# 2002: The Market in Transition

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**Abstract**

**The year 2001 saw one of the most significant downturns in the history of the wireless market. After exiting a booming Q4 2000, the wireless industry began to see the ugly face of economic downturn coupled with excess inventory and capacity. As the market enters into 2002, it will face a different landscape with limited visibility amid a continuing economic downturn. What are the trends and challenges facing suppliers into the Wireless Food Chain?**

## INTRODUCTION

CIBC World Markets estimates that the analog GaAs semiconductor market for 2000 totaled $3.5 billion and increase of 42% over 1999 estimates of $2.5 billion in revenues. Unfortunately, the year of 2001 erased most of the gains of 2000 and we believe that GaAs revenues in 2001 will drop back to $2.6 billion, a 25% decrease. The downturn has caused some suppliers to re-evaluate their competitive position in the market. We also believe that the capital equipment expansions for 150mm technology upgrades, coupled with a emerging GaAs foundry market created a formula for significant over capacity in the semiconductor device and materials supply chain.

## GLOBAL MOBILE HANDSET FORECAST

CIBC World Markets believes that production of mobile handsets (sell in) was between 380-385 million units in 2001. We believe that handsets sold to the consumer market (sell through) may have reached 390-400 million units.

CIBC World Markets is currently is forecasting a growth of approximately 15% to 447 million units produced in 2002. We believe that the handset market will continue to see growth through 2004 reaching 582 million units.

We believe that unlike the period of 1995 to 2000 where subscriber growth drove the demand for mobile handsets, the period beginning in 2001 marks a transition away from new handsets to replacement handsets being the growth driver for the mobile handset market.

We believe there are a number of catalysts that may spur users to upgrade their wireless handset. A partial listing follows:

- Change of location requires new service operator
- Damage to handset (e.g., broken antenna, cracked LCD display)
- Lost or stolen handset
- Smaller handset
- Lighter handset
- Voice-activated capability
- Multi-mode capability
- Multi-band capability
- Enhanced SMS capability
- FM radio capability
- MP3 player capability
- Palm OS or similar PDA capability
- Full-color display
- Full-color video capability
- Embedded digital camera capability
- Internet Web access
- Bluetooth capability

The introduction of color displays may be the largest catalyst. We note that approximately 50% of handsets shipped in 2001 for the Japanese market were color and our estimate is that 100% of the market in Japan for 2002 will be color. We also note that Qualcomm recently indicated that 60% of the Korean CDMA handset market in 2002 would be color. Nokia will be introducing color handsets for each of its core platforms and indicated that penetration rate by the end of 2002 would be significant.

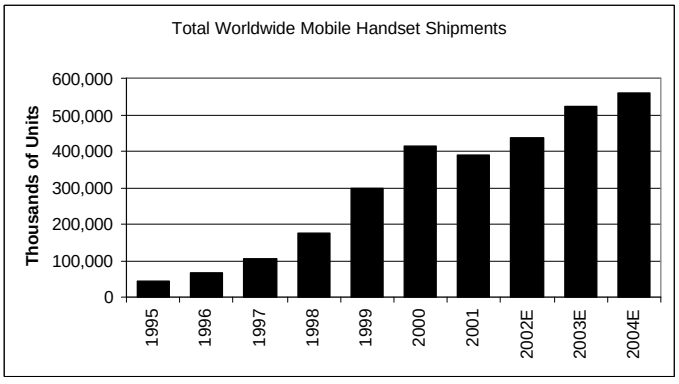


Figure 1. Worldwide Mobile Handset Forecast

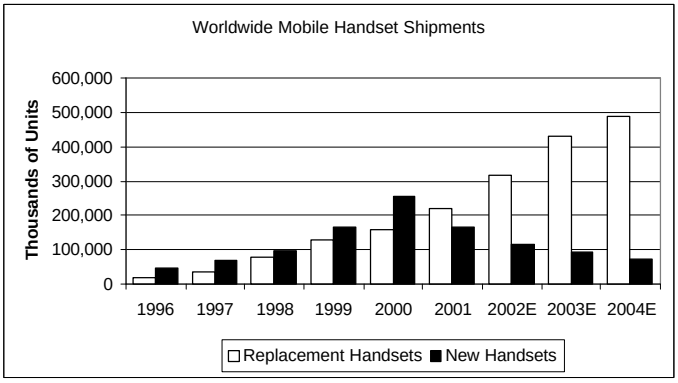


Figure 2. Worldwide Mobile Handset Forecast, Replacement vs. New Handsets

THE RECOVERY

With the downturn in the industry during 2001, wafer fab under utilization, coupled with a severe drop in revenues caused companies in the supply chain to experience losses and scale back programs. A 10% reduction in work force in 2001 was considered positive for any company as massive layoffs impacted many companies. New capacity expansion plans were put on hold and those that had expanded were left with fabs running at less than 25% utilization.

The over capacity in the market also negatively affected the many GaAs foundry projects in Asia that were launched in 2000. The shutdown of orders and delays in production also impact start ups in the industry and the sky-high valuations of the Internet bubble days were gone. The market began to see venture capital money exiting the technology sector with some companies unable to seek additional VC funding for their next round of financing.

As the downturn continued in 2001, the market began to experience some trends that will alter the landscape of the supply chain in the future. The macro trends that CIBC World Markets believes will determine the leaders of the next wave of growth are:

Industry Trend #1 – The transition from MMICs to MCMs
Industry Trend #2 – The transition from FETs to HBTs
Industry Trend #3 – Consolidation of Supply Chain

**Trend #1**
We believe that 2001 marks the departure from the traditional IC packaging technology for wireless semiconductor products (especially power amplifiers) towards MCMs. While some suppliers (Hitachi and Conexant Systems) have been shipping power amplifier modules for the past five years, the majority of the power amplifiers are still ICs. We believe that this shift will begin to distinguish those suppliers who will be capable of offering the right combination of device and package technology coupled with acceptable yields and pricing. Ultimately, we believe that those suppliers who can manufacture the majority of the components inside the MCM will be able to maintain acceptable net margin performance. We have seen announcements from nearly every major wireless semiconductor supplier introducing power amplifier modules.

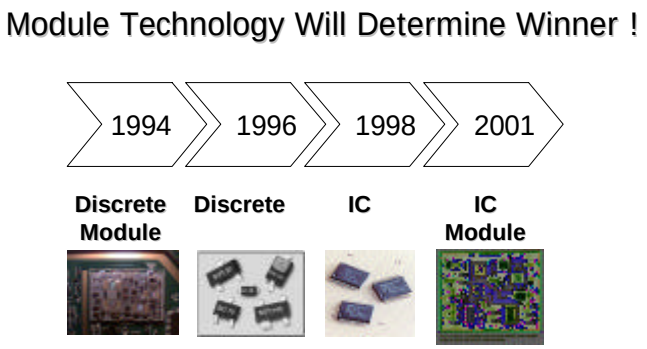


Figure 3 Packaging Technology Migration

**Trend #2**
We believe that there is a significant shift occurring in power amplifier technology. While RF MicroDevices and Conexant Systems led the HBT wave in 1997 with their AlGaAs technology, others have recently followed with InGaP technology. But whichever flavor you look at, the market is definitely going HBT. We believe that this is evident with Hitachi Ltd. choosing to migrate away from LDMOS and towards HBT. While we believe that their will be some continued acceptance of E-mode PHEMT power amplifiers, the HBT type will be the majority of the market. We also believe that those suppliers using AlGaAs HBT devices will eventually migrate to InGaP HBT devices.

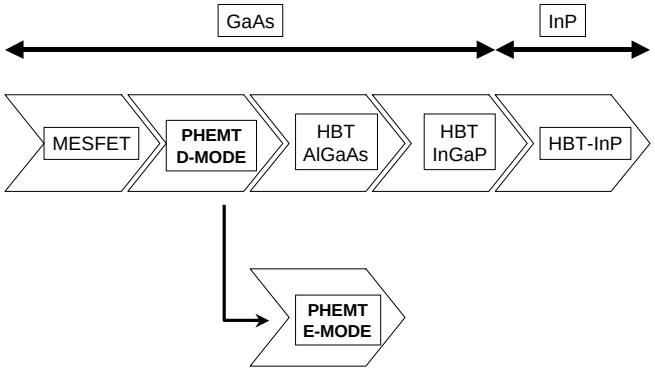


Figure 4. Semiconductor Technology Migration

**Trend #3**
With the downturn in 2000, cash flow, excessive inventory, zero visibility and a high customer concentration has led to some significant mergers and partnerships as a strategy for beating the downturn and positioning for the upturn. The notable merger events for 2001 include the following:

- TriQuint Semiconductor Merging with Sawtek
- Alpha Industries Merging with Conexant
- RF MicroDevices Partnership with Hitachi Ltd.

It is our belief that we are entering a phase of the market where the large are getting larger and the small will disappear or be relegated to a niche market that they can serve. We believe that with the number of handset OEM suppliers continuing to shrink due to zero or negative operating margins on handsets and decreasing market share, there will be more suppliers fighting for less handset OEM customers.

TABLE I
SELECTED WIRELESS OEM SUPPLIER/CUSTOMER ALIGNMENT

| Company | OEM | Standards |
|---|---|---|
| RF MicroDevices | Nokia | GSM, TDMA |
| | Motorola | CDMA |
| | Siemens | GSM |
| | Sanyo | CDMA |
| | Ericsson | GSM |
| Hitachi Ltd. | Nokia | GSM |
| | Ericsson | GSM |
| | Siemens | GSM |
| | Samsung | GSM |
| | Panasonic | GSM |
| Alpha Industries | Motorola | GSM, TDMA, CDMA |
| | Ericsson | TDMA |
| | Siemens | GSM |
| | Samsung | CDMA |
| TriQuint Semiconductor | Nokia | TDMA |
| | Motorola | GSM |
| | Ericsson | TDMA, CDMA |
| Conexant Systems | Nokia | CDMA |
| | Ericsson | GSM |
| | Samsung | CDMA |
| | Motorola | GSM |

In analyzing the suppliers of both GaAs epitaxial and substrates, we believe that consolidation will also occur at this level of the supply chain. Litton Airtron became a casualty in 2001 and exited the GaAs LEC market. Kopin purchased Super Epitaxial Products in 2000. We believe that other suppliers may exit the market due to continued financial difficulties.

## CONCLUSIONS

We believe that 2001 will have significantly altered the mobile handset market. While 2002 will see the handset market potentially growing 15%, the first quarter will experience the seasonal declines related to a strong fourth quarter. While the GaAs market saw significant revenue declines in 2001, we believe that the market leaders will begin to see sequential growth again during the first half of 2002. The right recipe of power amplifier modules may pave the way for market share gains in 2002.

## ACKNOWLEDGEMENTS

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## REFERENCES

### ACRONYMS

AlGaAs: Aluminum Gallium Arsenide
HBT: Heterojunction Bipolar Transistor
IC: Integrated Circuit
InGaP: Indium Gallium Phosphide
MESFET: Metal Semiconductor Field Effect Transistor
MCM: Multi Chip Module
MMIC: Monolithic Microwave Integrated Circuit
PHEMT: Pseudomorphic High Electron Mobility Transistor