

# Is 5G the Next RF Compound Semiconductor Industry Driver?

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**Keywords:** compound semiconductor, GaAs, MIMO, 5G

## Abstract

The RF compound semiconductor market has experienced more than a decade of strong, uninterrupted growth to reach nearly \$10 billion in revenue. The engine for this growth has been the wireless market, but this driver is slowing. This paper will discuss the trends that have shaped the RF compound semiconductor market and how emerging 5G developments will influence this market in the future.

## INTRODUCTION

From humble beginnings with GaAs digital circuits, the RF compound semiconductor industry has grown to encompass many other technologies as the devices form an integral part of most every piece of RF equipment manufactured. The challenge is revenue growth is slowing and the industry is looking for what will drive the next wave of expansion in the market. The paper will profile the GaAs portion of the compound semiconductor market, looking at the trends that have driven GaAs growth and how these are changing. The paper will also assess how emerging 5G developments may shape the future of the RF compound semiconductor industry.

## HISTORY

The compound semiconductor industry traces its roots to GaAs technology, first in high-speed digital circuits and then in military applications. Defense funding and applications helped expand the capabilities and revenue of the entire compound semiconductor supply chain. The transition to commercial applications proved difficult, with revenue growth in the late 1990s collapsing as the “internet bubble” burst in the early 2000’s. While mobile wireless networks began to grow, the GaAs market lacked direction until mobile communications became more data-centric and consumers began to embrace smartphones. Increasing data traffic on higher speed networks is the trend that has driven the compound semiconductor industry to more than a decade of revenue growth. The paper will address the developments that fueled this growth and offer some insight into why this growth engine is slowing. The historical performance of the RF GaAs device market is shown in Figure 1.

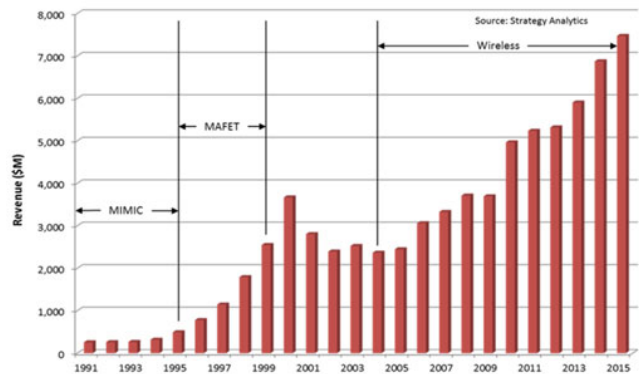


Fig. 1. GaAs RF Revenue

## IS 5G THE NEXT GROWTH ENGINE?

As the RF compound semiconductor industry digests changes in the market, 5G wireless is emerging with the potential to shape the future of the industry. Figure 2 shows the vision of 5G. This development has the potential to be transformative for society and the compound semiconductor industry. The vision relies on three fundamental pillars; extreme mobile broadband, critical machine communication and massive machine communications. The network requirements needed to enable the implementation of these pillars are daunting and they will be reviewed briefly.

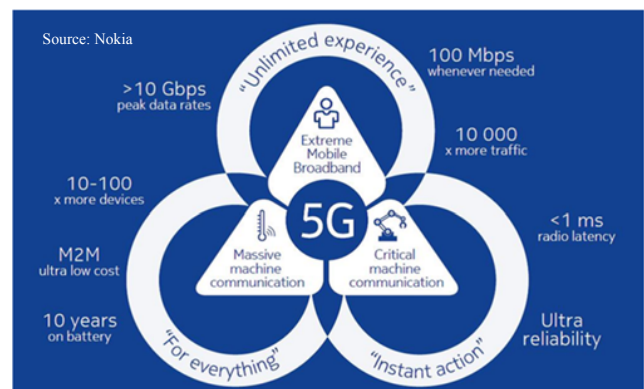


Fig. 2. The 5G Vision

The challenge for the compound semiconductor industry is the design and implementation of networks and consumer devices that enable the 5G vision of Figure 2. The

motivation for the industry is the size of the opportunity. Various standards bodies, as well as operators looking for a first-mover advantage are working to define the network and user equipment. Figure 3 shows a conceptual functional diagram of the network. It includes significant increases in the density of wireless base stations, wireless backhaul at millimeter wave frequencies, increased transport data rates on wired networks, millimeter wave radios in user equipment to support higher data rates, more devices on the network, steerable beams resulting from massive MIMO antennas and many other concepts that *could* revolve around compound semiconductor technologies.

ms: Milliseconds  
MIMIC: Millimeter Wave Monolithic Integrated Circuits  
MIMO: Multiple Input Multiple Output  
RF: Radio Frequency

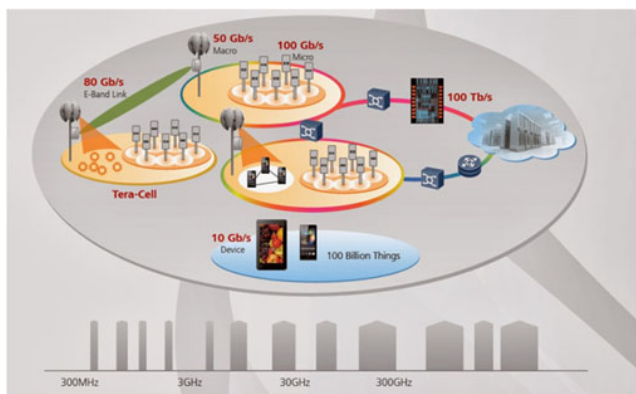


Fig. 3. 5G Network Concept

The paper will discuss some of the challenges the 5G vision imposes on the network, solutions that companies are investigating and how these architectural decisions will influence the future of the RF compound semiconductor industry.

## CONCLUSIONS

The RF compound semiconductor industry has grown to nearly \$10 billion of revenue, primarily because of commercial wireless adoption. The growth fueled development of new technologies, products, manufacturing and technology processes as compound semiconductors expanded into new market segments and applications. This has been very beneficial to the entire supply chain, but the wireless growth engine is slowing for the compound semiconductor market. This paper and presentation will address why the drivers are slowing and describe how emerging 5G networks could be the next growth engine for the RF compound semiconductor industry.

## ACRONYMS

5G: Fifth Generation  
GaAs: Gallium Arsenide  
Gbps: Gigabits per second  
MAFET: Microwave and Analog Front End Technology  
Mbps: Megabits per second