Before the
DEPARTMENT OF COMMERCE
Bureau of Industry and Security
Washington, DC 20230

In the Matter of	)	
	)	
Request for Public Comments on Risks in the	)	Docket No: 210915-0189
Semiconductor Supply Chain	)	RIN: 0694-XC08

COMMENTS OF NOKIA

Nokia submits these comments to the Bureau of Industry Security ("BIS") in response to the above-captioned Notice of Request for Public Comments on Risks in the Semiconductor Supply Chain ("Notice"). As discussed further below, Nokia is best described as an "intermediate user" of semiconductor products or integrated circuits and thus responds to the items directed at that market segment.

I. RESPONSE TO QUESTIONS FOR INTERMEDIATE USERS AND END USERS OF SEMICONDUCTOR PRODUCTS OR INTEGRATED CIRCUITS

a. Identify your type of business and the types of products you sell.

Nokia offers unparalleled leadership in the technologies that connect people and things. Nokia delivers the industry's only end-to-end portfolio of network equipment, software, services, and licensing that is available globally. Our customers include communications service providers whose combined networks support 6.1 billion subscriptions, as well as enterprises in the private and public sector that use our network portfolio to increase productivity and enrich lives. Our product portfolio covers multiple diverse segments of the telecommunications infrastructure landscape, including mobile broadband and fixed line access (for example, fiber and cable networks), and the underlying IP routing and optical technology that connects them.

Our mobile solutions include equipment and services in all relevant segments of the network ranging from radio access network (RAN) components to mobile core, routing, and transport. Nokia also offers a robust portfolio of cloud and network services. Semiconductor components are an essential input to many of our products in both the fixed and mobile segments.

b. What are the (general) applications for the semiconductor products and integrated circuits that you purchase?

Nokia purchases semiconductor products and integrated circuits for use in various telecommunications products, including the radiofrequency (RF) and Baseband of base station products, Customer Premise Equipment (CPE), Wi-Fi, Routing and Optical networking equipment. This encompasses products across all of Nokia's business groups and touches products including those supporting Cloud Services (providing software as a service solutions), Technology and Intellectual Property (where Nokia has licensing agreements with manufacturers e.g., Mobile Phones). Semiconductor technology is an essential part of the operational activity for the Nokia business and is used everywhere.

c. For the semiconductor products that your organization purchases, identify those that present the greatest challenge for your organization to acquire; purchasing data and lead times.

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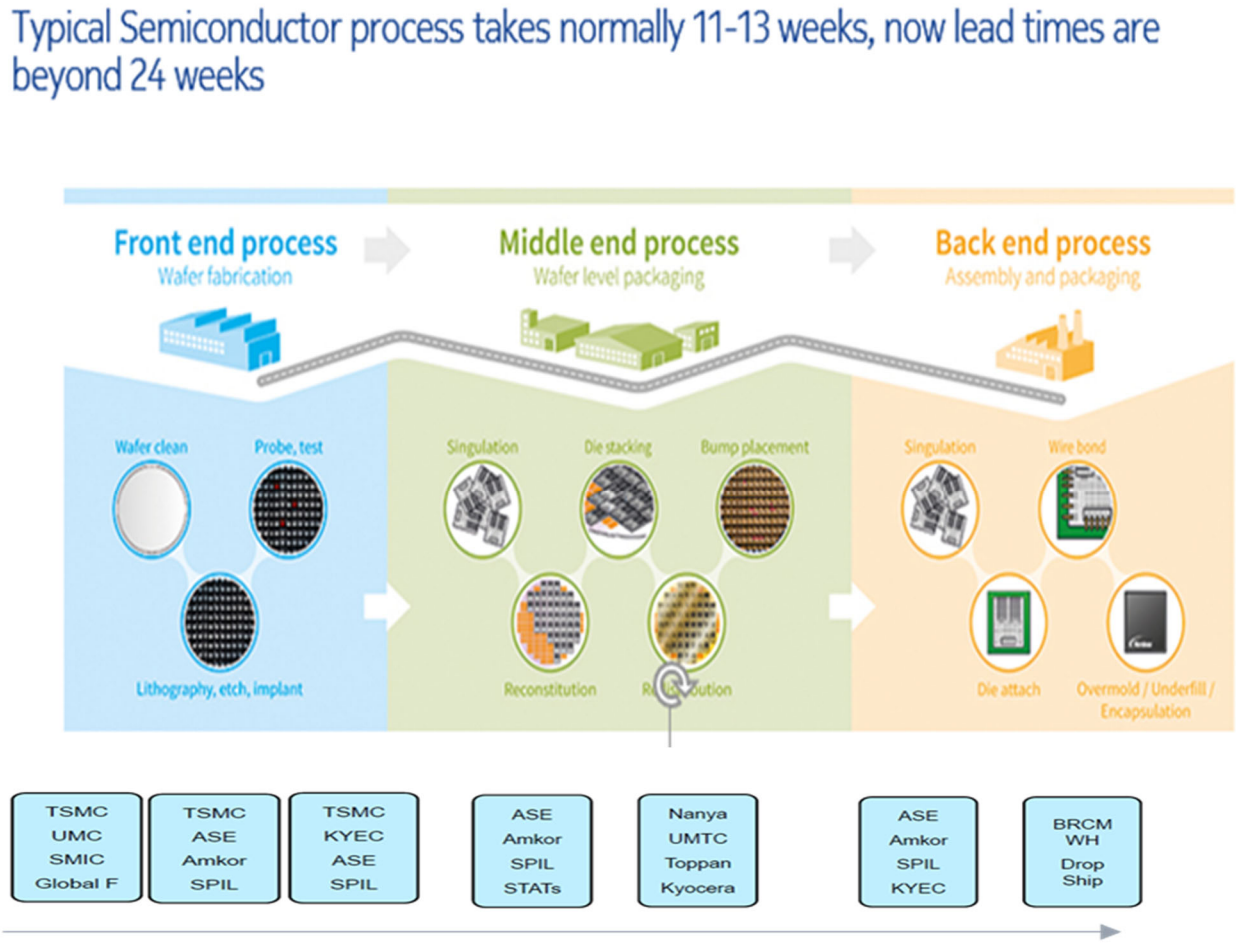
d. What are the primary disruptions or bottlenecks that have affected your ability to provide products to customers in the last year?

The primary bottlenecks faced by Nokia are lack of substrates, constrained wafer supply, very long lead times, supplier decommits, and COVID lockdown impacts. Of note, the number of scale providers of essential substrates is small and geographically limited. Similarly, the number of packaging firms that provide this essential step in the chip process are limited, geographically concentrated, and face over booking far into the future. This combined with inadequate supply of processing nodes in fabrication plants has created a multi-level strain on Nokia's supply chain that will similarly require solutions to address each supply shortfall. Expanding substrate capacity is helpful but not, for example, if run time is unavailable on critical processing nodes. In other words, single strand interventions that increase supply at one bottleneck are helpful, but not themselves likely to produce a supply crunch if we still have insufficient production capacity in other parts of the process. Typical semiconductor processes are quite complex and geographically distributed. See below example:



There are multiple companies and processes involved and Nokia has seen restrictions in many of the areas from Front end manufacturing of silicon wafers from providers such as TSMC, to substrate manufacturers (*e.g.,* Nanya, UMTC, Toppan, Kyocera). The heart of the components that are mounted on these substrates and connections are made from this and final packaging and test in the Back-end process. Some of these constraints are not just limited to raw materials, but also to labor shortages. What we need is a comprehensive package of improvements that will support the ability of companies in the semiconductor supply chain to grow and expand capacity at a rate that will meet the accelerated demands of an increasingly digital marketplace.

e. Is your organization limiting production due to lack of available semiconductors? Explain.

Yes. As described in greater detail above, the supply of semiconductors that Nokia can procure is not enough at this time to fulfill the anticipated demand from all of our global customers on timelines that are consistent with their existing deployment aspirations.

g. Is your organization considering or carrying out new investments to mitigate semiconductor sourcing difficulties? Explain.

Nokia is increasingly relying on second sourcing (selecting more than one vendor for a type of component) and parallel designs (having two platforms that have the same functionality while using different components) to facilitate order fulfilment in the face of supply shortages. These practices had already existed within Nokia; however, the global supply chain constraints have required Nokia to be much more flexible and creative in addressing component shortage issues.

The practice of second sourcing normally takes the form of awarding two or more component providers that supply the same specification devices, with a share of the business (e.g., 50% of total Nokia demand to each). That share is maintained or adjusted, depending upon the capabilities, pricing, and production capacity of the suppliers. Second sourcing can be implemented for simple products such as many of the Standard semiconductors, but this is not possible for many of the more complex components such as customized ASICS or Microprocessors. These are particularly critical in 5G where specialized chips offer very high performance with better power consumption than prior generations of wireless equipment. These are thus of critical importance to maintaining 5G deployment momentum in the U.S. and other fast-moving markets.

With more complex products, parallel designs need to be implemented. This is much more costly and design effort intensive. A parallel design may reuse common standard elements for both platforms (circuits boards) but will ultimately need to use very different components for the complex or high-performance operations needed by the product. Those components may in some instances also involve completely different software to allow these platforms to operate. The parallel design process is difficult, time intensive, and costly and cannot be maintained indefinitely. Interventions and policies that can provide short term supply relief of the underlying components (substrates, etc.) are therefore critical including implementation of processes that can reduce over ordering or submitting duplicate orders, which we believe some entities continue to do as a strategy to increase the chances their needs will be met but that in the aggregate may introduce additional "paper" demand that exacerbates the short-term challenges.

h. What semiconductor product types are most in short supply and by what estimated percentage relative to your demand? What is your view of the root cause?

The products that have posed the greatest challenges to acquire are: Standard semiconductors, Analog ICs, ASICs, Processors, Telecom ICs, Memory, and FPGAs. Specifically, 14nm process nodes and above are proven to be the most challenging.

Nokia views the root cause as lack of substrates, constrained wafer supply, very long lead times, supplier decommits, and COVID lockdown impacts.

i. Has your organization changed its material and/or equipment purchasing levels or practices in the past three years?

The short answer is yes, Nokia's demand has increased. 5G deployments have moved from the early stages of targeted deployment to broader adoption both by individual

customers accelerating their deployments and the launch of 5G in additional markets. The industry is now on the ascending part of the deployment curve, which is reflected in the ordering patterns. In addition, starting in 2021, due to increased lead times required to obtain materials, we started ordering earlier than has been the industry custom in previous generations of technology. Due to requirements by our suppliers, we have also entered a larger number of commitments and for longer time period. Many suppliers have altered purchasing terms that impact duration and cost including provisions that make commitments non-cancellable and on-reschedulable.

j. What single change (and to which portion of the supply chain) would most significantly increase your ability to purchase semiconductors in the next six months?

The most significant change for Nokia would be an increase in wafer and substrate capacity. There are short term and longer-term approaches that are essential. Over the longer term, investments in wafer manufacturing and the substrate and packaging areas of the supply chain will provide increased capacity and flexibility. In the shorter term, efforts to aid suppliers in managing and eradicating over ordering and duplicative ordering that manifest as "panic buying" are important to consider. Order verification, which some have suggested, will be difficult to implement due to differences across industries in how demand is forecasted, and orders are planned, but not enough has been done to alleviate the short-term supply crunch. Critically, the Administration needs to avoid conveying signals that preference for any particular industry or segment is part of the strategy particularly if doing so would result in other critical sectors such as telecommunications equipment being negatively impacted. We believe this has been an issue leading to increased lead times at critical production nodes.

k. What percentage of your orders are fulfilled by distributors versus through direct purchase orders to semiconductor product manufacturers?

Nokia mostly fulfills its orders through direct purchases; only a very small fraction of Nokia's purchases is through distributors.

l. For the semiconductor products your organization purchases, how long (in months) are the typical purchase commitments? How, if at all, do your organization's purchase commitments differ for products in short supply?

Nokia's purchase commitments are typically rolling commitments between 12-24 months. This number of months is typically longer for products in short supply, such as Standard semiconductors, Analog ICs, ASICs, Processors, Telecom ICs, Memory, and FPGAs.

m. Has your organization faced "de-commits" (defined as a notification from a supplier that expected or committed supply will not be delivered in the agreed-upon time and quantity) in recent months? If this is a significant issue, please explain (*e.g.,* nature of product, supplier, impact).

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Respectfully submitted,

Nokia

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