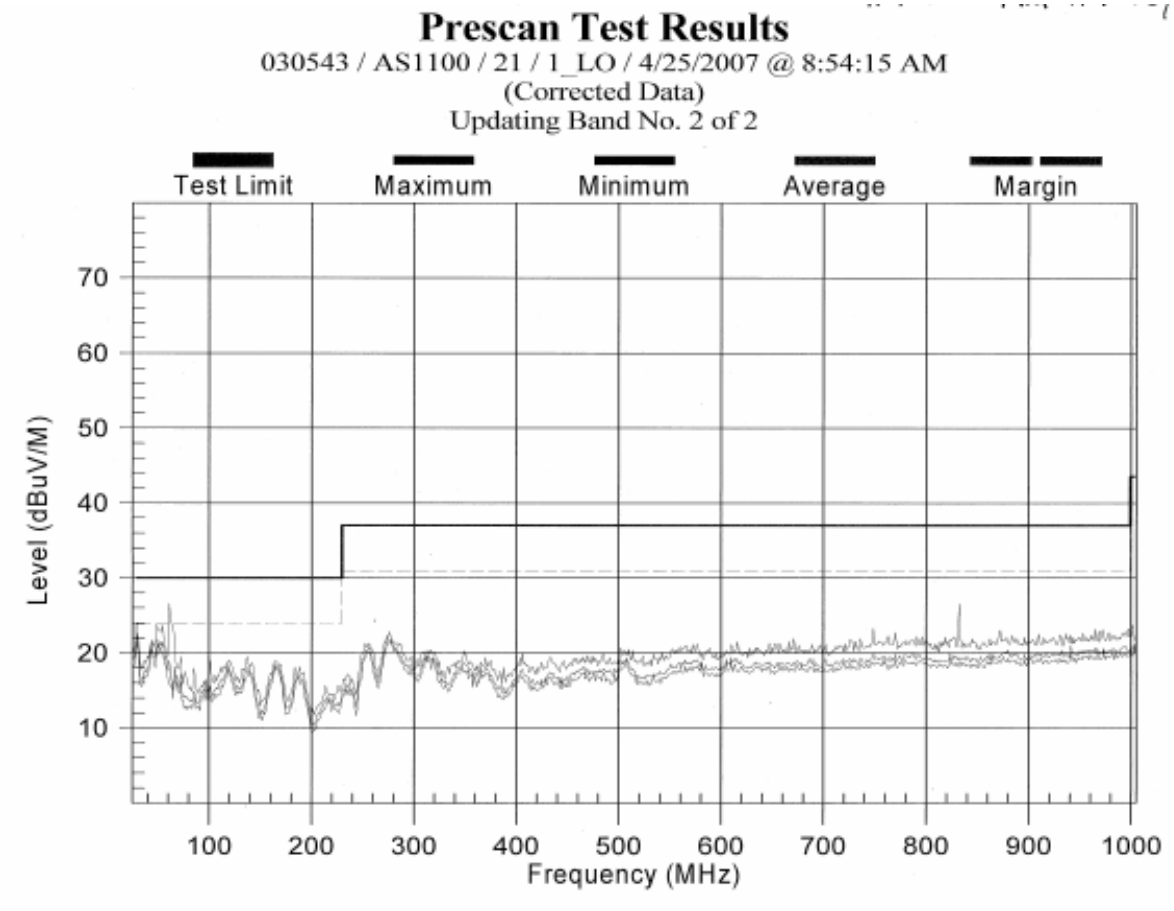

Figure 8: AS1100 based PD-Splitter EMI scan – 10Watt load

Summary

Managing noise in complex POE-PD systems is a challenging task as there are various contributors close to the Ethernet UTP interface. Meeting stringent CISPR 22 Class B or FCC Class B emissions requirements requires simultaneously addressing all the noise variables in the system. These include reducing the common-mode noise on all the direct paths to the UTP interface, choosing low noise topologies for components like switching DC-DC converters that reduce ground bounce, managing impedance of all ground planes and ground connections for shields etc, and good board layout practices to minimize board level radiations.

Emissions on the UTP cable have a direct correlation with the common-mode noise leaking on to the Ethernet cable. CM noise in the system will try to find the lowest impendence path to the UTP cable. Actual level of emissions at any frequency depends on the location and amplitude of the noise source, and impedance ratio between the path between the noise source and UTP, and antenna impedance of the cable. Frequency dependent nature of the noise sources and impedances makes analysis fairly complex and intractable to predict the results. System designers typically find that as they fix one noise path in the system, noise finds next alternate path to dominate and radiate at a different frequency.

The Akros proprietary architectures as implemented in AS160X and AS1100 products, when combined at that system level, address multiple common-mode noise generation and transmission issues for the UTP Ethernet interface. This helps reduces EM emissions significantly compared to traditional POE-PD solutions. Using AS160X and AS1100 still requires system designer to follow general good EMC design practices, especially related to board layout and power-supply decoupling/filtering.

In conclusion, the AS160X and AS1100 series devices provide following value proposition to the system designers:

- Enables easy compliance to EMI Class B requirements for Radiated and Conducted Emissions, with consistent margin
- Improves system EMI robustness – reduces effect of manufacturing variances (Txfrmrs, boards)
- Enables transition from Class A compliant equipment to Class B compliant equipment
- Reduces development cycle with fewer board spins and less time in compliance testing
- Robust designs increase front-end design reuse

References

AS1601 Datasheet, Akros Silicon

AS1602 Datasheet, Akros Silicon

AS1113 Datasheet, Akros Silicon

AS1124 Datasheet, Akros Silicon

AS1100 Radiated Emission Compliance Lab Test Report, Akros Silicon

Contact Information & Notices

Headquarters
Akros Silicon Inc.
6399 San Ignacio Ave, Suite 250, San Jose, CA 95119
USA
Tel: (408) 746-9000 ext. 100
Fax: (916) 351-8102
Email inquiries:
marcom@akrossilicon.com
Website: www.akrossilicon.com

Regional Offices
Northern CA

Akros Silicon, Inc.
1296 Kifer Road, Suite 603
Sunnyvale, CA 94086
Tel: 408-746-9000

Canada

Brian Turner and Associates
51 Cecil Walden Ridge, Kanata
ON K2K 3C6 Canada
Tel: 613-254-9024
Website: www.btai.ca

IMPORTANT NOTICES

Legal Notice

Akros Silicon™ assumes no responsibility or liability for information contained in this document. Akros reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or services without notice. The information contained herein is believed to be accurate and reliable at the time of printing.

LIFE SUPPORT POLICY

LIFE SUPPORT: AKROS' PRODUCTS ARE NOT DESIGNED, INTENDED, OR AUTHORIZED FOR USE AS COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS. NO WARRANTY, EXPRESS OR IMPLIED, IS MADE FOR THIS USE. AUTHORIZATION FOR SUCH USE SHALL NOT BE GIVEN BY AKROS, AND THE PRODUCTS SHALL NOT BE USED IN SUCH DEVICES OR SYSTEMS, EXCEPT UPON THE WRITTEN APPROVAL OF THE PRESIDENT OF AKROS FOLLOWING A DETERMINATION BY AKROS THAT SUCH USE IS FEASIBLE. SUCH APPROVAL MAY BE WITHHELD FOR ANY OR NO REASON.

"Life support devices or systems" are devices or systems which (1) are intended for surgical implant into the human body, (2) support or sustain human life, or (3) monitor critical bodily functions including, but not limited to, cardiac, respirator, and neurological functions, and whose failure to perform can be reasonably expected to result in a significant bodily injury to the user. A "critical component" is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

SUBSTANCE COMPLIANCE

With respect to any representation by Akros Silicon that its products are compliance with RoHS, Akros Silicon complies with the Restriction of the use of Hazardous Substances standard ("RoHS"), which is more formally known as Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. To the best of our knowledge the information is true and correct as of the date of the original publication of the information. Akros Silicon accepts no duty to update such statements