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A night-time photograph of a city skyline, likely San Francisco, with a bridge and water in the foreground. The image is overlaid with a network of glowing blue nodes and connecting lines, symbolizing connectivity and technology. A solid yellow vertical bar is on the far left edge of the slide.

Chips for 6G

The supplier perspectives

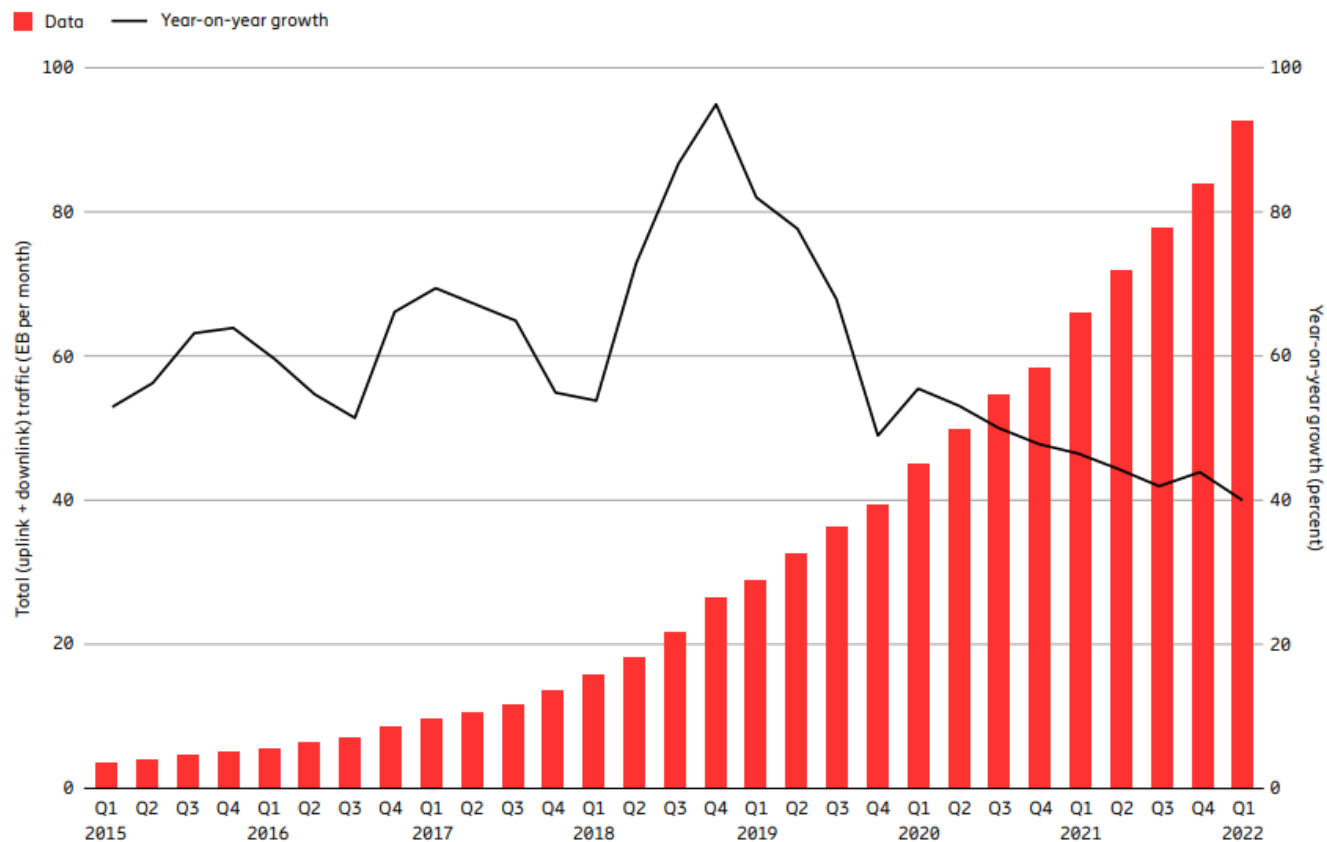
Fred Giancesello

ROLE

STMicroelectronics

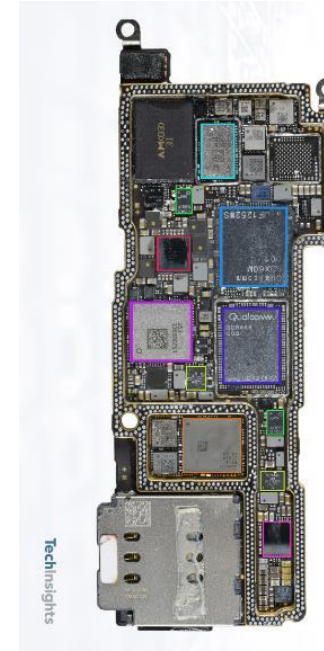
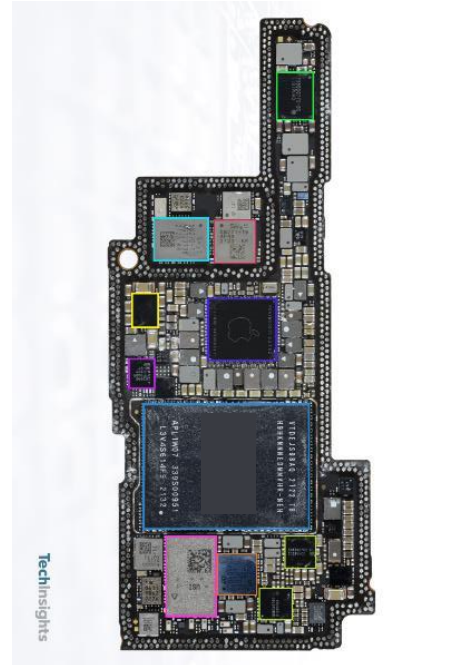
Wireless market trends

Driven by a never-ending demand for mobile data, wireless communication is adopting 5G adding new frequency bands for higher data rate



Implication on RF technologies

5G adoption has a direct impact on the wireless system, increasing the RF BOM and driving the growth of smartphone RF front end module market

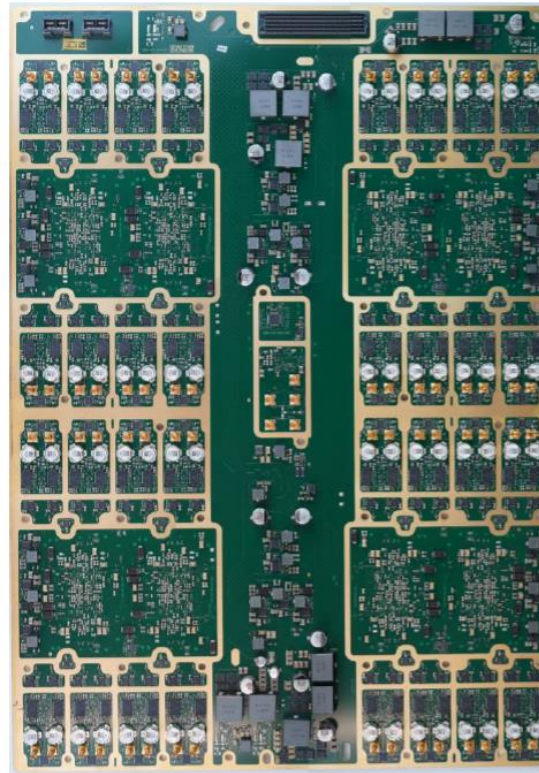


<https://www.techinsights.com/blog/teardown/a-pple-iphone-13-pro-teardown>

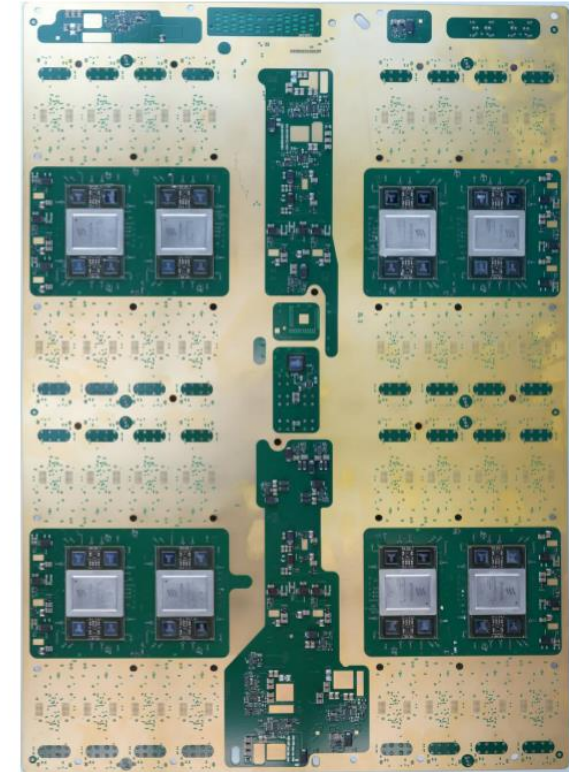
Moving to 6G will require **integration** and **power efficiency improvement**

Wireless infrastructure market challenge

This cost/integration challenge also concerns the wireless infrastructure market since mMIMO introduction drastically increases the RF BOM



RF Main Board: Front side
©2022 by Yole SystemPlus



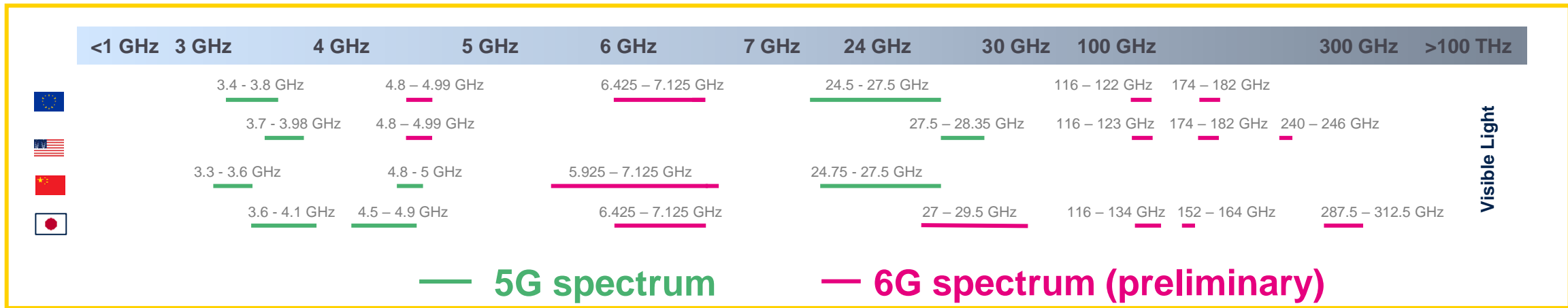
RF Main Board: Back side
©2022 by Yole SystemPlus

5G RF technologies partitioning and products

		Cellular	Connectivity	Infrastructure
Digital Baseband		5 nm CMOS	16 nm CMOS	5 nm CMOS
RF TRX		14 nm CMOS (<6 GHz)	16 nm CMOS	7 nm CMOS
		28 nm FDSOI (mmW)		
FEM	PA	GaAs	SiGe BiCMOS RF SOI	GaN LDMOS
	Pre Driver			SiGe BiCMOS
	LNA	RF SOI SiGe BiCMOS	SiGe BiCMOS RF SOI	SiGe BiCMOS
	RF SW	RF SOI	SiGe BiCMOS RF SOI	RFSOI
	RF filters	SAW BAW IPD	BAW IPD	

6G technology preliminary requirements

While 6G use cases and new applications are under definition, preliminary 6G spectrum allocation allows us to define some technology requirements



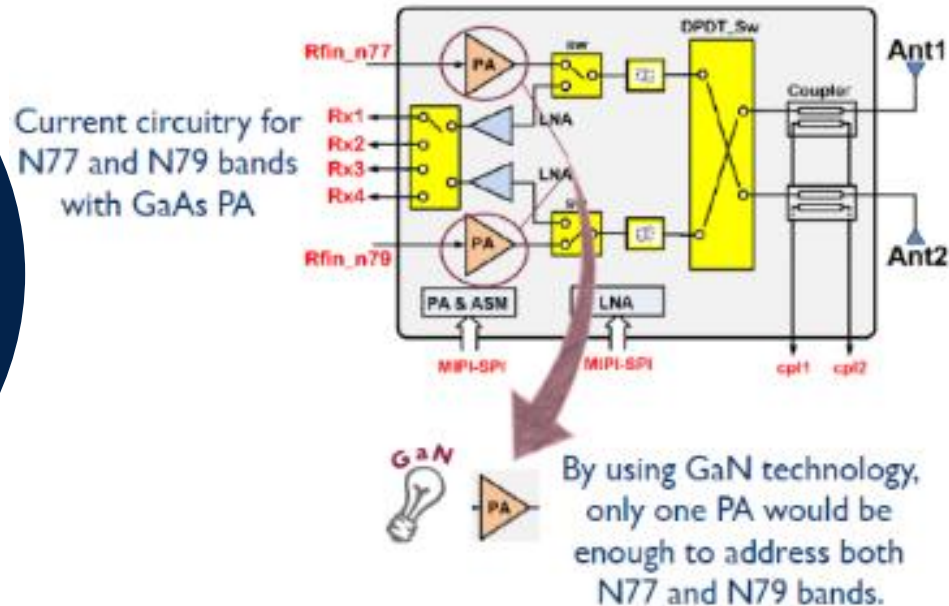
Mid band spectrum may ask for the improvement of current technologies used for 5G while application > 100 GHz may require some breakthrough.

6G Mi-band PA challenge & GaN opportunity

6G <7 GHz poses a challenge from PA side because of higher frequency and wider bandwidth (at least 200 MHz)

GaN-on-Si Pas could not make their market entry in sub-6GHz handsets within N77 and N79 bands, especially in Chinese and Japanese markets, owing both to technical benefits and geopolitical issues related to Chinese OEMs.

5G FEM structure for UHB



If appropriate performance and cost structure can be achieved, GaN on Si could be disruptive for 5G and 6G handsets PA

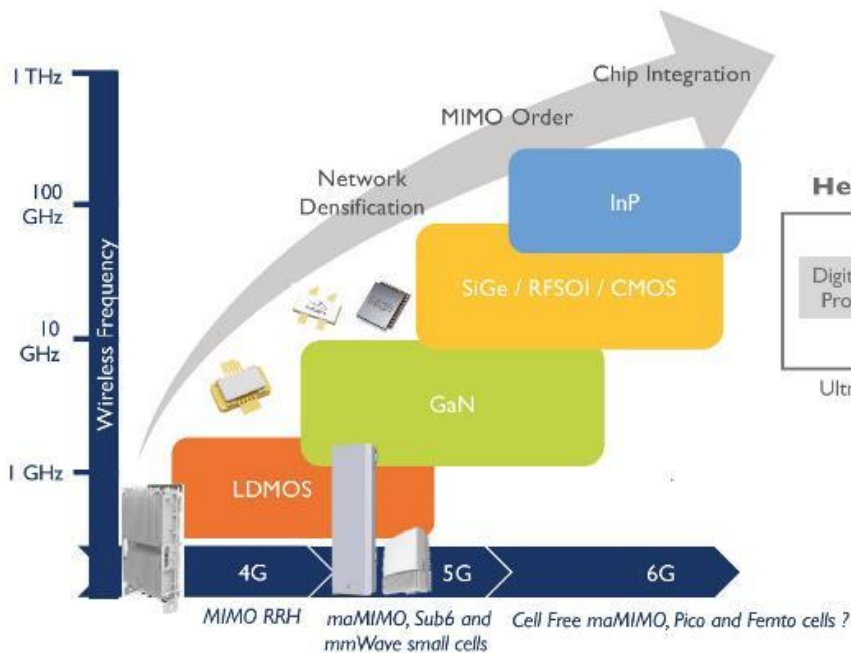
GaN RF Market Players, Technology and Substrates, Yole Développement, 2021

6G THz challenges & InP opportunity

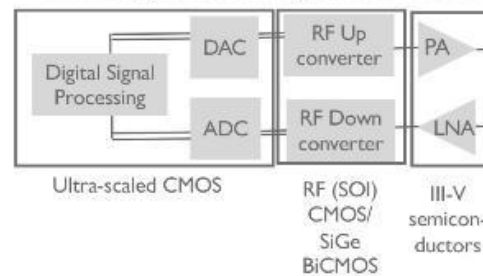
6G targeting even higher data rate, sub-THz communication are considered and consequently InP could be a promising solution

6G technology roadmap – 2030 overview

(Source: RF for Telecom Infrastructure 2022 - Focus Mobile Network, Yole Développement, May 2022)



Heterogenous Integration for 6G ?



What is the best approach to enable 200/300 mm InP on Si technologies?

<https://www.i-micronews.com/products/rf-for-telecom-infrastructure-2022-focus-mobile-network/>

Conclusion and perspectives

More than ever connectivity technologies are fundamental to **address key societal needs**

6G deployment in mid band will reinforce **RF-SOI & SiGe BiCMOS** technologies relevance

6G also creates **opportunity** for new innovative RF technologies (**GaN & InP**)

Further development will require **creativity** and strong **collaboration** between academics and industrial players

Our technology starts with You



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