

***Meeting The Needs Of The Bluetooth Market***



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# Technology Edge

## Meeting The Needs Of The Bluetooth Market

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Bluetooth wireless technology is upon us. The start of the new millennium has been marked by a continuing growth in Bluetooth activities. From National's perspective, much effort is being expended in supporting the needs of this soon-to-be high volume market. In the past year I have visited many OEMs, and have learned much about OEM Bluetooth needs. This article covers several topics that are a guaranteed must for any meeting.

### Key Product Concerns

For most OEMs the integration of Bluetooth wireless technology into their products will require small size, low power, good performance, cost efficient solutions.

In the case of a Laptop PC, power consumption and space may be partially traded for communication range. This is also an obvious choice for main powered products, such as Desktop PCs, Data Access Points, Printers, and other computer peripherals. While Class 1 Transmission supports extended range, receive sensitivity is a key differentiating factor, and should be carefully considered for such applications when selecting a Bluetooth Radio.

Even applications requiring lower power consumption still benefit from good receive sensitivity. The designer should note however that in a typical Bluetooth radio, low power and sensitivity will have been traded against each other, and therefore both parameters should be investigated, based on the application needs.

### How Many Bluetooth Wireless Technology Chips?

Initially, most OEMs felt their needs could best be met by employing the existing MIPS and Memory of their Host processor and just adding a Bluetooth radio. However, on further investigation heavy MIPS requirements, power management and the integration of a Bluetooth Protocol Stack with the host application's Stack (especially in the case of a Cellular Phone or PDA), led most to conclude that a 2nd, Bluetooth wireless technology dedicated processor made sense (at least in the mid-term).

For those willing to invest the effort in integrating Bluetooth wireless technology and Host Stacks, the issue of heavy MIPS loading on the Host can be alleviated by the inclusion of a Bluetooth 'Engine' hardware block into the Host processor. However, unless the OEM anticipates providing Bluetooth wireless technology as a standard function in all product variants, the inability to depopulate a circuit board to remove Bluetooth wireless technology may result in a cost burden on the lower end, non Bluetooth wireless technology products.

Based on the above design complexity and low-end product cost burden, this otherwise logical approach to Bluetooth integration appears to be more attractive as a longer term solution in the market.

### Single Chip Bluetooth Wireless Technology ?

To solve the conflicting needs for small size and low cost, single chip solutions may be considered. This approach may not however provide all the rewards it promises.

To implement Bluetooth wireless technology into a single chip (without impacting the Host application's processor) it is necessary to implement a CMOS Radio. While it is possible to build such a radio using 0.25um CMOS technology, the following points should be noted.

To obtain the desired receive sensitivity with CMOS, the resulting power consumption may be higher than compared with alternative, Bipolar technologies. Also, since today's radio designs still employ analog circuit functions, the semiconductor manufacturer may well be faced with the higher yield losses of an analog circuit, coupled with the very large die size of a digital baseband. This significantly reduces the number of useable die per wafer, resulting in a cost which quickly overrides any immediate gains from the use of CMOS technology and reduced packaging requirements.

With two chips, National Semiconductor can utilize the performance benefits of BiCMOS for the radio and CMOS for the baseband, while avoiding the above cost implications.

### **Module Technology**

In the case where small size is essential, National will offer LTCC Module technology solutions, benefiting from bare die and discrete component embedding for significant size reduction. By embedding some of the circuitry into the ceramic layers, the added assembly costs, normally associated with Modules can also be reduced.

For many OEMs the prospect of including a high frequency radio into their product for the first time represents a daunting task. For such customers, National's LTCC technology will offer a quick and safe route to production.

### **What Else Matters?**

Having made some key decisions on Bluetooth wireless technology and integration, OEMs are then faced with turning a newly attached Bluetooth interface into an attractive asset to a product. Amid all the enthusiasm it is easy to forget that Bluetooth is an adjunct to a product, not a product itself! The end customer Bluetooth wireless technology 'user model/s' must therefore be considered, and functionally catered for.

Implementing a full Bluetooth Node to the standard (providing for multiple data and/or audio links) requires that several Bluetooth firmware modules be added to the Host Protocol Stack. Specifically, RFCOMM, L2CAP, Service Discovery Protocol (SDP) and HCI Drivers are required. In addition to this, the Bluetooth SIG is defining a range of 'Profiles' (to ensure a common user experience) and at least one such profile would be required in an OEM product. In theory it may be possible to simply link these modules to existing Host Stack modules, however this inefficient approach could lead to higher power consumption or even higher cost, due to increased program memory.

For the larger OEMs this may mean creating a 'Bluetooth' wireless technology Software Department, and obtaining the remaining majority portion of the equation from external sources.

Now, it may be possible to enlist the services of a semiconductor supplier to provide support for this task, but it has been my experience that better support can generally be gained by employing 3rd parties, whose growth is dependant on software as a product (as opposed to silicon).

### **National Semiconductor's 2nd Generation**

National Semiconductor will offer a complete Bluetooth Node (antenna to HCI), including all necessary Bluetooth Firmware. To ensure customers gain the benefits of 3rd party specialists, National is working with selected Antenna and Host Software suppliers to ensure compatibility, and permit cost effective complete solution offering is made available to our customers.

### **Low Risk Market Entry, today**

Working with Digianswer, National Semiconductor is able to offer a 1st Generation, USB reference design to meet the needs of Bluetooth wireless technology 'Early Adopters'. In parallel with these efforts National has also been actively specifying and creating a Bluetooth wireless technology optimised, 2nd Generation product offering. For more information on National s Bluetooth technology visit <http://www.national.com/bluetooth>.

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