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ETSI ERM Meeting

C-PMSE – Improving frequency utilization and coexistence for PMSE systems by cognitive procedures

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A research project in co-operation of industry and science

Publicly sponsored by
Federal Ministry of Economics and Technology

Contents

- What is PMSE?
- Background and Challenges
- The C-PMSE project
  - Cognitive Radio for PMSE
  - Objectives
  - Structure
  - Research Platform

PMSE (Programme Making and Special Event)

PMSE covers:

- Services Ancillary for Programme-Making (SAP)
- Services Ancillary for Broadcasting (SAB)
- Electronic News Gathering (ENG) and Outside Broadcasting (OB)

As defined in ERC Report 38 and ERC Report 42 (see also ITU-R Report BT.2069 and ECC Report 002) including wireless production tools used for front-end solutions (audio, video, data) in the field of professional multimedia production (from radio and television to art, culture, conferences, trade fairs, entertainment applications, education, sport events and much more).

Components for PMSE are:

- Video cameras
- Microphones
- In-ear monitors
- Conference systems
- Intercom devices
- Data links (e.g. for remote control)

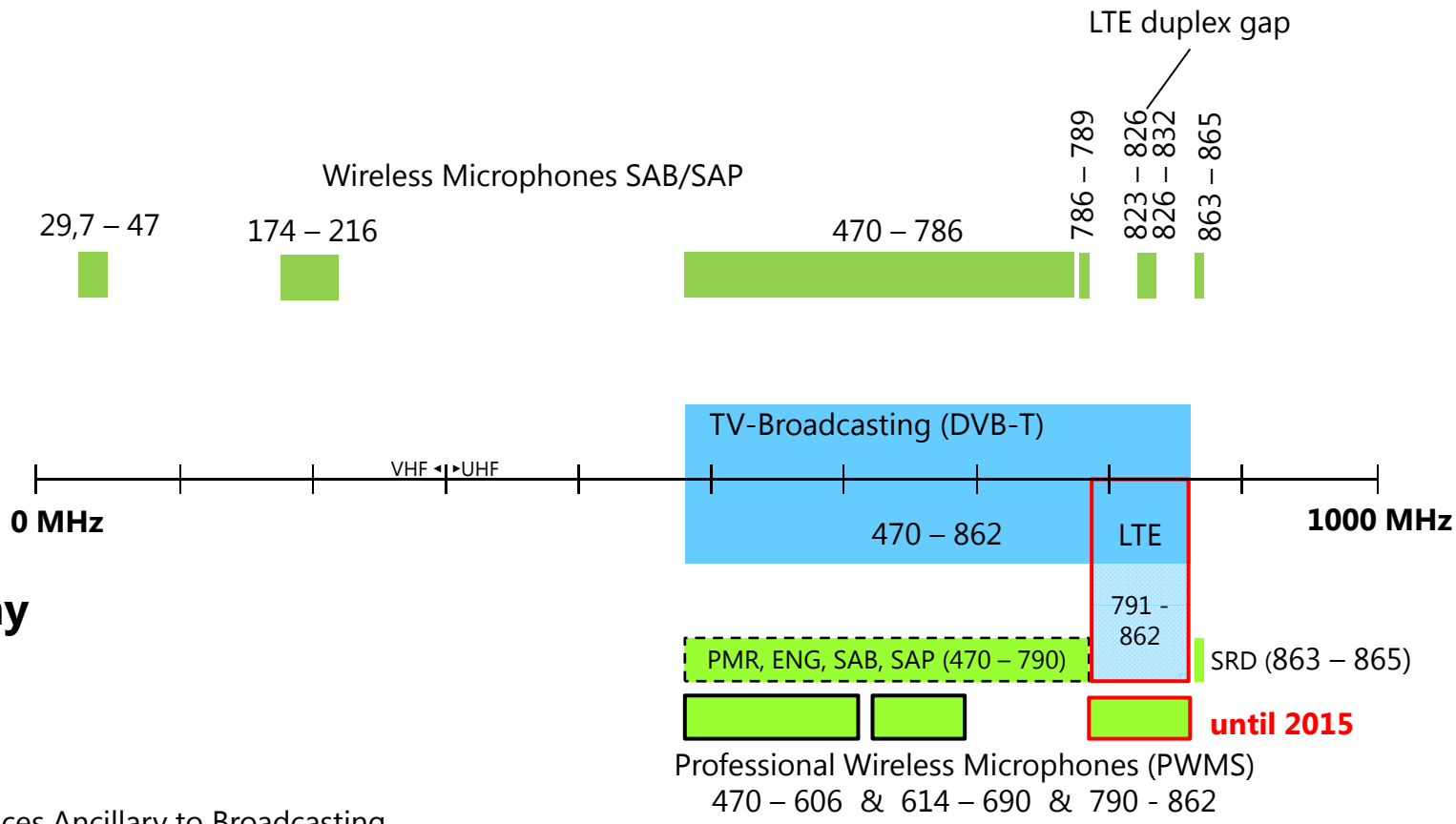
PWMS (Professional Wireless Mikrophone Systems)

PWMS is a part of PMSE and includes:
All wireless equipment used at the front end of all professional audio productions, like:
stage productions, public events, TV program production, installation in conference centres/rooms, city halls, musical and theatres, sport/event centres or other professional entities/ installations.

Background and Challenges

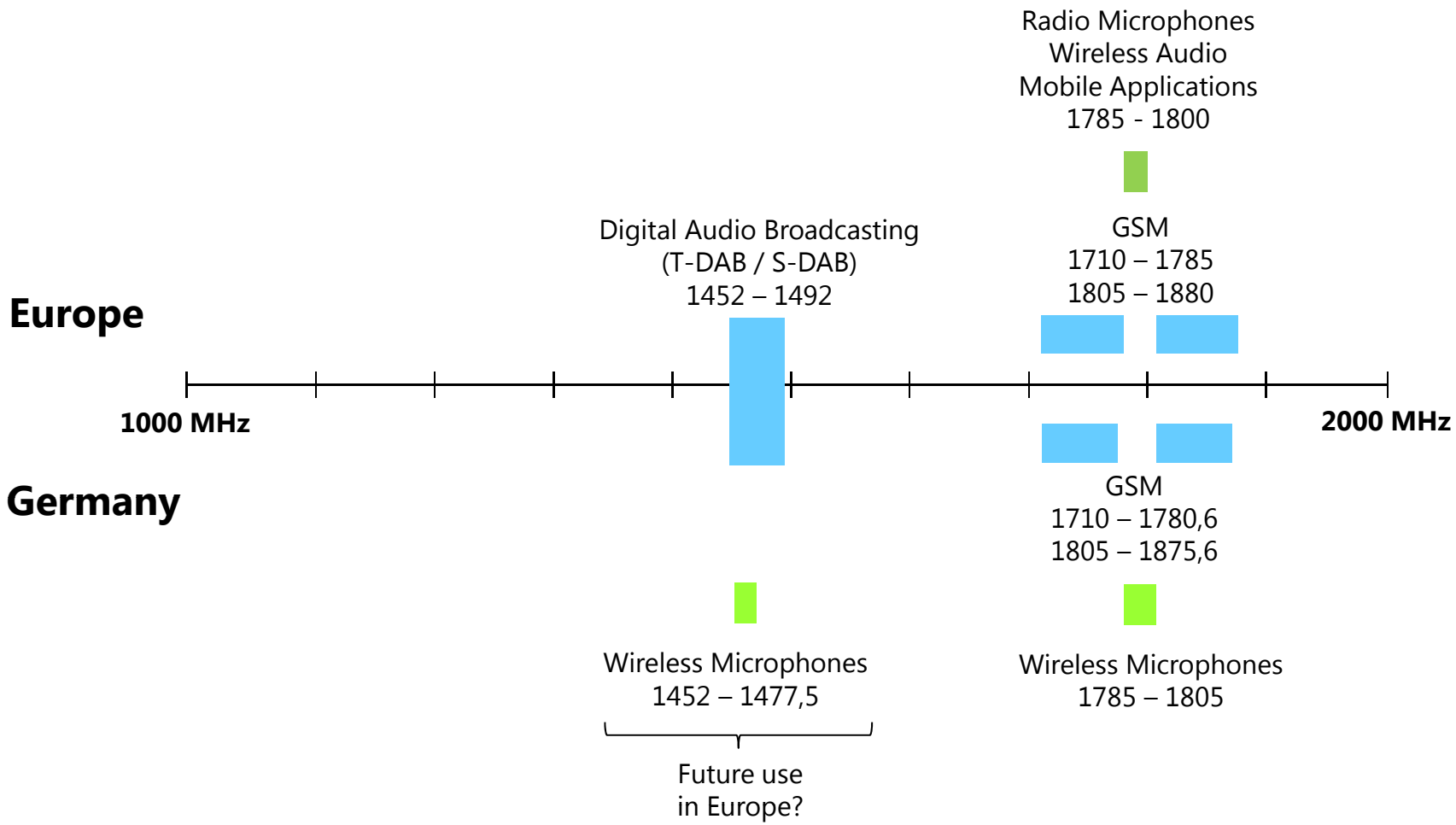
- Reallocation of the old analogue TV bands to the digital TV bands (DVB-T) in Europe provided the so called Digital Dividend.
- PWMS operate mostly in a frequency range 470-862 MHz as secondary user on licensed, tuning range basis.
- Part of the newly available spectrum from 790-862 MHz in Germany was auctioned in April 2010 to mobile telecommunication service providers.
  - **From 2015 on the range 790-862 MHz is no more usable for PWMS.**
  - **One of the consequences is that several components of fixed installations, which are working in the auctioned frequency range must be substituted.**
- PMSE industry will probably be faced with new challenges:
  - **The European Commission and the national administrations are already discussing the Digital Dividend II, which would further restrict the spectrum for PWMS.**
  - **Do PMSE devices have to share spectrum with White Space Devices in the remaining TV band (Wifi, Smart Grid, …)?**

PWMS-related Frequency Assignment below 1 GHz



SAB = Services Ancillary to Broadcasting
SAP = Services Ancillary to Programme-making
ENG = Electronic News Gathering
PMR = Private Mobile Radio
SRD = Short Range Devices

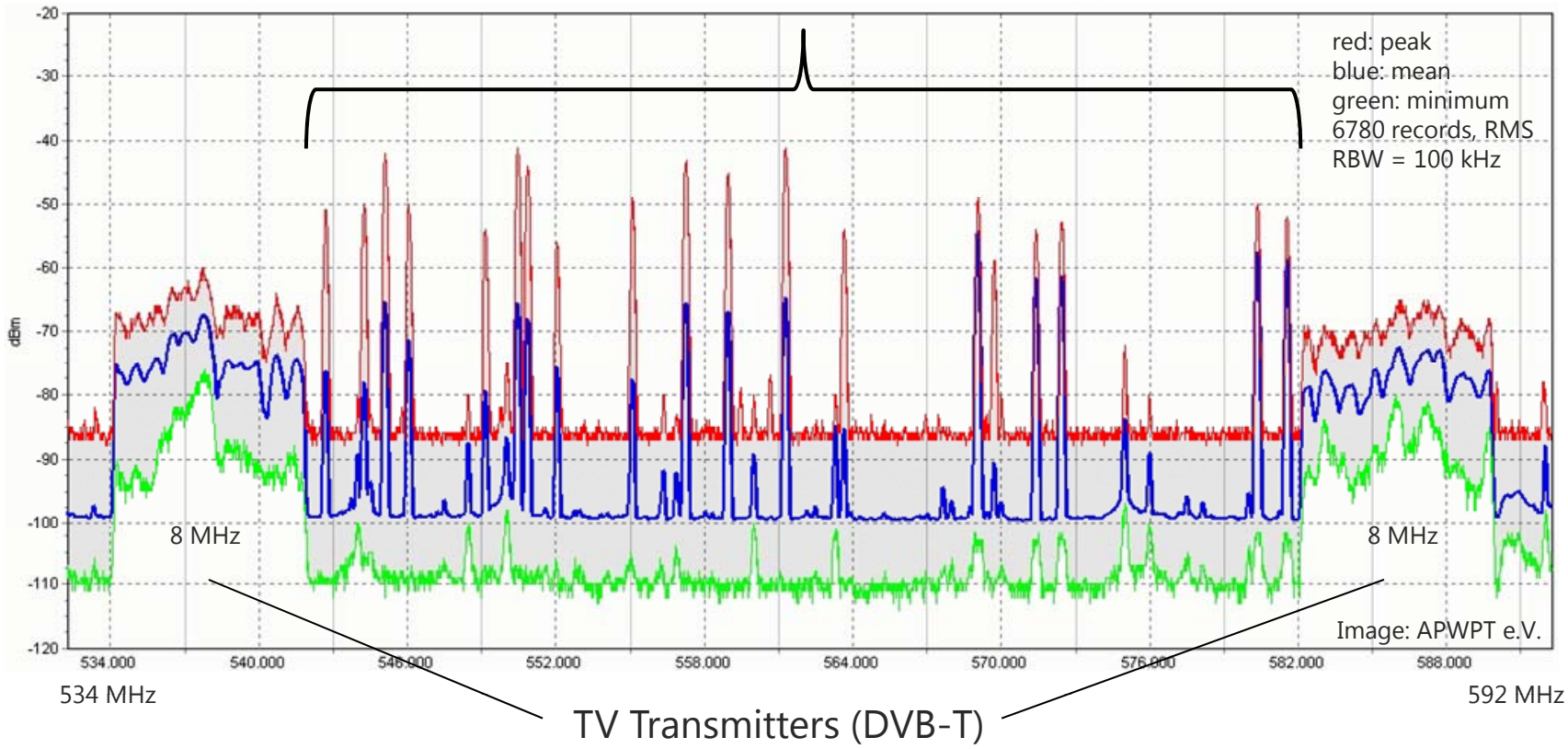
PWMS-related Frequency Assignment 1 - 2 GHz (L-Band)



Example of used spectrum for PWMS/PMSE

Frequency usage of PMSE during “Eurovision Song Contest 2011” in Germany (section of 62 MHz)

PMSE devices
(microphones , in-ear monitors, talk backs, … in total approx. 140 audio links)



C-PMSE Project Data

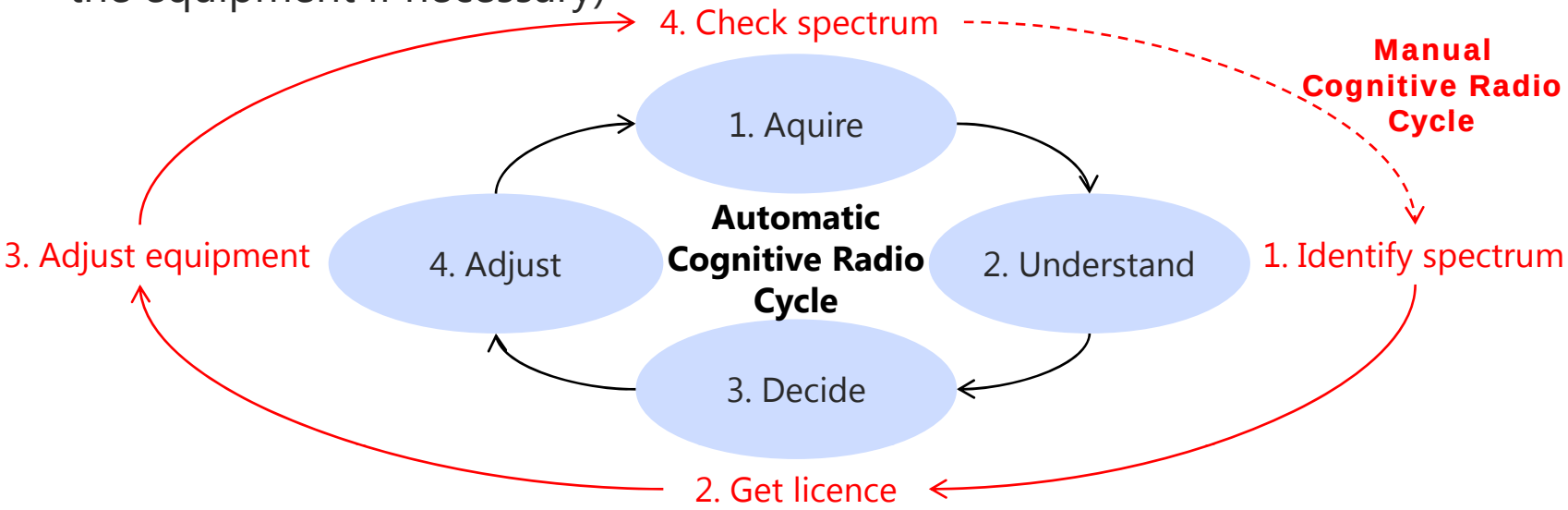
Duration:	1.4.2011 – 31.5.2013 (26 months)
Budget:	about 7.5 m€ (about 4.5 m€ gov. funding)
Partner:	beyerdynamic, eesy-ID, Huawei, Institut für Rundfunktechnik, RF mondial, Robert Bosch, Sennheiser, University Nuremberg-Erlangen, University Bochum, University Hannover
Project Office:	Robert Bosch (project lead) Sennheiser (consortium lead)

Publicly funded by:	German Ministry of Economics and Technology (BMWi)
Project Management Agency:	German Aerospace center (DLR)

From manual to automatic Cognitive Radio Cycle

Manual "Cognitive Radio Cycle"

1. Identify available spectrum depending on the location (between DVB-T transmitters within 470-862/790 MHz)
2. Ask the administration for a license (for the identified spectrum for a certain time frame)
3. Adjust the equipment to the chosen frequency range
4. Check the used spectrum against interferences (and modify the adjustment of the equipment if necessary)



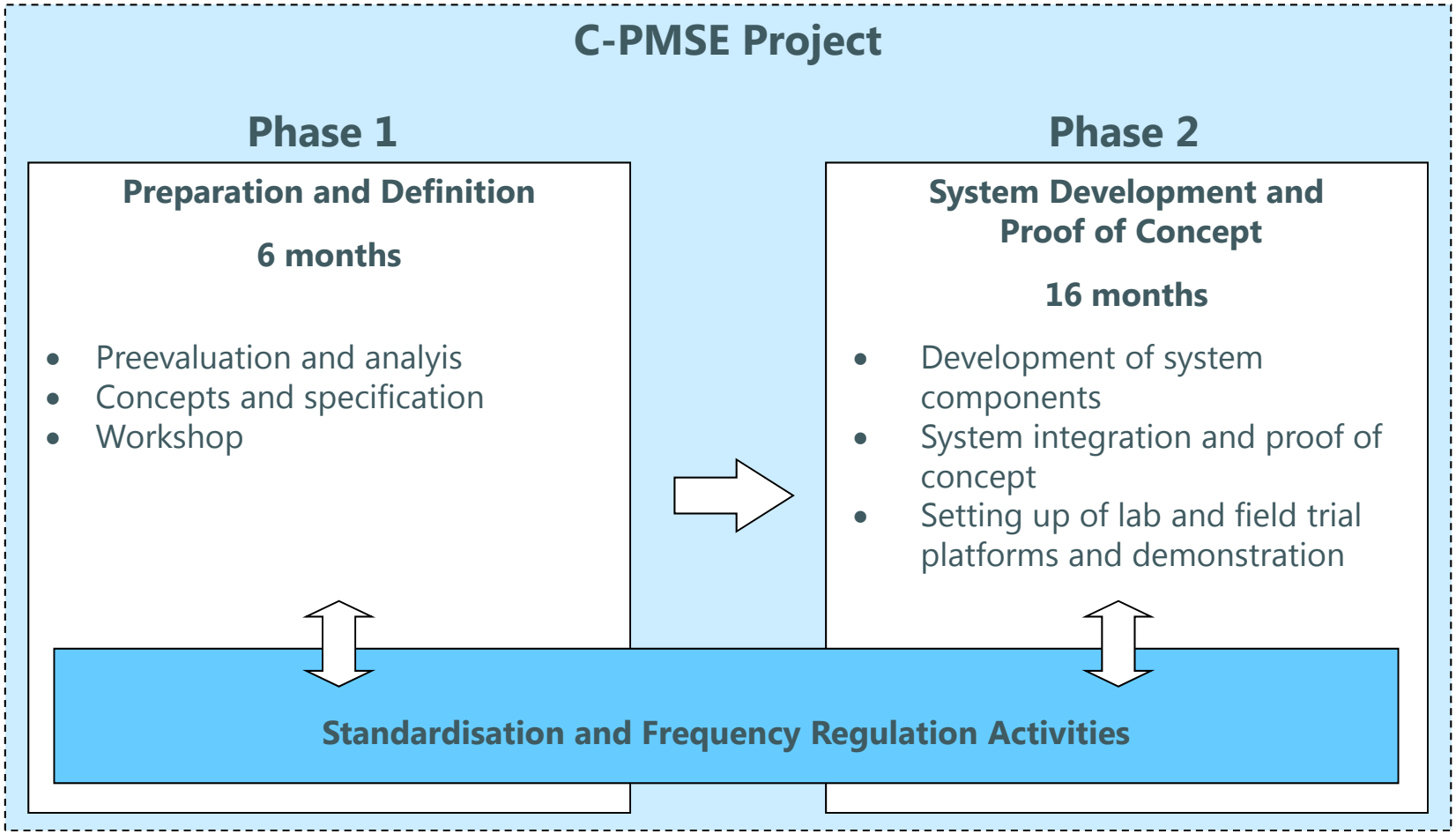
Major challenges of the Cognitive Radio Cycle for PMSE

- **Aquire and Understand**
  - Detect and track a potential interferer before it is interfering
    - PMSE service must be available 100% of time with production
    - No interruptions with production are accepted, a lot of events cannot be repeated
  - As a consequence measurement of spectrum data in the surrounding area is needed
    - not only inside, but also outside of an event hall
    - large number of scan receivers and data network is necessary
- **Decide**
  - Knowledge of available spectrum is necessary
  - A central data base with local copy seems to be a promising way
    - CR device must be able to read the data base online
    - The data base must be frequently updated
- **Adjust**
  - Remote channels for PWMS devices are necessary, which currently are not existing

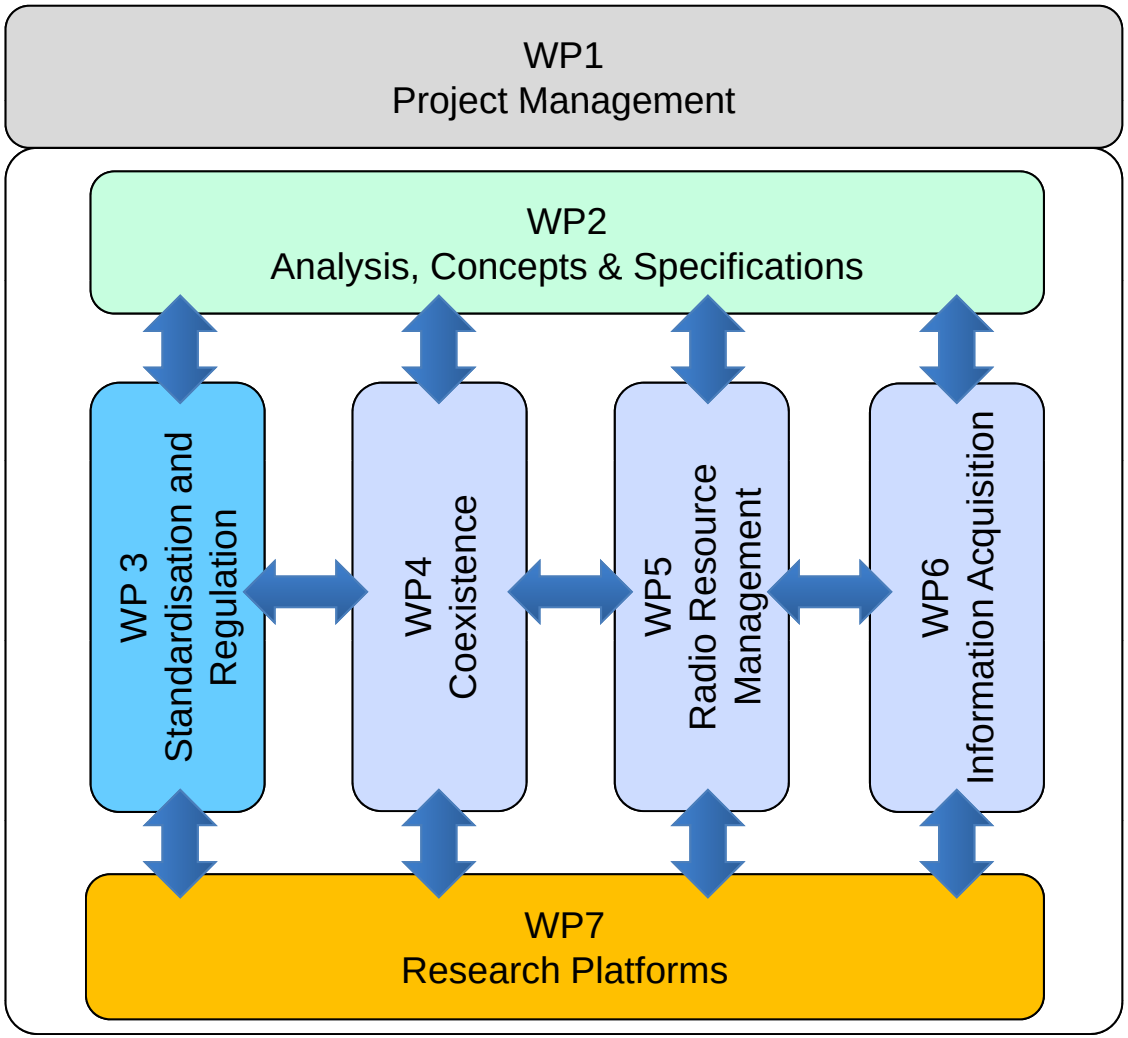
Objectives of the C-PMSE project

- **R&D on the cognitive system and procedures for PMSE**
  - Development of system components, like antennas, scan receiver, scan controller, cognitive engine, aso.
  - Simulation and implementation of a data base as key technology for co-existing
  - Measurement- and test procedures as well as channel-, interference- and co-existing models as reference for the standardization and regulation activities
- **Field trial platform**
  - Setting up a field trial platform for cognitive PMSE applications inside the Congress-Center of Berlin fair grounds
  - Technical and economical proof of concept of the cognitive methods for PMSE
  - Realizing an open and modular R&D platform for future research
- **Frequency regulation and standardization**
  - Setting up a forum to discuss and prioritize necessary actions concerning cognitive PMSE on national, European and worldwide level
  - Active collaboration in meetings ITU, ETSI, CEPT und Bundesnetzagentur by using the project results and the preparatory work of the Special Task Force ETSI STF 386

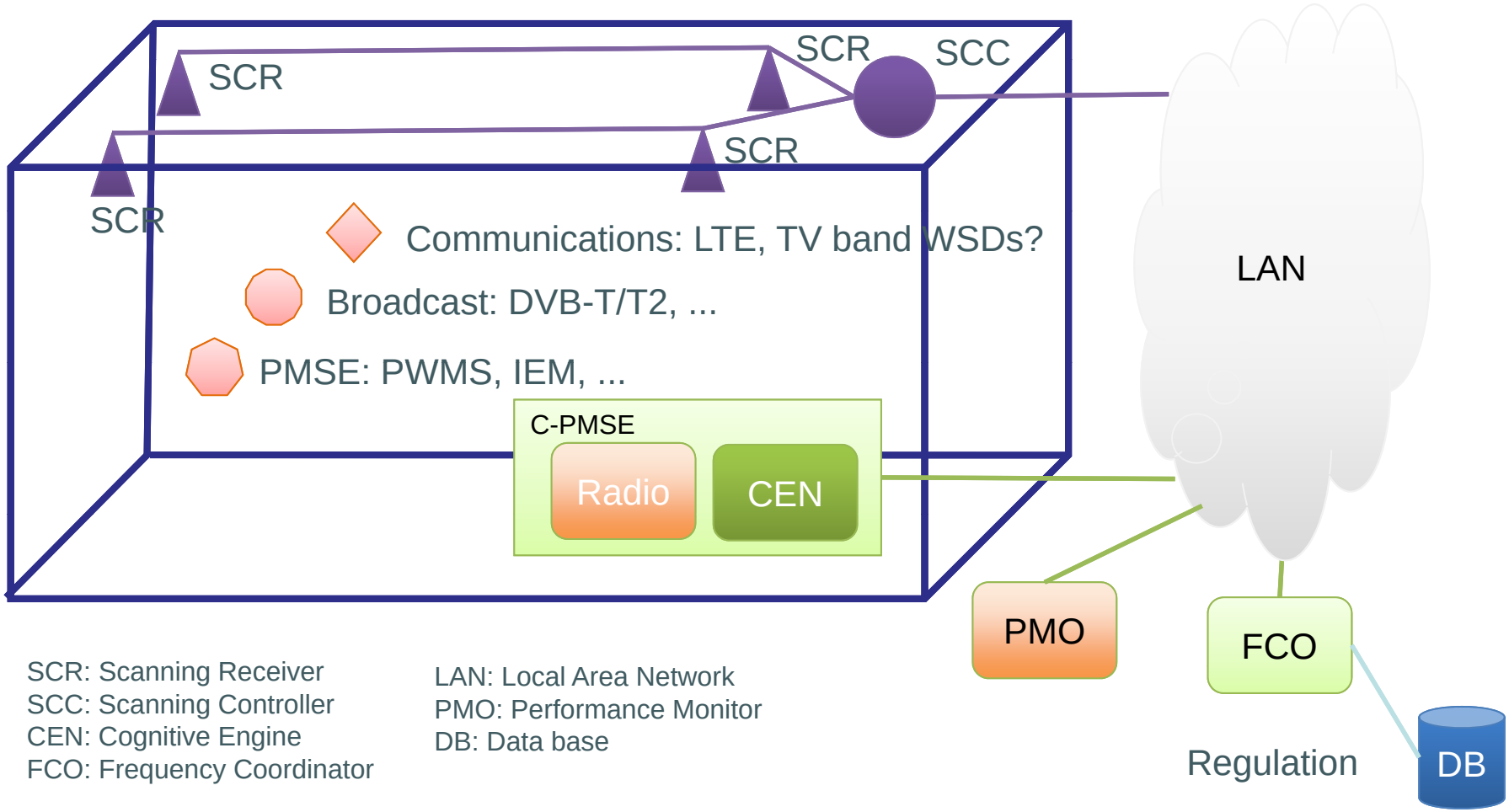
Project Phases



Overview Work Packages



Basic concept of lab and field trial platforms



SCR: Scanning Receiver
SCC: Scanning Controller
CEN: Cognitive Engine
FCO: Frequency Coordinator

LAN: Local Area Network
PMO: Performance Monitor
DB: Data base

Current Regulation and Standardisation

PMSE + Cognitive Radio

	PMSE	Cognitive Radio
Outside Europe	• **ITU-R WP6** - Broadcasting service • **WRC-12** - AI 1.5 & 1.17	• **ITU-R WP5D** - IMT Systems • **WRC-12** - AI 1.19 • **IEEE SCC41 WGs 1900.1 - 1900.6** • **IEEE 802.19** - Wireless Coexistence Working Group • **IEEE 802.22** - Working Group on Wireless Regional
Europe	• **ECC WG FM PT45** - Digital Broadcasting Issues • **ECC WG FM PT48** – Spectrum aspects for Broadband Direct-Air-to-Ground Communications (DA2GC) systems • **ECC WG FM PT50** - 1452-1492 MHz L-Band • **ECC WG SE PT7** - Compatibility and sharing issues of MS (except IMT2000) operating below 3GHz • **ECC WG SE PT44 -** Satellite Communications • **ETSI TC ERM TG17 WG3** - ERM Radio Microphones, Cordless Audio and Audio Links • **ETSI STF 386** - Special Task Force • **ETSI TC ERM EMC** - Spurious Emissions of LTE in UHF band	• **ECC WG FM PT45** - Digital Broadcasting Issues • **ECC WG SE PT43** - Cognitive radio systems - White spaces (470 - 790 MHz) • **ECC WG RA PT WS_CR** - White Space Cognitive Radio • **ECC CPG-PTA** - Conference Preparatory Group A • **ETSI TC ERM TG17 WG3** - ERM Radio Microphones, Cordless Audio and Audio Links • **ETSI STF 386** – Special Task Force • **ETSI TC RRS 01** - System Aspects (SA) • **ETSI TC RRS 02** - Reconfigurable Radio Equipment Architecture (RREA) • **ETSI TC RRS 03** - Cognitive Management and Control (CM&C) • **ETSI TC RRS 04** - Public Safety (PS)
Germany	• **DKE/AK 731.0.8** - Professionelle Funkmikrofonsysteme und Veranstaltungstechnik	• **BNetzA AK3** - IMT-Mobilfunk, Rundfunk und Cognitive Radio

Thank you very much for your kind attention

I would be pleased to answer your questions

Acknowledgement
The C-PMSE project is co-funded by the
German Federal Ministry of Economics and Technology (BMWi)