Spectrum Sharing as a Key Enabler to scale Private industrial Networks Deployments

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FRANCO-GERMAN ECOSYSTEM
FOR PRIVATE 5G NETWORKS

Agenda

- MERCI short introduction

- DECT-2020 NR short introduction

- Private Network & Spectrum Access

- The European Harmonized 3.8 – 4.2 GHz Frequency Band

- Spectrum Sharing
  - Introduction
  - Brief history
  - MERCI viewpoint

- Work Status

- Key Takeaway

Partners

Associated Partners

more to come...

About MERCI (1)

- German-Franco innovation project for private 5G networks
  - The only one not using 3GPP technologies

- Funded by the Bundesministerium für Wirtschaft und Klimaschutz (BMWK) and the französischen Ministère de l'Economie et des Finances et de la Relance (MEFR) (via BPI)

- **M**edia and **E**vent production via **R**esilient **C**ommunication on IoT **I**nfrastructure

- Develop innovative solutions based on the non-cellular 5G technology DECT-2020 NR for private networks through cooperative integration of
  - the **media & event sector**, manufacturing/producing content up to distribution to the audience,
  - with the **(industrial) IoT sector**,

FRANCO-GERMAN ECOSYSTEM
FOR PRIVATE 5G NETWORKS

Gefördert durch:

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für Wirtschaft
und Klimaschutz

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MINISTÈRE
DE L'ÉCONOMIE,
DES FINANCES
ET DE LA RELANCE
Liberté
Égalité
Fraternité

About MERCI (2)

MERCI has three main goals:

- Integration of DECT-2020 NR in existing wireless communication infrastructures

- Evaluation and demonstration of the DECT-2020 NR technology and their possibilities

- Practical evaluation of new frequency bands for private 5G networks

$\Rightarrow$ Enabling 5G for small and medium enterprises via non-cellular DECT-2020 NR

$\Rightarrow$ Increase the European sovereignty on wireless communication technology and eco-systems
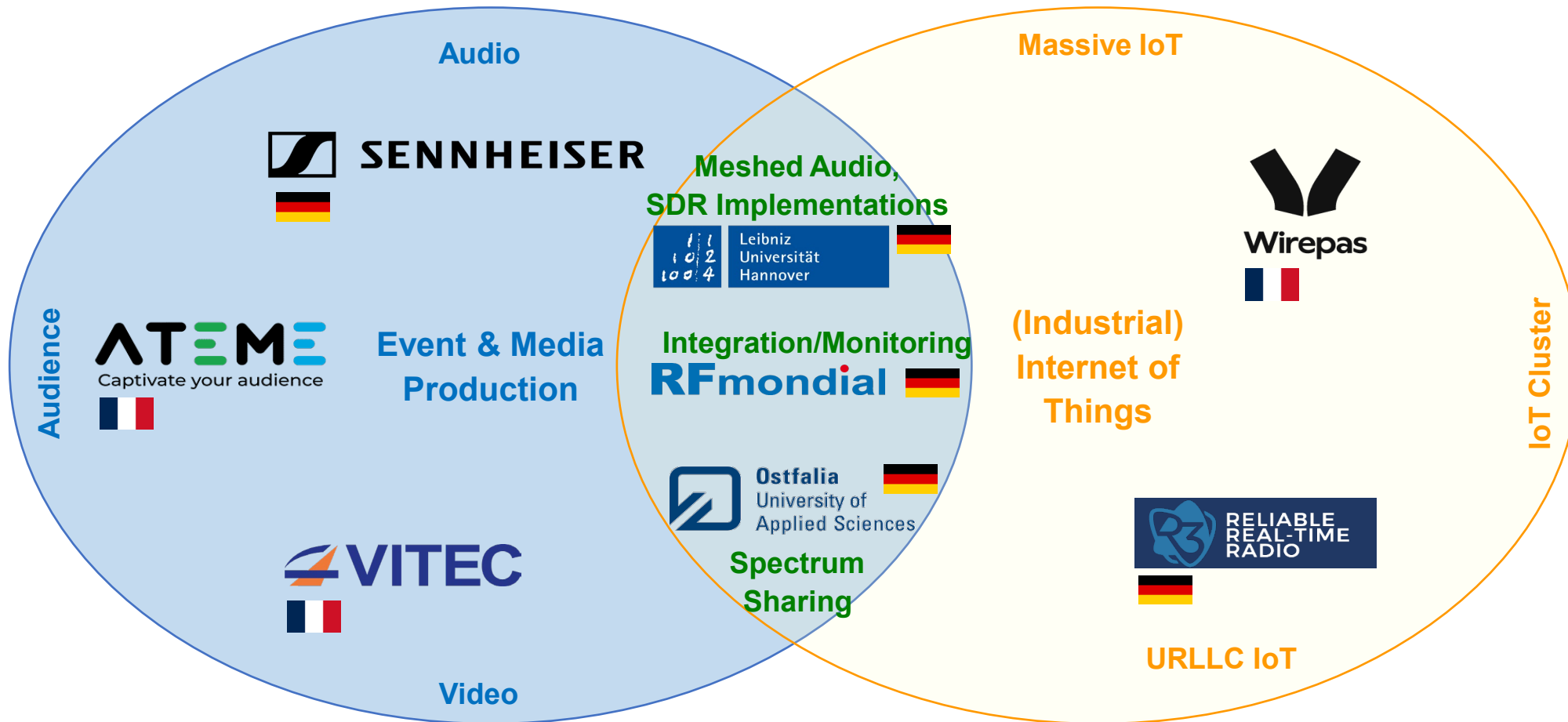
Partners

SENNHEISER

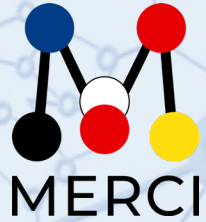ATEME
Captivate your audience

RFmondial

VITEC

R3 Solutions

Wirepas

Ostfalia
University of Applied Sciences

Leibniz
Universität
Hannover

Associated Partners

NORDIC
SEMICONDUCTOR

GÖTTING

BR

dect
forum

Bundesnetzagentur

more to come...

MERCI consortium

Audio

Massive IoT

SENNHEISER

Meshed Audio,
SDR Implementations

Leibniz
Universität
Hannover

Wirepas

Audience

ATEME
Captivate your audience

Event & Media
Production

Integration/Monitoring

RFmondial

(Industrial)
Internet of
Things

IoT Cluster

Ostfalia
University of
Applied Sciences

RELIABLE
REAL-TIME
RADIO

VITEC

Spectrum
Sharing

Video

URLLC IoT

DECT-2020 NR short introduction

- DECT-2020 NR, developed by ETSI, is a Radio Interface Technology (RIT) that aligns with ITU-R's IMT-2020 requirements as part of the 5G standard

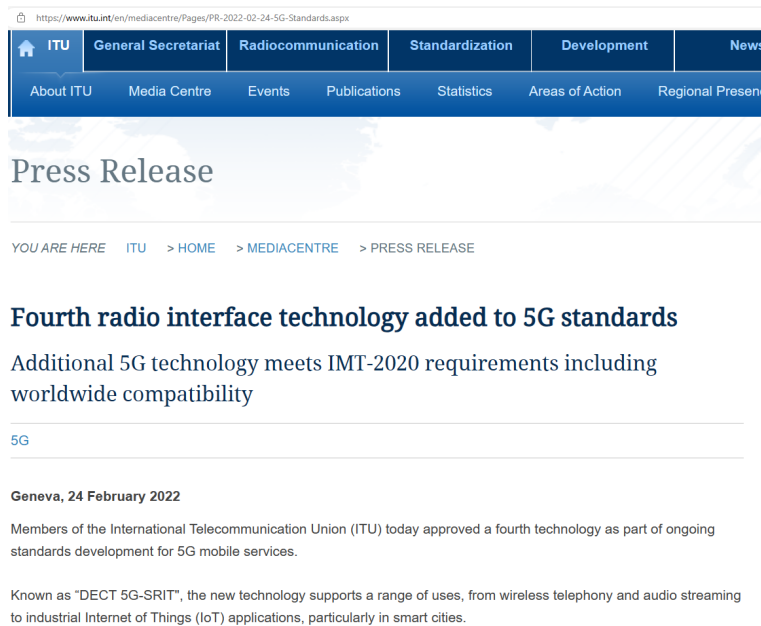- DECT-2020 NR is **the first non cellular 5G technology standard**
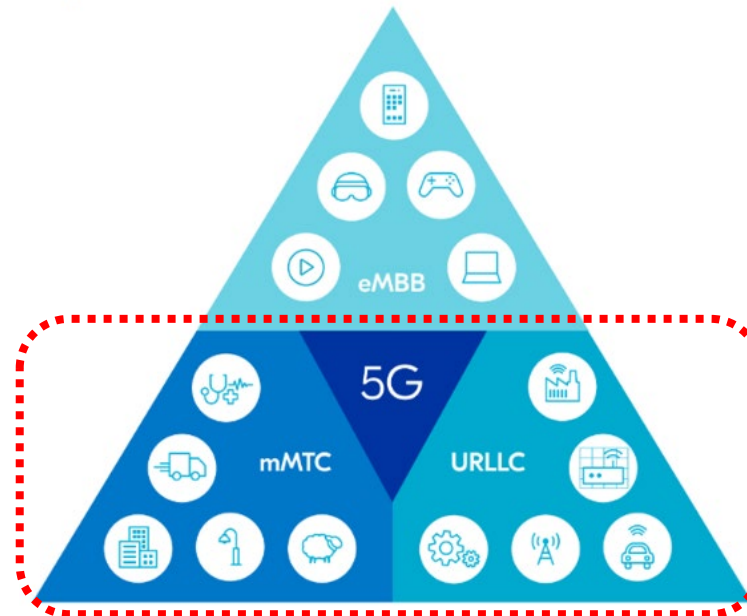

Fig.1 ITU R press release

Fig.2 DECT-2020 NR fulfills two 5G requirements

Question:
What is the benefit of non-cellular 5G?

Answer:
To facilitate private networks that might benefit vertical industries, including small and medium enterprises.

Vertical Industries including Programme Making and Special Event Industries, Wireless Industrial Automation, and Utilities

Private Network & Spectrum Access
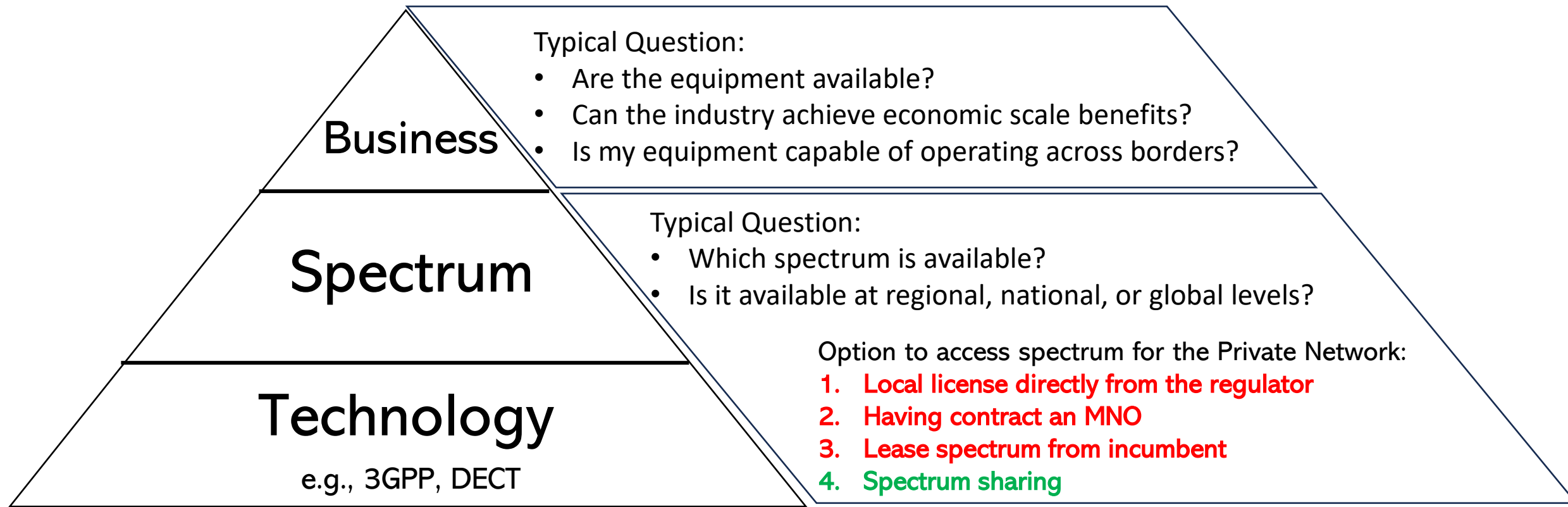
Q: What should be considered?

Typical Question:
- Are the equipment available?
- Can the industry achieve economic scale benefits?
- Is my equipment capable of operating across borders?

Typical Question:
- Which spectrum is available?
- Is it available at regional, national, or global levels?

Option to access spectrum for the Private Network:
1. **Local license directly from the regulator**
2. **Having contract an MNO**
3. **Lease spectrum from incumbent**
4. **Spectrum sharing**

Business

Spectrum

Technology
e.g., 3GPP, DECT

Fig.3 Level/Condition to deploy private network

- European (through EC) recommends its member states **to consider shared use of 3.8 – 4.2 GHz frequency band** for local applications using Low/Medium Power (LMP) networks due to existence of incumbent applications and services [1]

- This band **supports** 5G equipment, but the band **is not dedicated** to MNOs in Europe

- The local band must be shared by considering:
  – Incumbent protection within the band
  – Need for coordination of local area networks in the band
  – Adjacent coexistence with adjacent services, mainly MNOs below 3.8 GHz

The European Harmonized 3.8 – 4.2 GHz Frequency Band (2): Operating Frequency Band

DECT Core Band

DECT-2020 NR (or DECT NR+ terms which are promoted by DECT Forum) has access to the DECT core band (License-Exempt 1.9 GHz)

Our project would like to investigate this band

Source: [2]

Band number	Receiving band (MHz)	Transmitting band (MHz)
1	1 880 to 1 900	1 880 to 1 900
2	1 900 to 1 920	1 900 to 1 920
3	2 400 to 2 483,5	2 400 to 2 483,5
4	902 to 928	902 to 928
5	450 to 470	450 to 470
6	698 to 806	698 to 806
7	716 to 728	716 to 728
8	1 432 to 1 517	1 432 to 1 517
9	1 910 to 1 930	1 910 to 1 930
10	2 010 to 2 025	2 010 to 2 025
11	2 300 to 2 400	2 300 to 2 400
12	2 500 to 2 620	2 500 to 2 620
13	3 300 to 3 400	3 300 to 3 400
14	3 400 to 3 600	3 400 to 3 600
15	3 600 to 3 700	3 600 to 3 700
16	4 800 to 4 990	4 800 to 4 990
17	5 725 to 5 875	5 725 to 5 875
18	5 150 to 5 350	5 150 to 5 350
19	5 470 to 5 725	5 470 to 5 725
20	3 800 to 4 200	3 800 to 4 200
21	3 700 to 3 800	3 700 to 3 800

Tab.1 Operating Frequency Band Table

The European Harmonized 3.8 – 4.2 GHz Frequency Band (3): Workflow Interaction
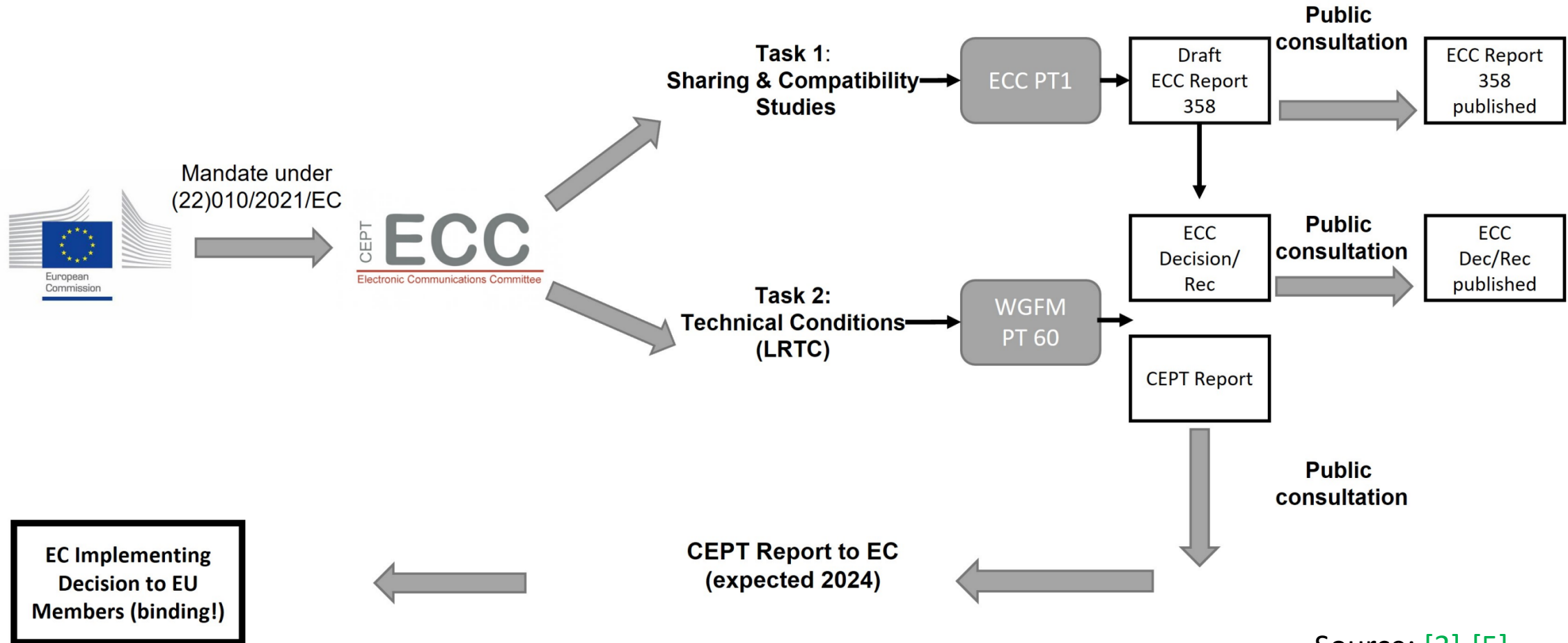

Fig.4 Workflow interaction between European policy making bodies to harmonize the band

Source: [3]-[5]

Spectrum Sharing (1):
Introduction

Technical Perspective	Regulation Perspective
"A condition where users reuse radio waves across dimension space, frequency, time, and signal domain (code)" [6]	*"It refers to the situation where two or more radio systems use the same frequency band"* [7]

Technical Perspective

Spectrum Sharing

always apply | at least one of these*

- Sensing
- Coordinating
- Informing

*Currently, the application of AI is under investigation

Regulation Perspective

Spectrum Sharing

There are | two types:

- Horizontal
- Vertical

Spectrum Sharing (1):
Introduction

Technical Perspective	Regulation Perspective
Typical Questions are: How can regulation be enforced? How can sharing be made more efficient?	***Typical Questions are:*** Who holds the rights to the spectrum? Which users are entitled to these rights? Under what conditions can these rights be granted?
	**Sharing Scheme*:* 1. Incumbent protection from being interfered by secondary users 2. To coordinate secondary users among themselves

Q: Why do we need Spectrum Access/Sharing?
A: Increasing demand for **local private wireless networks** ⟶ It refers to a connectivity which controlled and managed by private organization and
A **high level of Quality of Service**

Spectrum Sharing (2):
Brief History of spectrum sharing

Early 2000s - 2009

2010

2011 - 2013

2014 - 2022

2023-2024
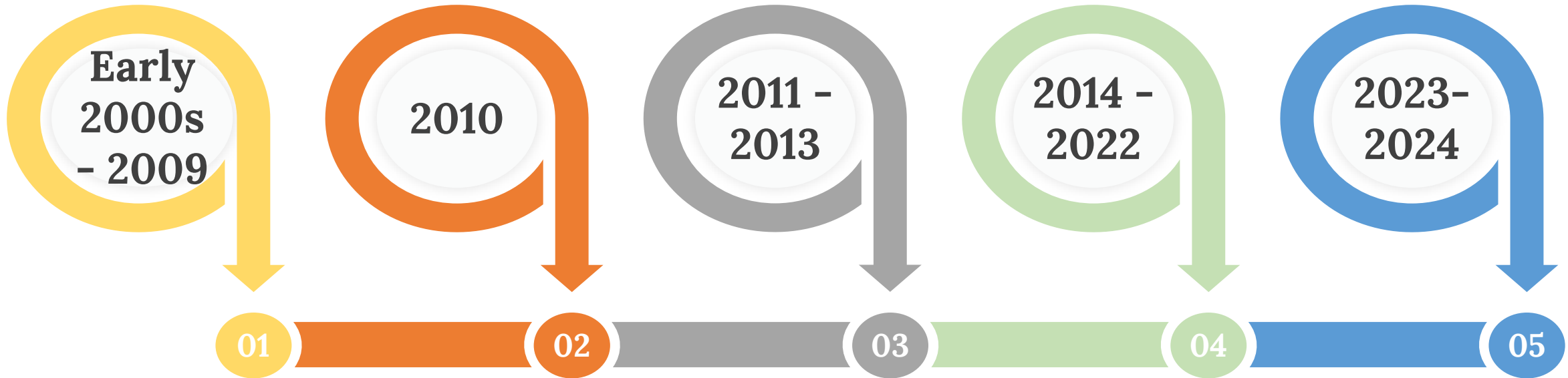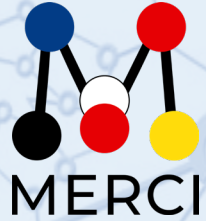
01 The advent of Cognitive Radio & FCC warned about a looming spectrum crisis (Spectrum Crunch) [8]
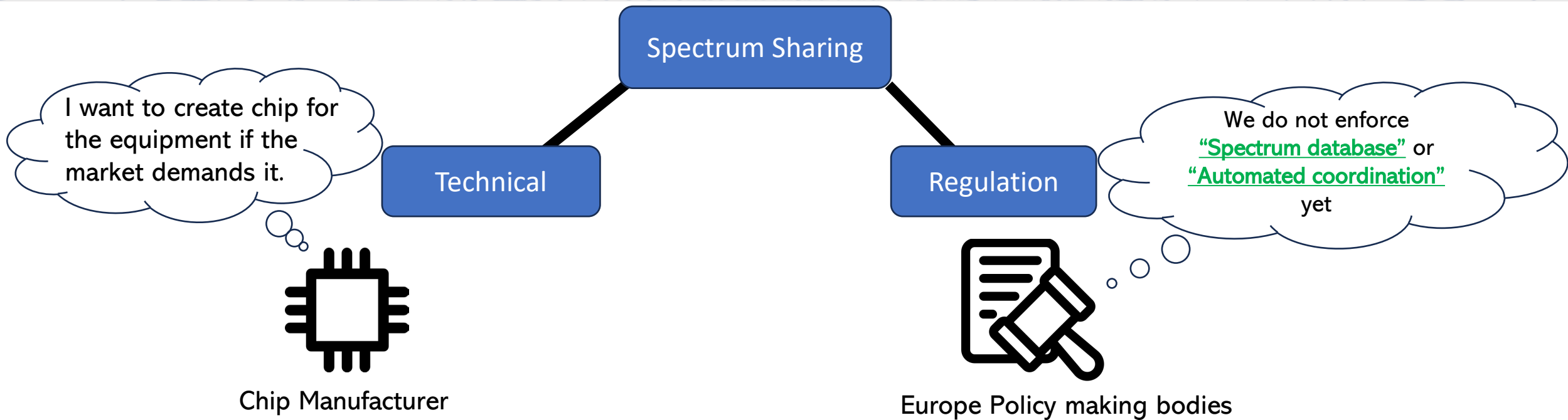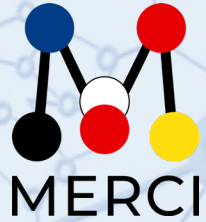
02
- Television White Space (TVWS) was defined [9]
- No guaranteeing for QoS

03 Nokia and Qualcomm introduced the concept of Authorized Shared Access (ASA) and RSPG formally described the concept of Licensed Shared Access (LSA) [10] [11]

04
- CBRS was created and initialized [12]
- eLSA was technically specified [13]

05 The work of Dynamic Spectrum Allocation Service (DSAS) System Requirements (ETSI TS 104 011) started in 2023 and is currently on progress

Spectrum Sharing (3):
MERCI viewpoint on spectrum sharing

I want to create chip for the equipment if the market demands it.

Spectrum Sharing

Technical

Regulation

We do not enforce "Spectrum database" or "Automated coordination" yet

Chip Manufacturer

Europe Policy making bodies

One of our objectives in MERCI project is to investigate the use of Spectrum Database and Automated Coordination concepts to scale-up the deployment of private networks, drawing on the commercial achievements of CBRS and AFC in the US market.

Work Status

- There is an analysis regarding the **introduction of private spectrum** in 5G and assessing its implications for vertical industries [14]–[17]

- There is an investigation regarding challenges caused by the **lack of harmonization in spectrum use** and its impact on service and market development

- ECC PT1 has prepared a draft report 358 regarding incumbent protection within the band, and in-band sharing among different Wireless Broadband (WBB) LMP networks. The report is currently undergoing **public consultation** [3]-[5]

- The WG FM60 project team is currently **assessing the technical feasibility** of the frequency band and developing harmonized technical conditions. Their efforts involve drafting an ECC decision and preparing a CEPT response with ECC PT1 [3]-[5]

Key Takeways

- Importance of Spectrum Sharing
  - It is important to **scale up** local industrial private networks, **enhancing spectrum availability** for vertical applications [18]

- Automated Spectrum Coordination
  - Highlighted as a **potential game-changer** for efficiently managing spectrum use

- Technology Neutrality Role
  - To **promote innovation** and fair spectrum usage, in our study we consider both 3GPP 5G NR and DECT-2020 NR

- Policy Recommendation
  - Urged the need for **clearer and less restrictive** technical regulations to encourage diverse technological development and innovation [19]
  - Suggested that Europe **might benefit** from adopting automated sharing technology to manage spectrum more dynamically and efficiently, which is like the US's approach
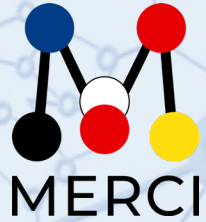
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