



Application Note #120:

Overview of Basic Problems Encountered with PSTN Lines that can Adversely Affect DAA and Modem Operations

INTRODUCTION

This application note discusses problems typically encountered by users of DAAs and modem modules. The comments contained herein are cautionary and underscore Cermetek Microelectronics' position that operability issues are best addressed during the design phase. In fact, most field operability problems can be avoided if the manufacturer of the end product follows the recommended protection schemes described in Cermetek's datasheets.

TYPICAL PROBLEMS

DAA and modem modules provide the required interface between the users equipment and the PSTN. Although every effort has been made by Cermetek to manufacture products that are as robust as possible, many aspects of the PSTN are beyond the control of either Cermetek, the manufacturer of the end product or the user of the product. This lack of control creates real world limitations that can cause operating problems and may lead to temporary or even permanent failure of the DAA and/or modem module. It is in the best interest of the telecommunications industry that everyone do their part to ensure a safe and reliable PSTN system.

Typical real world limitations (often referred to as parasitic conditions) encountered can be broadly lumped into the following four categories:

1. Electro magnetic/Radio Frequency Noise or Interference (EMI/RFI).
2. Cross talk.
3. Lightning and voltage/current surges.
4. Phantom Ringing.

Each of these basic categories are addressed in one or more application notes available from Cermetek upon request. It must be noted that similar applications are not necessarily effected in the same manner. The environment in which the application operates is, in most cases, the critical factor. Any sensitivity in a given application becomes more pronounced as the number of installations at a given site increases. Attached is an article from The Billboard, June 30, 1994 edition, Published by William H. Von Alven of the FCC, and is included so as to provide design engineers and manufacturers with some insight into these issues.

THE

WILLIAM H. VON ALVEN, EDITOR

BILLBOARD

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A NEWSLETTER FOR PART 68 APPLICANTS

Have We Forgotten the Consumers?

In my view certain aspects of deregulation went too far:

1. **RFI-to-Telephones.** Prior to divestiture, the telco took care of this problem. Our Field Bureau, as we reported to you during our March industry meeting, reported they get over 25,000 calls from the irate public on this subject annually. This doesn't count the calls others get, including the telcos, broadcast stations and even me. Over the past two years, the Telecommunications Industries Association started developing a voluntary RFI susceptibility standard that telephone manufactures might use for controlling the problem. **Joe Maheffy**, a retired Chief Engineer of a well-known PBX manufacturer tells me the problem should be fixed at the design stage for the consumer products and not after the fact. FOB field studies show that after market RFI filters (costing about \$20) fix less than 40% of the problems. Further, Joe says that the cost to equipment manufacturers to solve the problem during equipment design is only pennies per unit. The equipment manufacturers say that pennies multiplied by 100,000 or so for a production run becomes a substantial sum. The telcos, on the other hand, say that thousands of service calls are expensive to them and these costs are passed on to the subscriber in the monthly bills, let alone the exasperating problems faced by those irate consumers who are affected by this problem, especially when the interference is so bad they can't use their phones.

On this score, a little bit of history is worth recounting. Remember the cordless phones that would randomly dial when activated by electrical noise, perhaps from vacuum cleaners, fluorescent lights or noisy electrical motors? This was brought to our attention by the 911 operators nationwide. They would receive a call but no one would answer. They sent the police to the customer's premises, sometimes breaking down the door expecting to find someone in dire straights. Instead, they found the cordless phone. It didn't take long to discover that "digital security coding" would cure the problem. This is the same technique used by garage door openers so that radio transmissions from an airplane flying overhead or the neighbor's garage door opener would not inadvertently open your door. We got the TIA involved and they decided to file a petition to require digital security coding for cordless phones. Responsible firms immediately incorporated this technique in their products prior to rulemaking. Prior to rulemaking, only a fraction of registrations had incorporated digital security coding. The low-end operators held off until the last minute. Even after the rule was adopted, we received a petition from an importer requesting we delay the effective date so that he could sell his remaining inventory of non-complying products. The Commission turned down that request.

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Summary: For critical issues voluntary standards don't work!

2. **Premises wiring "cross-talk" problems.** In the old days, the telcos took care of this problem: in fact it rarely occurred. What happened was that when Part 68 rules for premises wiring were developed we swung the pendulum so far that we maintained only electrical safety requirements (insulation breakdown). Now when families want multiple line services, say, separate phones for their kids, or separate lines for running a small business, we find premises wiring contractors often use the cheapest, non-twisted pair wire which causes crosstalk. The problem even happens in apartment buildings. Others can listen in on your conversations and you can interfere with others. However, fixing the problem is substantial and it is nationwide affecting several hundred thousand customers annually. The problem only gets worse as we try implementing the "information superhighway". The fix is to specify UL listed and certified EIA/TIA-568 Category 3 twisted pair premises wiring. UL tells us that the initial cost increment of supplying the correct premises wiring for a 2000 sq. ft. house is only about \$2.00.

3. **The lightning surge problem.** If you draw a line from Montana to Virginia, below that line you can experience an average of 40 lightning days annually; the Rocky Mountain states get 70; the Gulf states 70; but Florida gets more than 100. For the West Coast the number is less than 20 and for the New England states the number is less than 20. BellSouth has indicated that in the nine southern states they serve, **they get hundreds of thousands of service calls** annually from subscribers whose phones have been knocked out by lightning surges. The better manufacturers have found that their newer electronic phones require the use of supplemental protectors to survive in this environment and a few include fuses to meet U.L. safety requirements. But U.L. standards aren't enforced except, perhaps, in a few localities. Furthermore, several telcos informed us that many of the surge problems with CPE come in on the ac power line as well as on the telephone line. The surges pass right through the wall transformer into the CPE. Another issue is that installers frequently do inadequate jobs installing premises wiring for both ac power and telephone wiring. In one of our industry meetings, one manufacturer investigated twenty five installations that had surge failures and found half of them had no ground connections. In one instance, the installer ran a grounding wire to a grounding clamp but forgot to take the insulation off of the wire. In another instance, the installer connected the system ground to a lightning rod. The equipment was blown to bits when the next lightning storm passed through. In an REA study, it was found that the Telco protector ground was missing in about 30 of 1000 installations. In at least one instance, the premises owner disconnected the ground permitting installation of new siding on the building, but forgot to reconnect the ground afterwards. Installers of ac premises wiring frequently forget to ground outlets, or they connect a "ground" to a water pipe which in turn is connected to a section of plastic pipe. Installation goofs are legion. We have asked TIA to review the entire surge problem at their June meeting and hopefully come up with some outstanding recommendations.

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4. **Bell tapping or “phantom ringing”**. This problem rarely occurred prior to deregulation. The telcos designed their phones properly. Even the E.C. countries have recognized this problem in their equivalents of Part 68. The consumer frequently runs into this problem when he or she has a pay-for-view TV installed which, usually in the wee small hours of the night, dials out to report to the provider on channel usage for the previous 24 hours; or someone in another room may dial and in doing so may cause other phones to “tinkle”. This is annoying to many people who waken to the noise. Some are frightened, thinking their line is being tapped. This is a frequent service call for many telcos. Even I get many calls on this subject. Yet the problem is easily fixed at the design stage. Many reputable firms review their designs to make sure this problem will not exist in the manufactured versions. The cost differential for eliminating this problem is trivial. In fact, there is an EIA test circuit that any self respecting manufacturer should use. Again, this is a nationwide problem. The cost for preventing this problem is minor in contrast to the service calls for the telcos and the emotional drane and frustrations on the part of the consumer when he or she tries to resolve the problem.

Comments or suggestions, anyone?

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406 TASMAN DRIVE | SUNNYVALE CA 94089 | LOCAL: 408-752-5000 | TOLL FREE: 1-800-882-6271
FAX: 408-752-5004 | WEB SITE: <http://www.cermetek.com> | EMAIL: sales@cermetek.com