

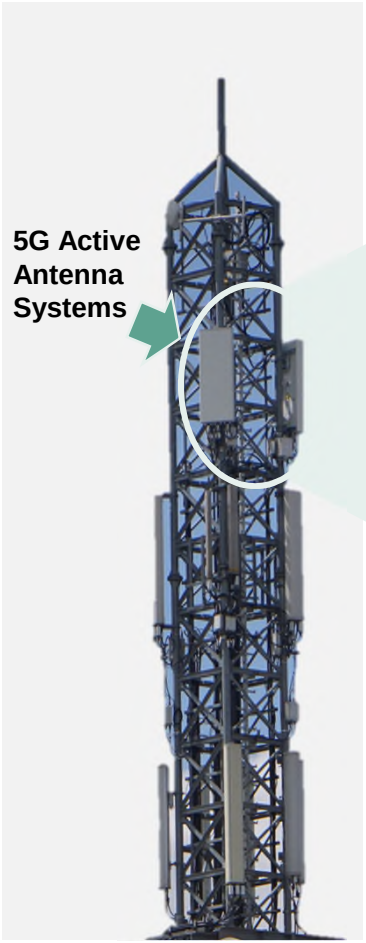
5G RF GaN on Silicon

Ludger Verweyen, Vice President RF Communication
MWC 2023

5G Radio Units with RFS IP in module design and RF GaN technology

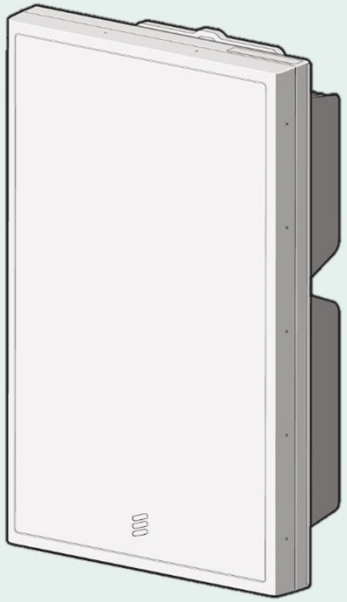
Each … **… carries 3 to 4 …** **… each of the 32 Antenna groups need two(1) …** **… each module consists of …**

Base station



Active Antenna System (Radio Unit)

Radio Unit with
96 Antennas

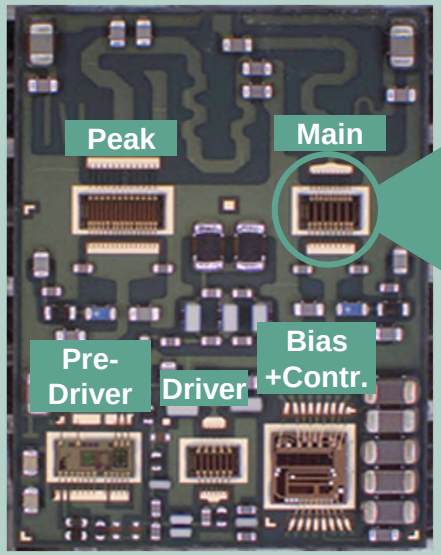


Antenna group
(3 Antennas per group)



TX PA module

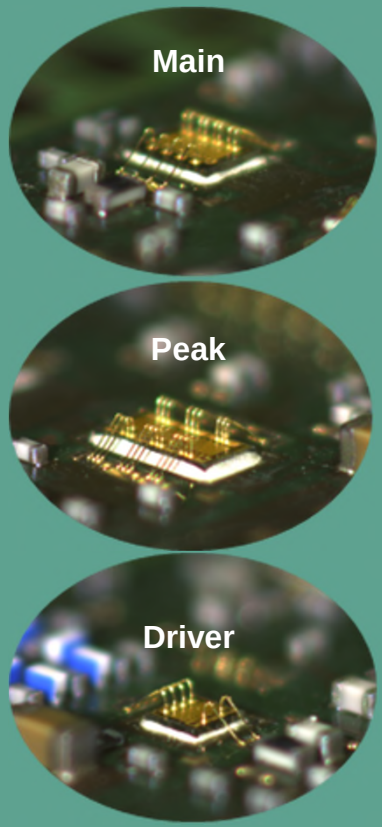
Referred to **"Module"**



Incl. Pre-Driver &
Bias+Control

RF GaN-Si PA bare dies

Referred to **"Technology"**



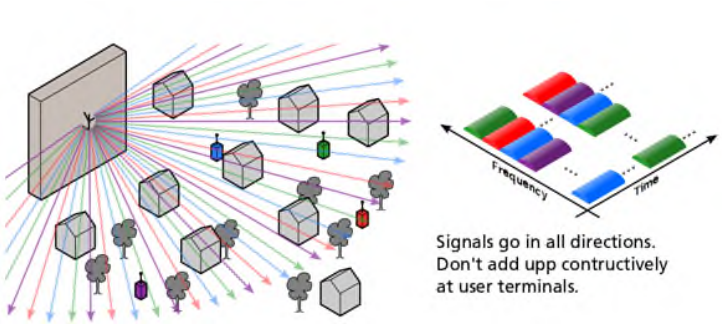
Note: (1) One PAM for vertical polarization and one for horizontal polarization

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Different types of 5G base stations

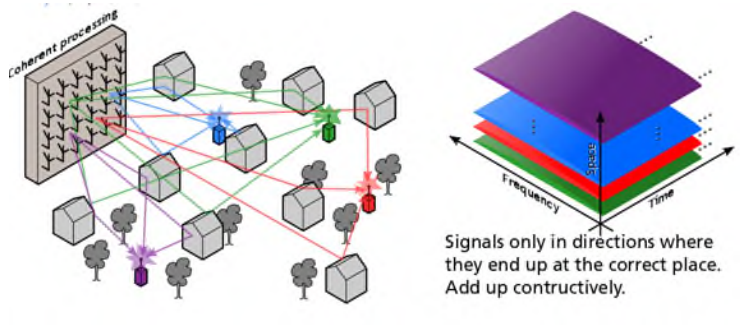
Focus

5G Macro



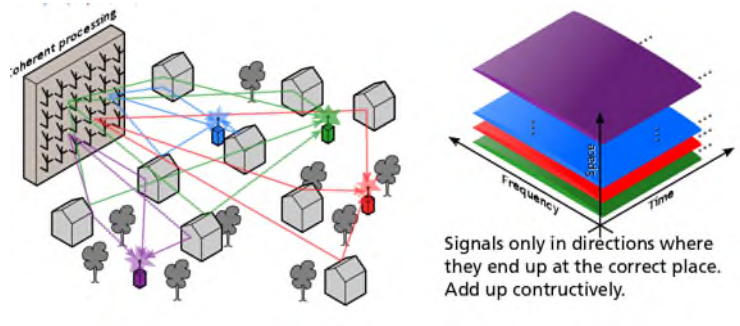
- **Long range** (~50 km)
- **Relatively slow speed** (up to x 100 Mbsp)
- **Low frequencies** (<2 GHz)

5G mMIMO



- **Medium range** (up to 20 km)
- **High speed** (up to Gbps level)
- **Mid-range frequencies** (2.5 – 7 GHz)
- **Dynamic capacity allocation**

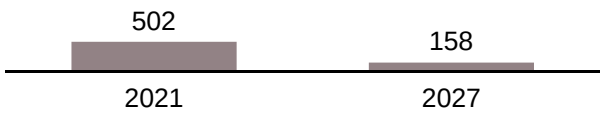
5G mmWave



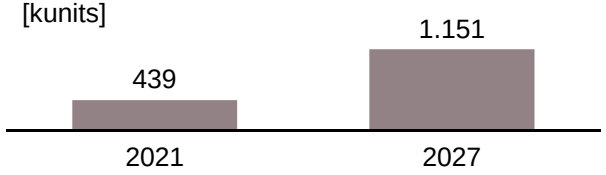
- **Short range** (up to 100 m)
- **Highest speed** (up to x 10 Gbps)
- **High frequencies / mmW** (>24 GHz)
- **Dynamic capacity allocation**

Coverage (km) → **Capacity (Gbps)**

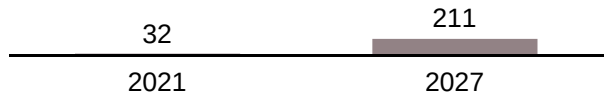
#5G Macro base stations deployed(1)
[kunits]



#5G mMIMO base stations deployed(1)
[kunits]



#5G mmW base stations deployed(1, 2)
[kunits]

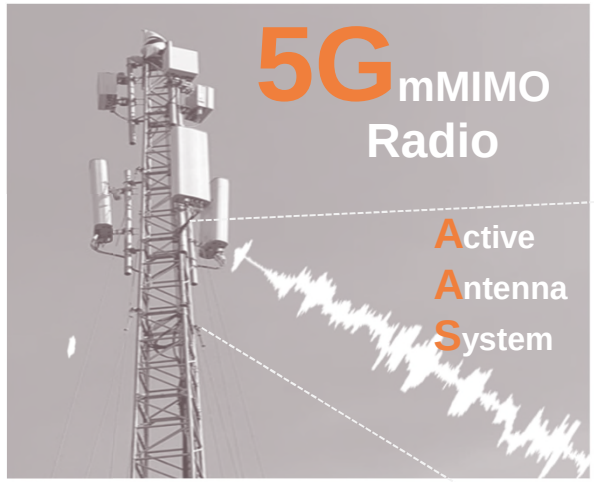


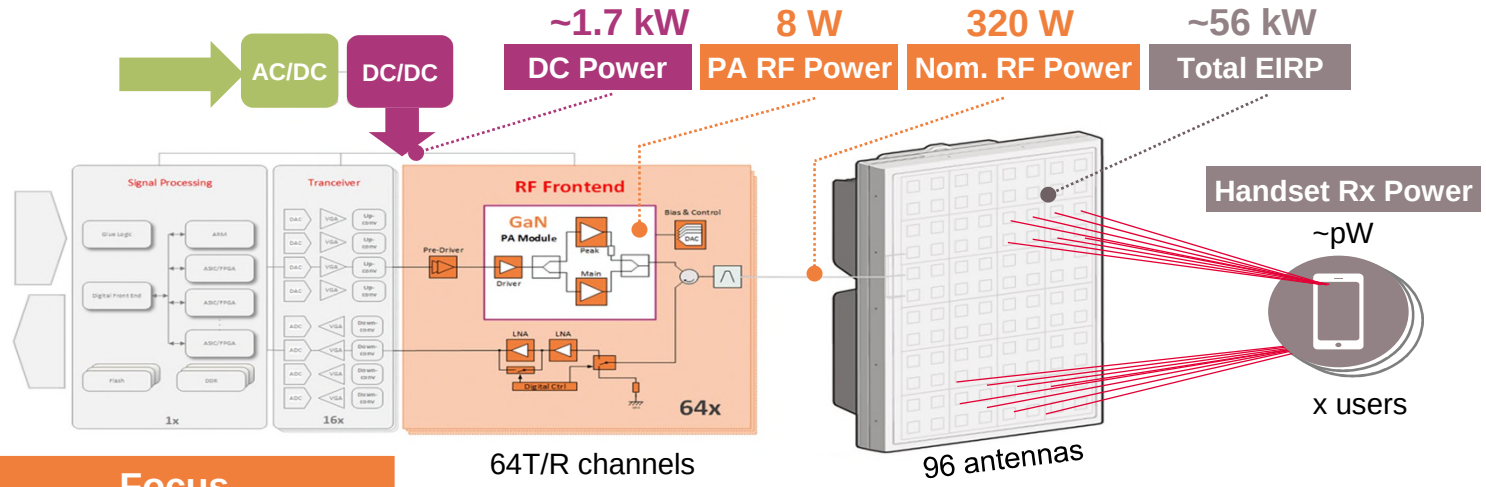
4T	8T	32T	64T	mmWave
4x 40 W	8x 40 W	32x 10 W	64x 5 W	256x 200 mW

Note: (1) Source Mobile Experts; (2) Assumptions for #5G mmW base stations deployed = 3 radio units per base station

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Complete portfolio for RF-Front-end, complemented by Power supply components and NOR Flash





	PA Transistor die	PA Module (Focus)	Bias & Control	Pre-Driver	RX Module
Product	**T9501A** **T9502A_x**	**BGMT1V1B36**	**BGMC1210**	**BGAP2xx0A**	**BGMR2x1E40**
Technology	**GaN-Si**	**GaN-Si** / SPT10 / B11HFC	**SPT10**	**B11HFC**	**B11HFC / SOI**
Status	**Mass Production**	**First Samples Available @N78 and B41**	**First Ramp end 2022**	**Gen 1 in Mass production Gen2 pre-qual passed, Ramp targeted Q4 2022**	**FS Targeted for Q4 2022**
IFX value Proposition	› Performance vs cost ratio ⇑	› Integration ⇑ › Strategic EU supply	› SOC integration › Cost ⇓	› Performance ⇑ › Cost ⇓	› Performance ⇑ › Cost ⇓

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Infineon has the right portfolio to tackle current & future requirements of Wireless Infrastructure

Technology leadership



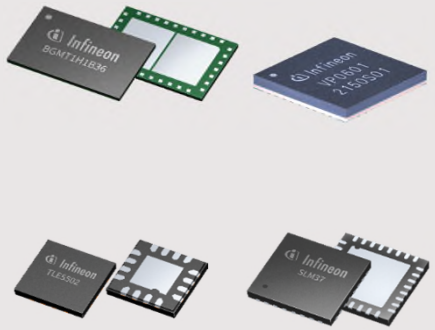
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RF GaN-Si (RF PA)

B11HFC (Pre-driver & LNA)

SPT10 (Bias & Control)

Full RF portfolio



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TX PA modules

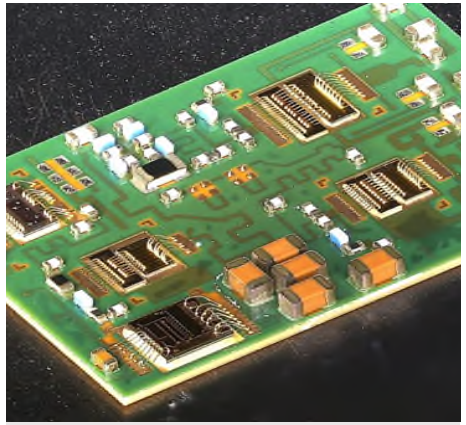
RX AFE modules

Pre-Driver

Bias & Control

See Backup for more details

Strong in-house IP



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RF Design IP



Future trends



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IFX is well prepared to support future trends of MNOs

European supplier



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Relaxed export control situation for controlled GaN material

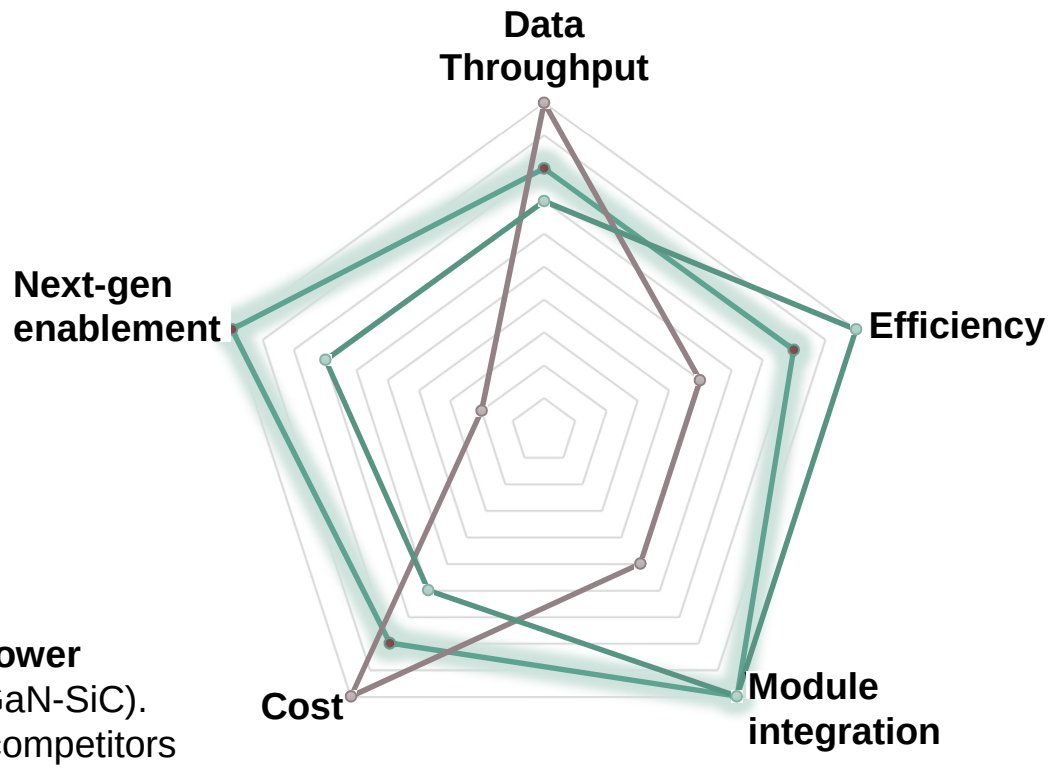
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RF GaN-Si technology: Strong cost/performance

Customers achieved very good EVM results with our RF GaN-Si using soft switching.

IFX can support MMIC capabilities (monolithic) needed for **higher frequencies.**

Cost advantage proven → **2-3 times lower cost/mm2** (RF GaN-Si compared to GaN-SiC). Larger wafers and lower carrier cost, competitors moving to 6“.



RF GaN-Si and GaN-SiC have comparable **transistor Efficiency,** GaN SiC can be run at higher supply voltage (48 V vs 28 V) due to **better heat dissipation.**

IFX is able to develop PAM modules with integrated Bias & Control.

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Infineon's RF GaN-Si modules offer exactly what MNOs need

Value drivers at Mobile Network Operators

Importance

1) **Performance** (Data throughput)

2) **Minimize operating expenditures** (OPEX)

3) **Minimize invest** (CAPEX)

All **value drivers** will be **in place with Infineon RF GaN-Si**

Infineon value proposition

- **Meets highest 5G technical requirements:** Supports higher frequency, higher output power, lower Error Vector Magnitude (EVM)



- **Energy efficient:** LDMOS is less efficient & closing gap on GaN-SiC
- **Low maintenance costs:** High reliability, lightweight radio unit, no cooling



- **Low HW cost:** Cheaper than GaN-SiC & no additional cooling system required
- **Low installation cost:** Lightweight radio unit (12 vs. 30 kg → no crane needed)



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Part of your life. Part of tomorrow.