D-band **R**adio solution **E**nabling up to 100Gb/s reconfigurable **A**pproach for **M**eshed beyond 5G network (DREAM)

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Outline

- Project introduction (vision, objectives, partners)
- Analysis of architectures for D band reconfigurable meshed transport networks
- Project status and next steps
- Conclusions

Vision

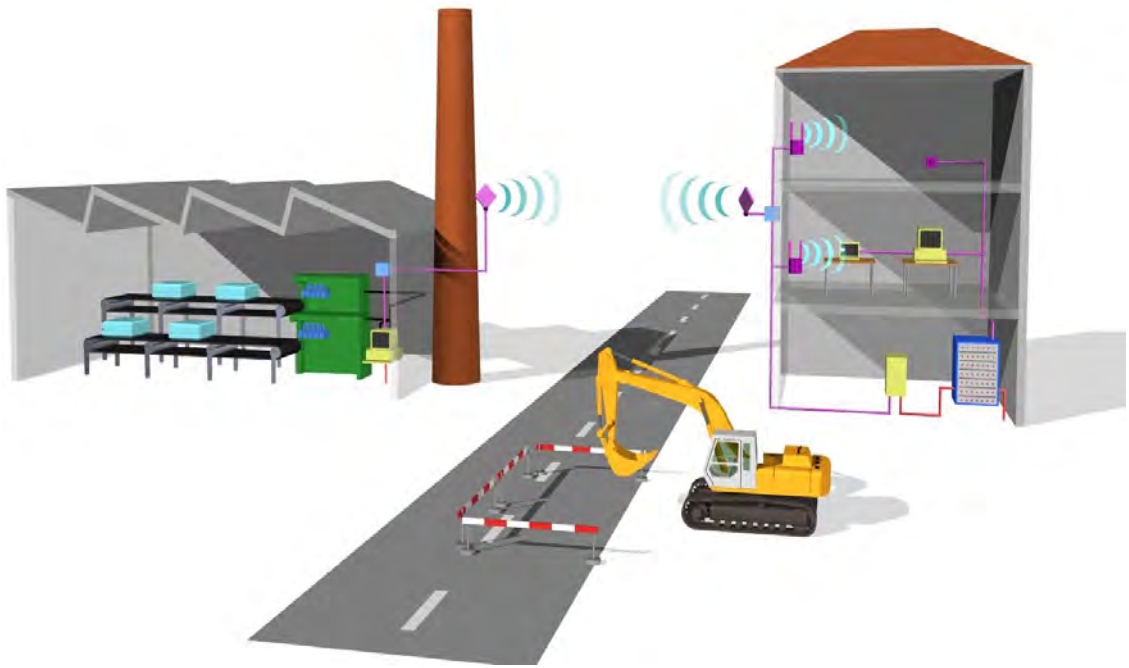
Nearly 10x wireless speed increase every 4 years. Extrapolating into the future, 100Gb/s will be required around 2020

> 50% world population in dense urban areas responsible for the majority of wireless traffic

New network architectures required to address high density urban environment. Macro-, micro- and pico-cell coverage, complement each other and need high speed, flexible and low-cost wireless backhaul solutions

The H2020 DREAM project is aimed at exploitation of the **D-band (130-174.4 GHz) spectrum, with beam steering** functionality, to enable wireless links with data rate **up to 100 Gb/s** , thus bringing wireless systems to the speed of optical systems.

Objectives

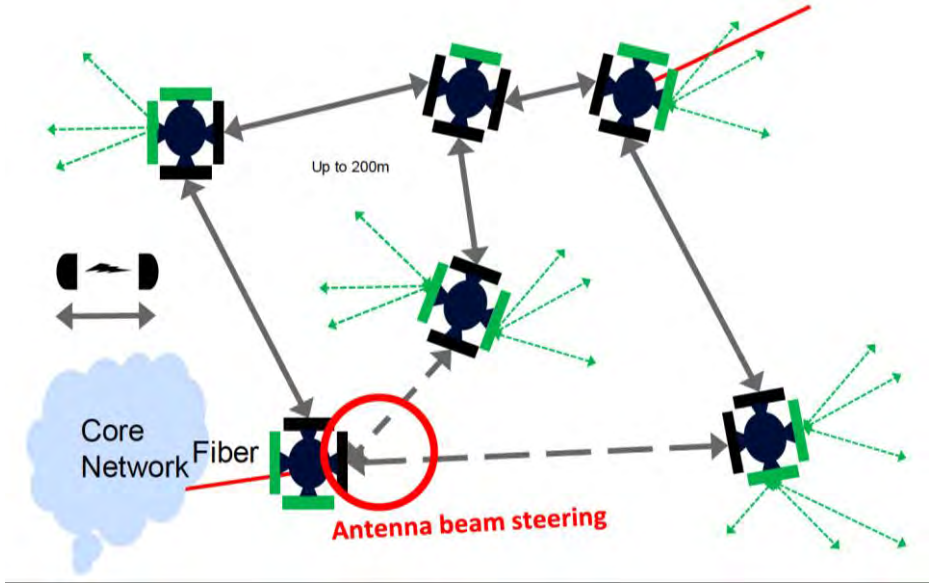


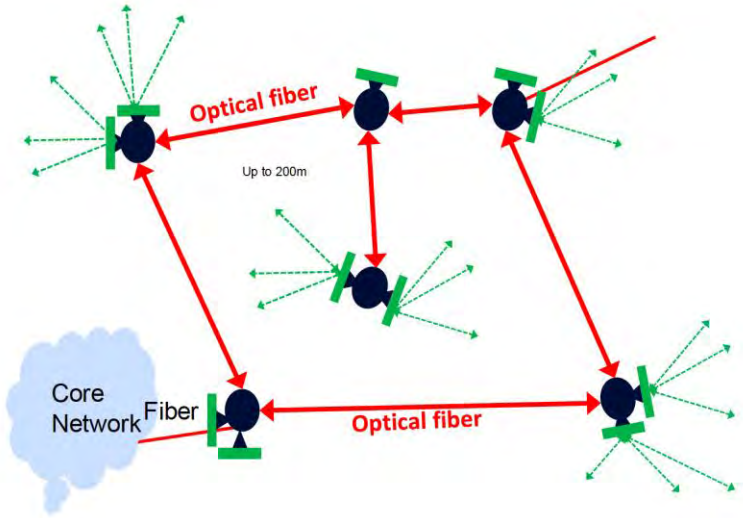
- Defining the specifications and the architecture of high data rate wireless link in D-band using real use cases and mobile network configurations.
- Demonstrate the feasibility of low-cost low-power SiGe BiCMOS transceiver in D-band, with antenna beam steering functionality, enabling backhaul/front haul link data rate up to 100 Gb/s.
- Provide a high capacity backhaul solution for future Small Cells access point networks.
- Increase flexibility and cost saving for network operator by inter-small cell backhauling connections, which enables a small cell access point network deployment close to the fiber backbone.

D band reconfigurable meshed transport network

Need of an ultrahigh data rate wireless solution

- Small-cells deployed within the macro-cell coverage to manage data traffic explosion
- Fiber interconnections are expensive, not always practical (e.g. dense urban area) or may have strong environmental impact

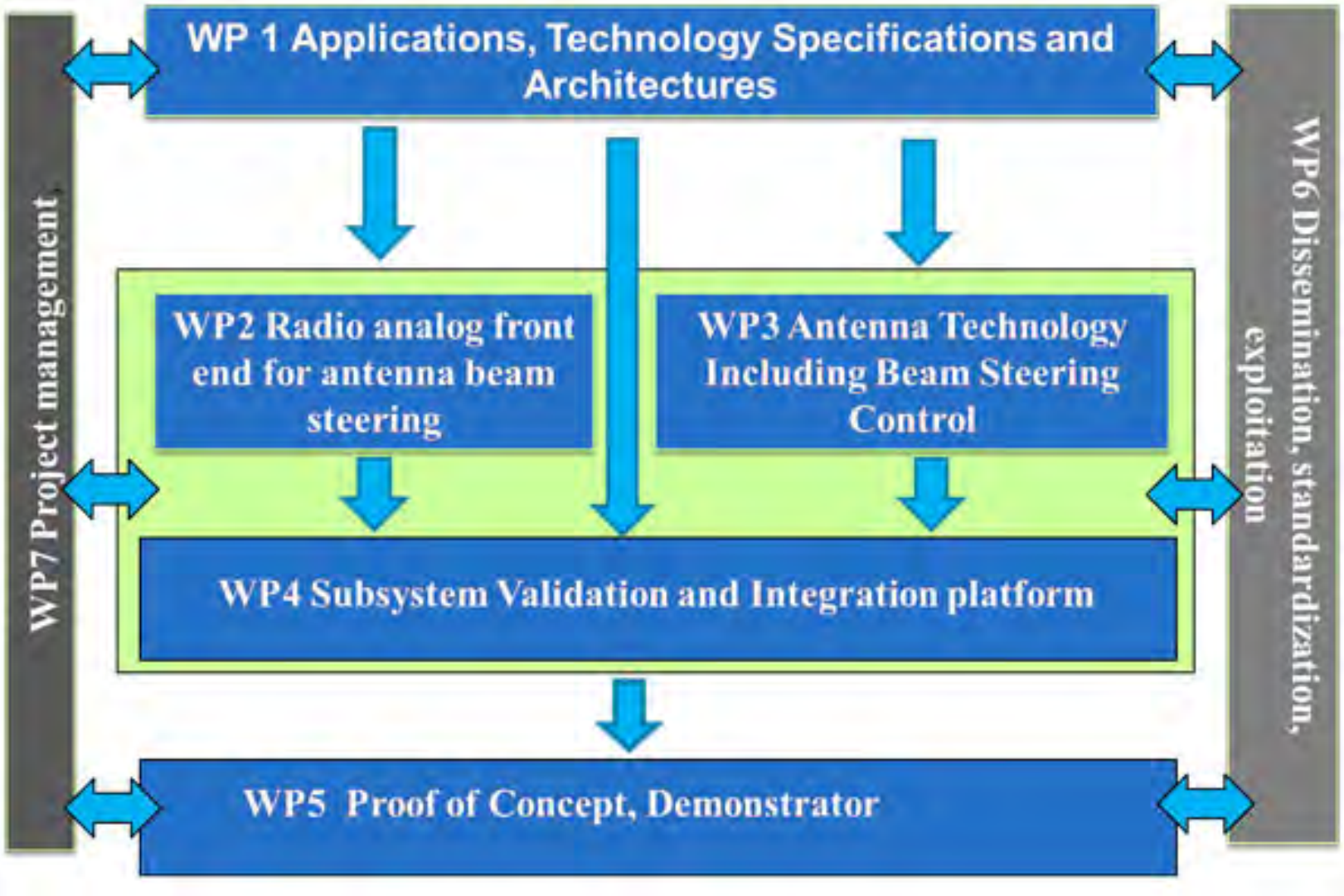




The DREAM project will research a wireless backhaul solution enabling up to 100 Gbps up to 300m distance

- D-band (130-174.8 GHz) with channels of many GHz
- Beam steering functionality to get flexible backhauling and network mesh re-configurability

Project Organization



Partners


VTT


ceit
IK4
Research Alliance


life.augmented

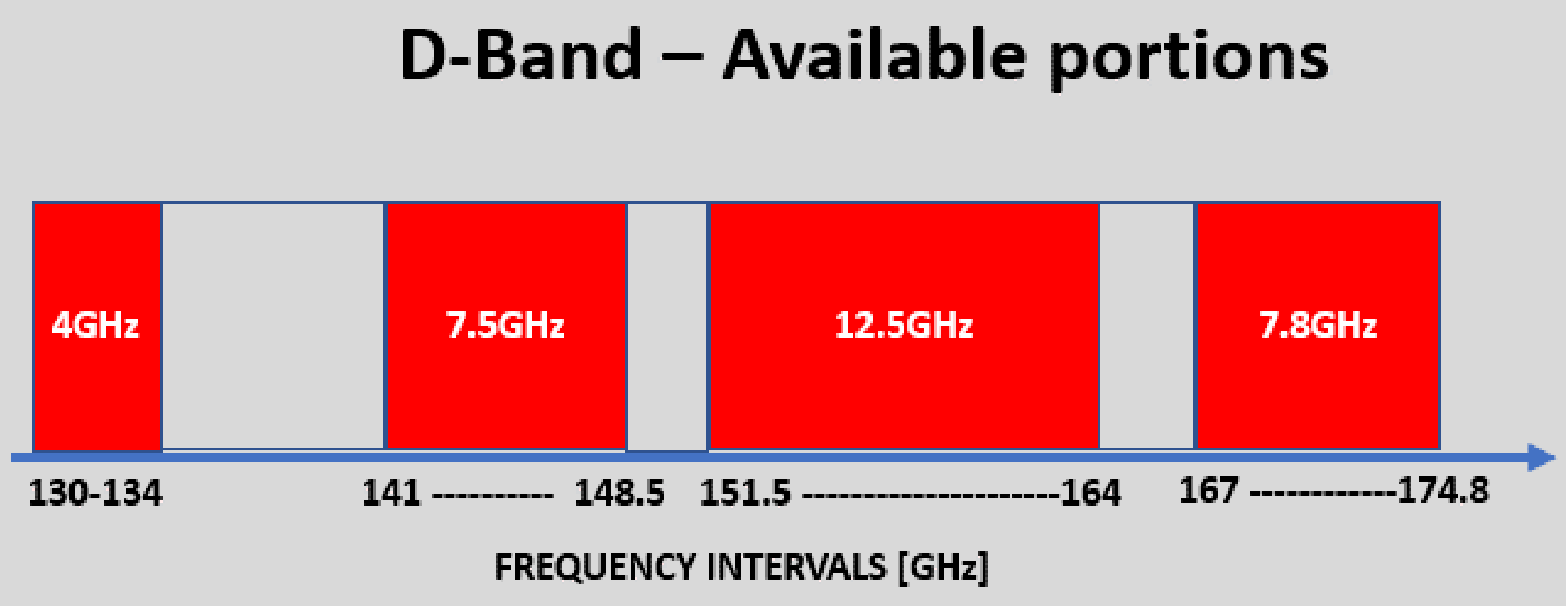

III-V lab


UNIVERSITÀ
DI PAVIA


NOKIA


ERZIA

Available portions of D-band for wireless communications (31.8 GHz is available only)

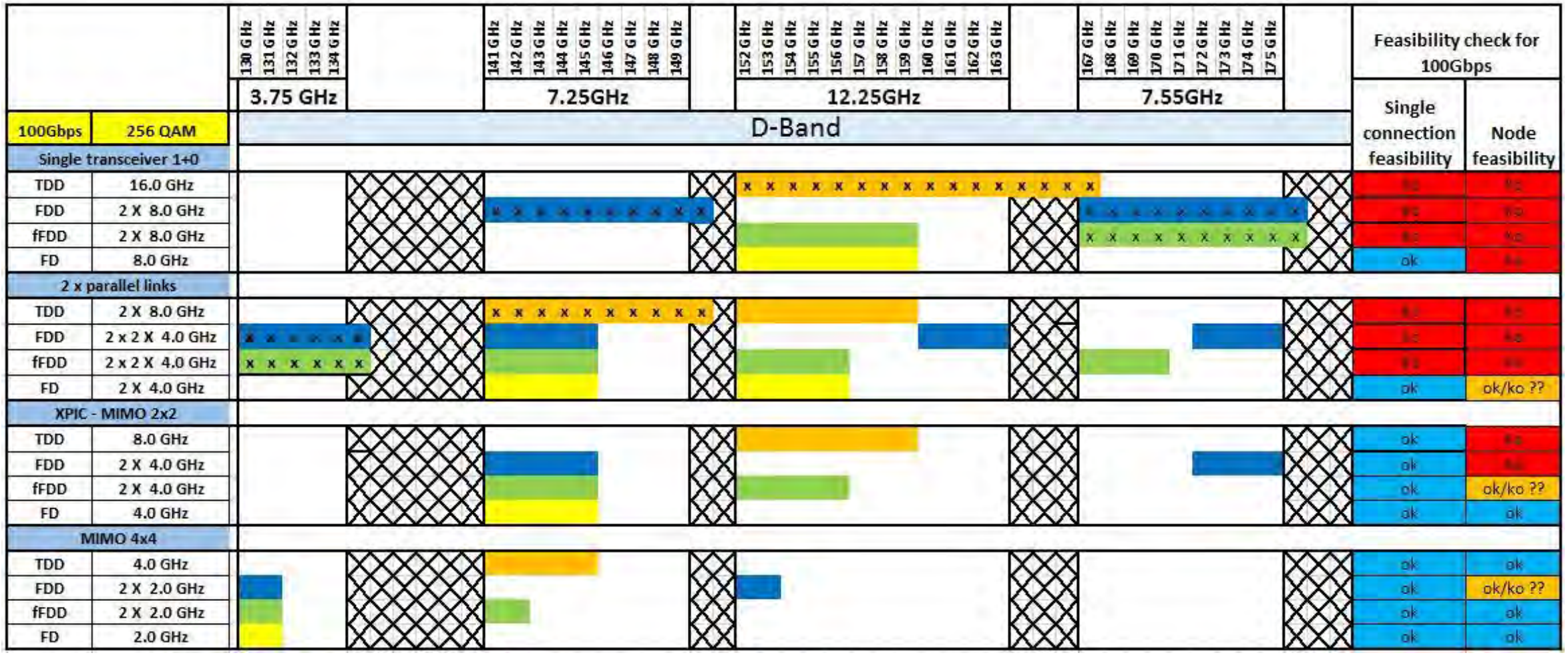


ECC Recommendation (18)01 on “Radio frequency channel/block arrangements for Fixed Service systems operating in the bands 130-134 GHz, 141-148.5 GHz, 151.5-164 GHz and 167-174.8 GHz”.

Target specification for D band link

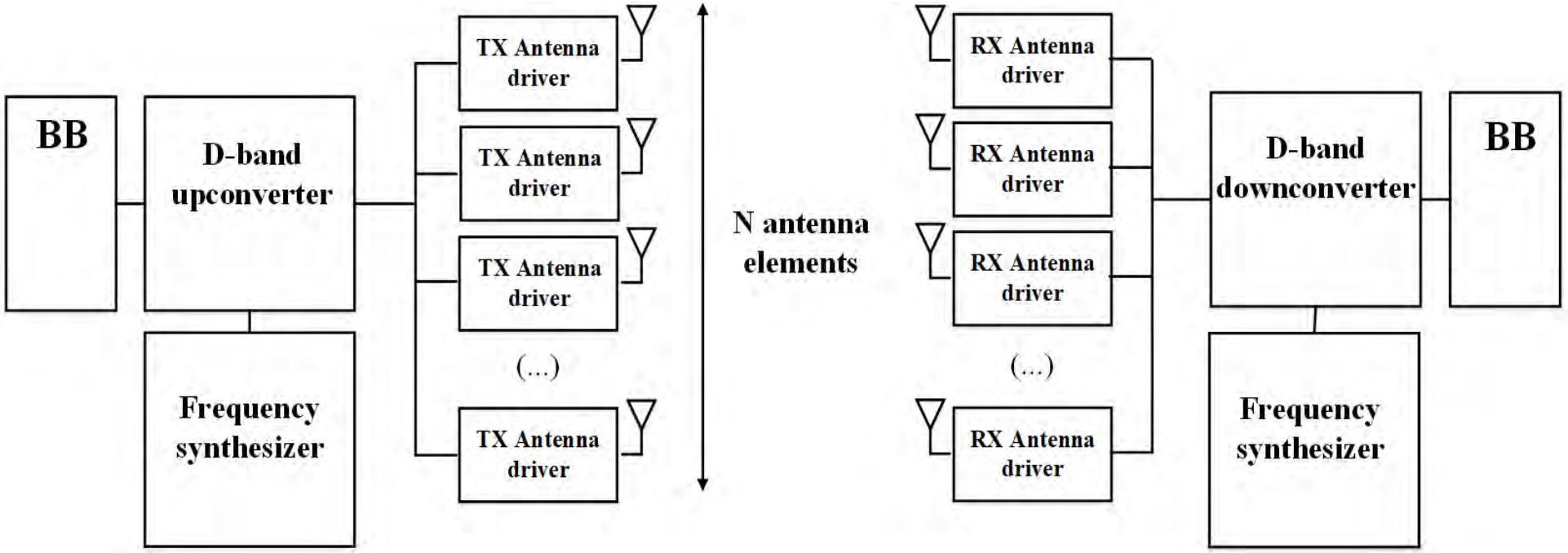
- Based on use cases for systems beyond 5G a radio backhaul transport network close to the access part should provide:
  - ✓capacity up to 100 Gbit/s (50 Gbit/s go + 50 Gbit/s return links)
  - ✓connection availability better than 99.9 %
  - ✓latency lower than 0.1 msec
  - ✓connection lengths of up 300 m

Analysis for 100 Gbit/s & 256-QAM solutions in D-Band



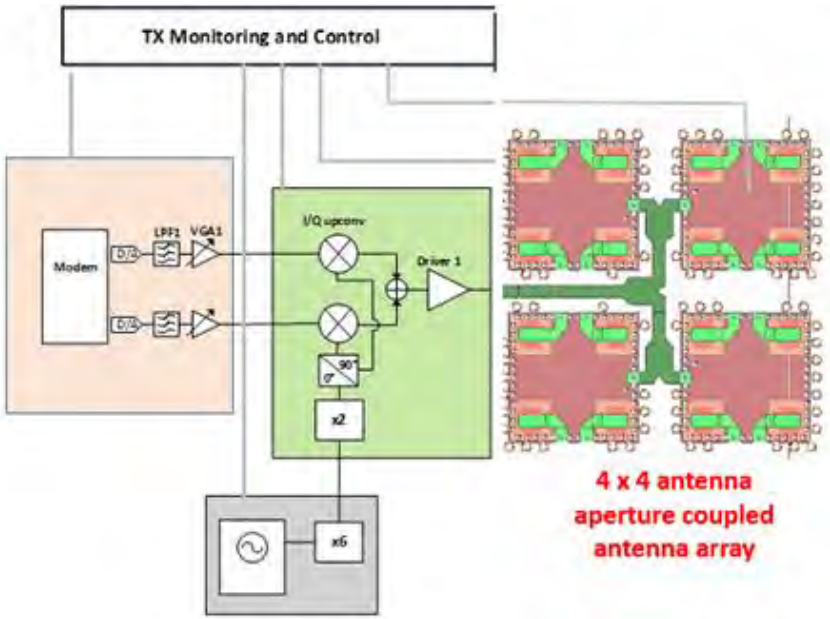
Different colors mark the required channel widths for Time Division Duplexer (TDD), Frequency Division Duplexing (FDD), flexible FDD (fFDD) and Full Duplex (FD), respectively.

Block diagram of the proposed architecture for the D-Band phased array transceiver.

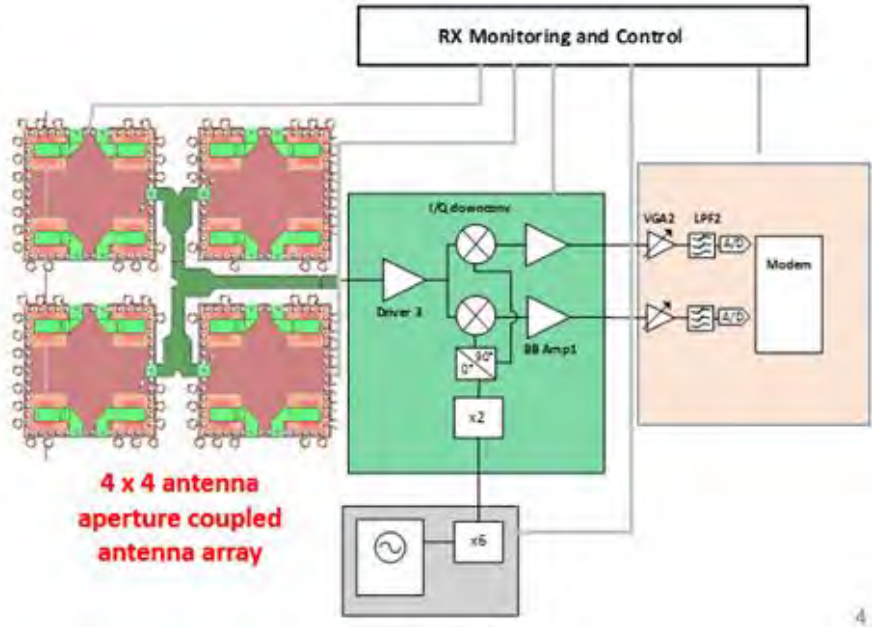


- Two completely different chains for TX and RX, including the antennas.
- For both TX and RX, a square (nxn) phased array antenna.

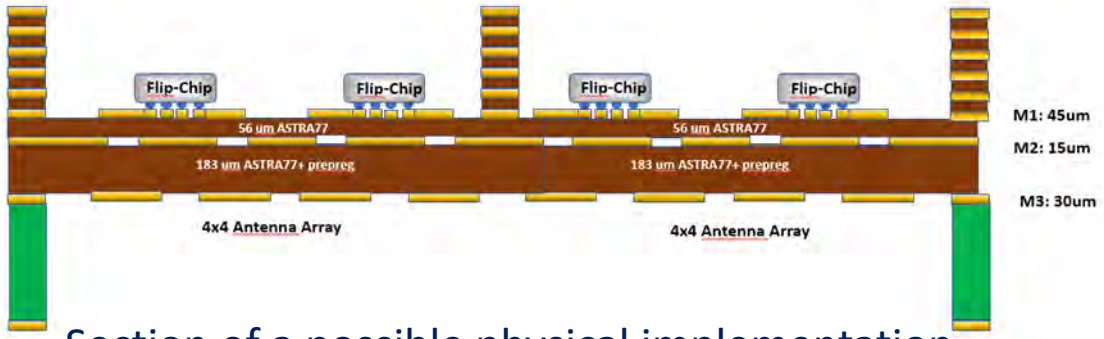
Demonstrator



Transmitter



Receiver



Section of a possible physical implementation

Status of project and next steps

- Status
  - ✓Architecture of the link is created
  - ✓Specs for all blocks are defined
  - ✓All sub blocks of a transceiver are designed, fabricated (55 nm BiCMOS process at ST) and under testing now.
  - ✓Elements of an antenna array designed, fabricated and tested. Antenna gain is 4.5 dBi at 150 GHz
- Next steps
  - ✓Integration of sub blocks in chipset
  - ✓Design antenna array
  - ✓System integration and testing

Conclusions

- A pragmatical approach in defining a possible transceiver architecture enabling a radio connection for a D band meshed transport network for 5G and beyond.
- To converge towards a possible commercial product, the impact of available spectrum has been considered and deeply analyzed.
- A scalable solution, in terms of capacity and channel width, fulfilling the most demanding case has been derived, in such a way that it can be adopted for plenty of different use case.
- A transceiver architecture is suggested.
- Based on project results, we can conclude that the proposed solution can be used for plenty of different radio connections, since it can provide a capacity level up to 100 Gbps over 160 meter and, at reduced capacity, hop lengths exceeding 1 km.

Acknowledgment

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