Why & How to Buy Intelligent Fax Boards

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Executive Summary

A myth exists that all fax boards and fax modems are essentially the same. If they all send at 14.4 Kbs speed, then all fax phone bills are the same and what else could matter? But fax technology can be surprising: for example, even sending at 14.4 Kbs, Class 1 and 2 fax modems typically triple page transmission time compared to intelligent fax board throughput!

Three distinct types of fax cards exist: Class 1 fax modems, Class 2 fax modems, and intelligent fax boards, and each provides substantially different levels of performance. In the mid-volume scenario presented in this white paper, intelligent fax boards are shown to reduce life-of-system fax phone bills by about $3,700 over Class 2 boards and by about $6,500 over Class 1 boards.

The reasons why intelligent fax boards provide superior performance may be obscure – including Modified Modified Read compression, signal-to-noise ratios, bit-stuffing, critical timing issues and call progress capabilities – but they are no less real to the bottom line for being esoteric. This paper explains how fax boards differ, how those differences play out according to fax phone call elements and installed base capabilities, and why intelligent fax boards are a superior choice for virtually all but the very lowest-volume computer fax applications.

This paper also provides a checklist of items to consider when purchasing intelligent fax boards.

Why to Buy Intelligent Fax Boards

In the glossy pages of the popular computer trade press, the "fax modem" has been widely regarded as a commodity item, triggering the widely held belief that all fax modems are the same. In fact, however, vast disparities exist between the performance provided by low-cost fax/data modems (for example, Class 1 and 2 devices) and intelligent fax boards (fax cards with on-board microprocessors). Schooled largely by the trade press, when equipping their LAN fax servers, fax-on-demand systems and fax broadcasting engines with fax cards, businesses all too often choose low-cost fax modems, a choice that typically saddles them with one or more of the following problems:

- **Dollar Drain:** Just about every fax phone call made with low-cost fax modems costs about twice as much as necessary in usage charges paid to one's telephone company (and it can literally be ten times as much!). This is a critical issue because over the life of a fax system, the "pennies" paid for thousands of fax calls tend to add up to far more than the original purchase price.

- **Hassle:** Headaches arise from unnecessarily high percentages of fax phone calls never being completed by low-cost fax modems, particularly with Class 1 devices.

- **Disinterest:** A fall-off occurs in computer fax system usage by workers due to the unreliability of the low-cost fax modems on which the system is based.

- **Quick System Max-Out:** Low-cost modems fail to support adequate system scalability because they require general-purpose PCs to struggle to muster enough power, quickly enough, to manage the multi-channel faxing that intelligent fax boards support with ease. When businesses commit to systems using fax cards that don't scale up well, one result can be the needless expense of an extra PC for every couple of ports (instead, for example, of one PC supporting 24 or 48 ports).

- **Languishing Labor:** When low-cost modems are installed on personal PCs, a hidden toll is extracted from users who are forced to sit idly while under-powered fax modems demand full PC microprocessor attention.

Intelligence Report: Differentiating Fax Cards

The three types of fax cards are Class 1 modems, Class 2 modems, and intelligent fax boards:

- **Class 1** fax modems (EIA 578) comprise the lowest-cost category for a very simple reason: they rely totally on the power of PC microprocessors for tasks critical to sending faxes, including the conversion of PC files to fax format, support for bit-stuffing (bit-stuffing is explained below), and management of the fax phone call itself, including all signaling to set up and maintain a fax call. They support fast transmission speed (14.4 Kbs), but only the slowest form of standard fax compression.

- **Class 2** fax modems, like their Class 1 cousins, rely on the power of PC microprocessors to convert PC files to fax format, but handle all signaling to set up and maintain fax calls via on-board circuitry. They may handle bit stuffing on-board or via the PC microprocessor, but support only low level fax compression. Note that there are both Class 2 and 2.0 fax modems: (1) Class 2 modems are based on a de facto standard [a proposed standard that was voted down – but manufacturers produced modems Class 2 modems anyway, resulting in many "flavors" of Class 2 modems]; millions of Class 2 modems are installed; while some bit-stuff on-the-fly, many do not; (2) Class 2.0 fax modems, which comply with the official EIA 592 standard, handle bit-stuffing on-the-fly; but Davidson Consulting was aware of only three Class 2.0-compatible devices on the market a full two years after the 2.0 standard was approved.

- **Intelligent Fax Boards** differentiate themselves via on-board microprocessors which, in addition to sending faxes at 14.4 Kbs speed, also can support advanced fax compression methods, convert documents to fax format and bit-stuff on-the-fly on the board (not on the PC), and can manage fax phone calls via on-board processing power.

Intelligent fax boards carry the highest price tags, which is why buyers naturally flock to the lower-cost "class" modems. But they save far, far more than the differential in cost by more reliably completing calls (see **Table 1**), sending faxes in less time to reduce fax phone bills (see **Table 2**), by minimizing maintenance issues, by providing strong enough performance that people actually use the computer fax systems based on them, and by cost-effectively exploiting server resources.

Are You Bit-Stuffing Your Fax Phone Bill?

Bit stuffing is required because, with many older non-memory fax machines, the code sent to describe a fax scan line transmits than the time it takes the printhead to move across the page. The solution is to stuff extra bits into the code to keep the mechanical parts synchronized. The receive-end fax machine invokes the need for bit-stuffing and, if the sending device cannot bit stuff, the fax call aborts. The best way to bit-stuff is dynamically, on-the-fly, via an on-board microprocessor. This ways, fax phone call time is extended for bit stuffing only when called for and only to the extent necessary. The alternative is to pre-stuff every file to be computer faxed, but this means that every fax phone call lasts longer and that more bits than necessary must be stuffed. Assuming that only 10% to 25% of the worldwide fax installed base actually requires bit stuffing, then pre-storing unnecessarily extends 75% to 90% of calls, typically by about 40%, give or take.

How to Buy Intelligent Fax Boards

Considerations in the purchase of intelligent fax boards include:

- **Compatibility:** Boards must be compatible with server operating systems, fax application software (for example., LAN fax, fax-on-demand), print-to-fax conversion methods, telephone network facilities (for example, analog loop start, T1, ISDN). Broad operating system support can be important to avoiding premature obsolescence. Support for T1 lines (and ISDN lines, particularly in Europe and Japan) can be crucial to generating the substantial savings that such bulk volume phone lines offer

- **Throughput Speed:** Boards preferably should support 14.4 Kbs transmission speed, MR and MMR compression as well as MH, and support both on-board on-the-fly document conversion and bit-stuffing. Whenever possible, buyers should test or otherwise determine the relative throughput speed of competing intelligent fax boards, as actual throughput can vary due a range of component and software level factors

- **Call Progress:** Boards should provide very efficient call progress for as many signal types and countries as possible. It is very much worth analyzing how much poor call progress can reduce overall fax server throughput and contaminate fax broadcast lists and address books

- **Computer Loading:** Buyers should test or otherwise determine the relative loading placed on server PCs, with an eye to how loading levels progress as more ports are added to a server.

- **Image Handling:** Can the fax device provide sophisticated and flexible handling of image files? For instance, can it support wide documents and business-form overlays on-the-fly? Does it support transmission of standard

TIFF (Type F) files, in particular enabling it not to have to rely on PCX/DCX file formats, which can be much larger than TIFF files and prolong the duration of fax phone calls by a factor of two to ten? When used to receive faxes, can the fax device provide on-the-fly conversion of faxes received in MH or MR formats to the smaller and more efficiently stored and processed MMR format?

- **Automated Processing of Received Faxes:** Particularly in LAN fax environments, buyers should consider the flexibility of using boards that can automatically route received faxes. While it may be significant for the fax device to support a technology like the ITU T.33 standard for subaddressing (which can automatically route faxes if transmitted from T.33-compatible devices; unfortunately, prior to mid-1996, no fax machines were T.33-compatible), the real issue is direct-inward-dial (DID) support. In North America, DID is the single type of inbound routing system that works with the entire worldwide fax machine installed base, works whether inbound faxes are manually or auto dialed, doesn't require that the person sending the fax enter some extra code or command, and doesn't require that routing clerks at the receive-end LAN laboriously open every received computer fax file, visually identify the recipient, and then route the fax to that person's fax mailbox. While DID requires special phone lines (sometimes available through one's PBX), by at least having DID implemented on fax devices, it saves the company the cost of buying external DID devices. Overseas, although DID-equivalent services (often abbreviated as DDI) are sometimes available, implementing equally viable and transparent inbound fax routing usually requires ISDN support. Again, having ISDN on the fax card eliminates the need to purchase third-party, external devices.

- **Programmability:** The API furnished with the intelligent fax board should be powerful, reliable, easy to use, and backwards- and forwards-compatible with other boards the vendor offers (and software that runs on the boards). Although there is a de facto standard fax programing interface, CAS, it is out-of-date and is a factor primarily in terms of supporting legacy applications with leading-edge intelligent fax boards. Because the API is the software "window" into the fax board's hardware functionality, its suitability is critical.

- **Patch, Fix and Upgradability:** It should be possible to fix and upgrade certain fax board capabilities with relative ease, which preferably means by simply downloading code and using it to update DSP-based functionality

- **System Integration Readiness:** How readily can the intelligent fax board be integrated with other, often telephony-based, systems? Can it support voice and fax on the same board? Does it support legacy integration interfaces like PEB and forward-moving architectures like MVIP and SCSA? Does it fully support key computer fax functions like DID and T.33 subaddressing and T.434 binary file transfer?

- **Overseas Usage Approvals:** Where intelligent fax boards are to be used outside their country of manufacture, it is mandatory that manufacturers have received approval from the telecommunications authorities in each country. Moreover, it is not enough that the vendor has just any approval of a fax device in a specific country, it must have approvals for each separate model of fax device for each separate country.