Broadband VHF Aeronautical Communications System Based on MC-CDMA (B-VHF)

Specific Targeted Research or Innovation Project (STREP)
conducted under Priority #4 - Aeronautics and Space - of the
6th Framework Programme of the EC

C. Rihacek (Christoph.Rihacek@frequentis.com)
FREQUENTIS GmbH

Contents

- Background
- B-VHF System Requirements
- B-VHF System Approach
- System Introduction and Transition
- B-VHF Consortium

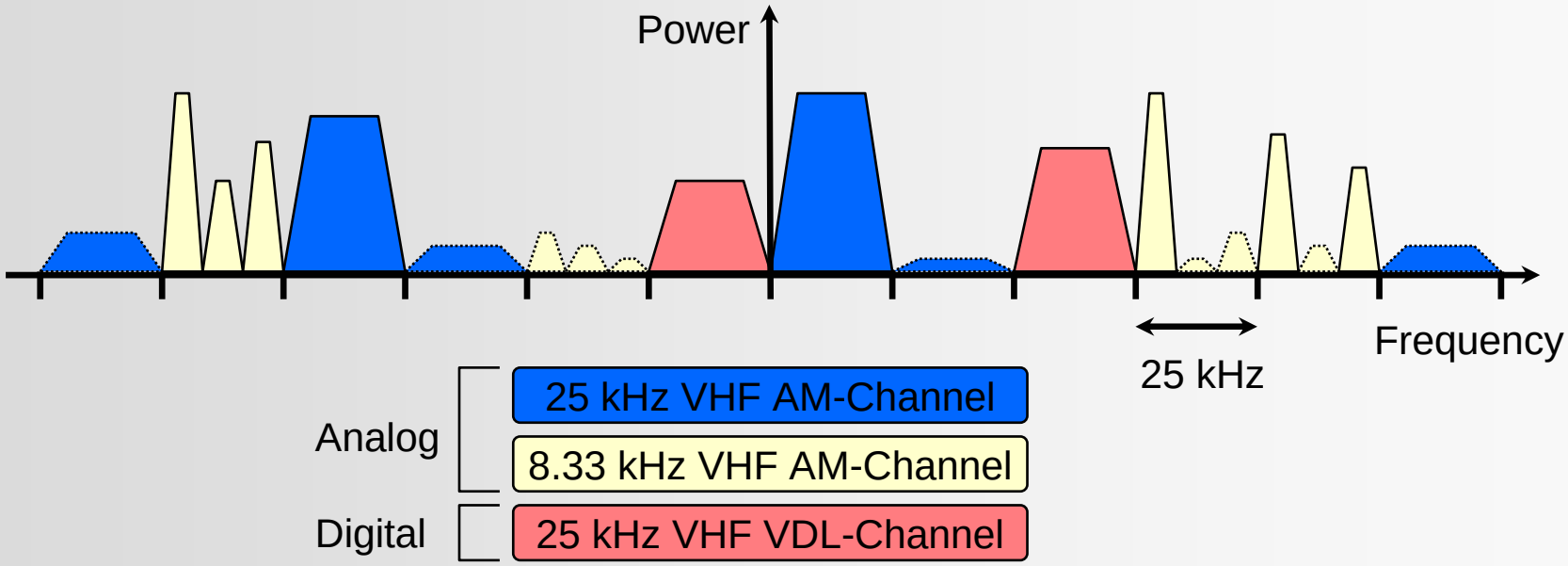
Background

- VHF communications are an important enabler for future ATM
- Today's VHF systems (DSB-AM, VDL) waste spectrum resources and will become saturated around 2015-2020
- Rapid air traffic growth mandates state-of-the-art technology!
  - With increased capacity, safety and robustness
  - With improved performance and efficiency
  - Affordable, with realistic deployment scenario
  - Sharing spectrum with legacy systems
    - Aeronautical VHF band in Europe is congested – spectrum sharing is the only way to deploy a new VHF system
- Our approach: Broadband VHF system
  - Developed within the B-VHF project (01.01.2004 – 30.09.2006)
  - Co-funded by the EC within the 6th Framework Programme

B-VHF System Requirements

- B-VHF project checks the feasibility of a new broadband VHF communications system
  - For safety-critical ATS and AOC communications
  - Preserving current operational procedures
  - Respecting existing airborne architectures
  - Cost-effective for airlines and ground ATS providers
  - Providing increased capacity, performance and security compared to legacy narrowband systems
  - Supporting existing- and being prepared for future voice and data communications services
  - **Deployable in the VHF** and other aeronautical ranges with **sound transition strategy**
  - Based on OFDM and CDMA

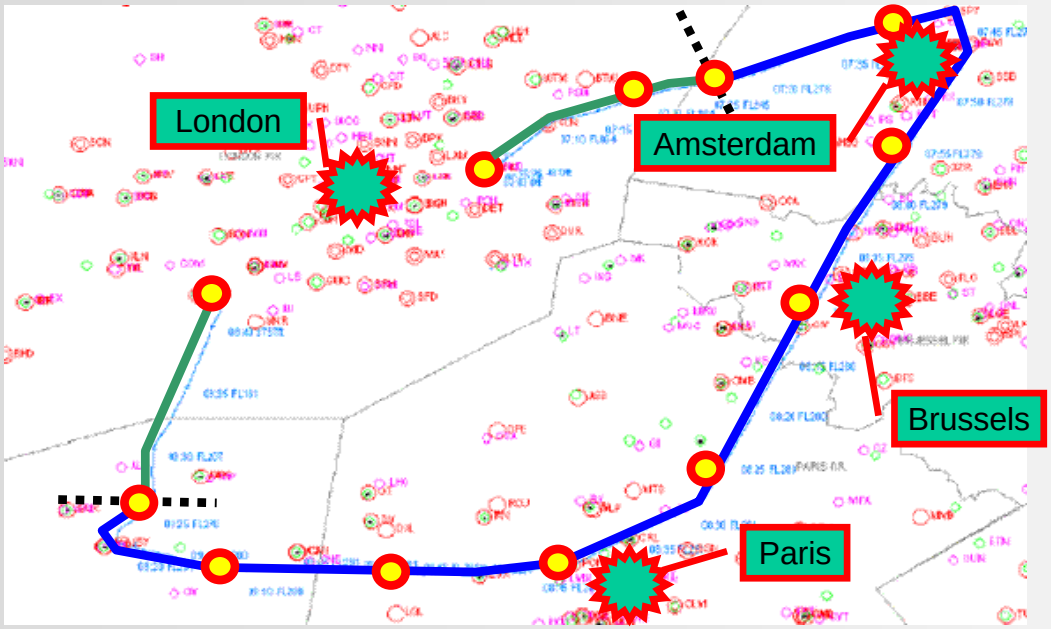
Current VHF Band Situation

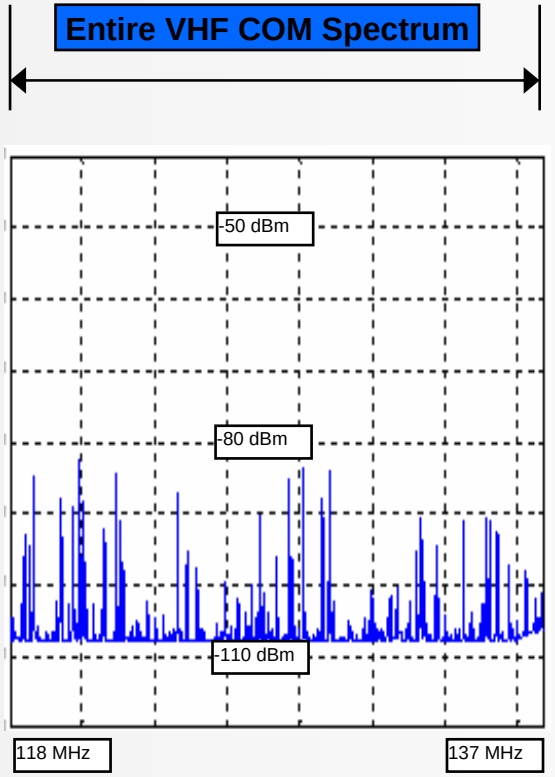


- At any point in space
  - Only near transmitters are ‘seen’ with full power
  - Allocated channels are not effectively used all the time
- Above statements have been validated via measurements and simulations

VHF Spectrum Usage over Europe

- Ground and in-flight measurements (UK/Core Europe)
- Worst-case local occupancy: obtained via modelling and simulations with NAVSIM tool

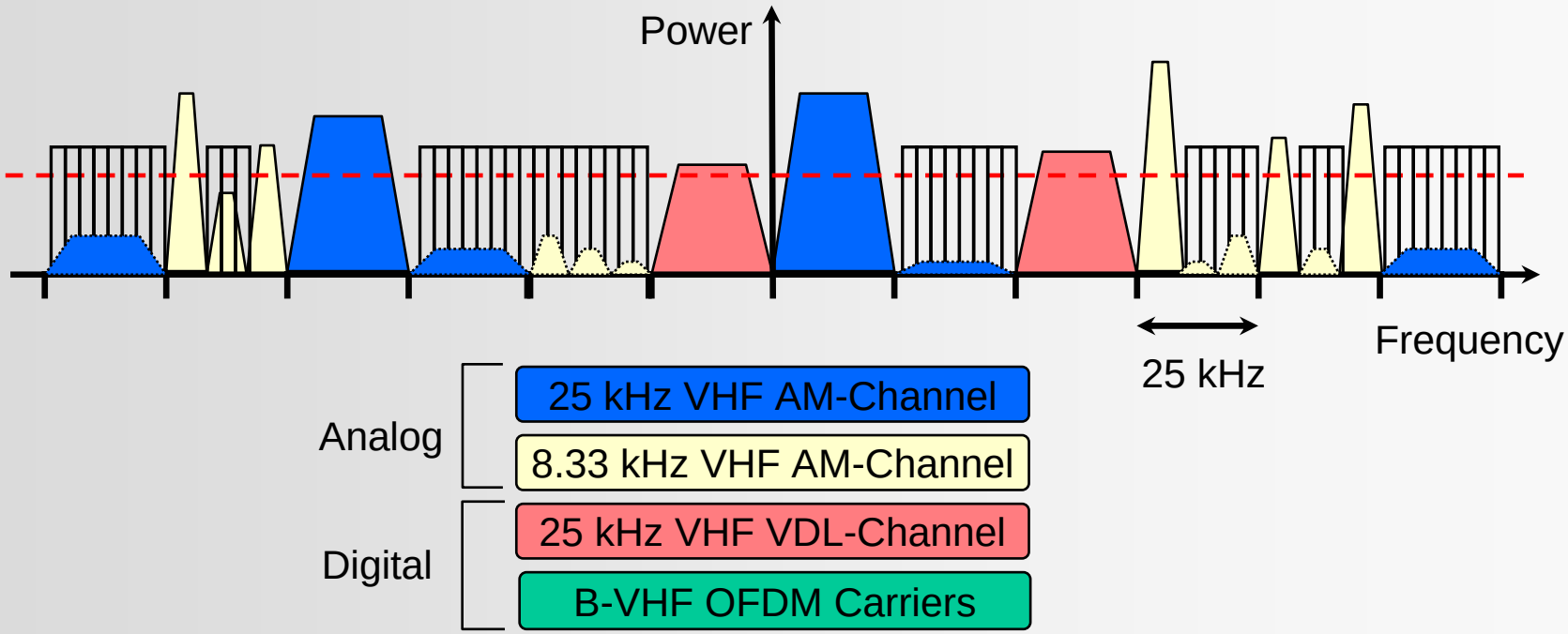




B-VHF System Approach

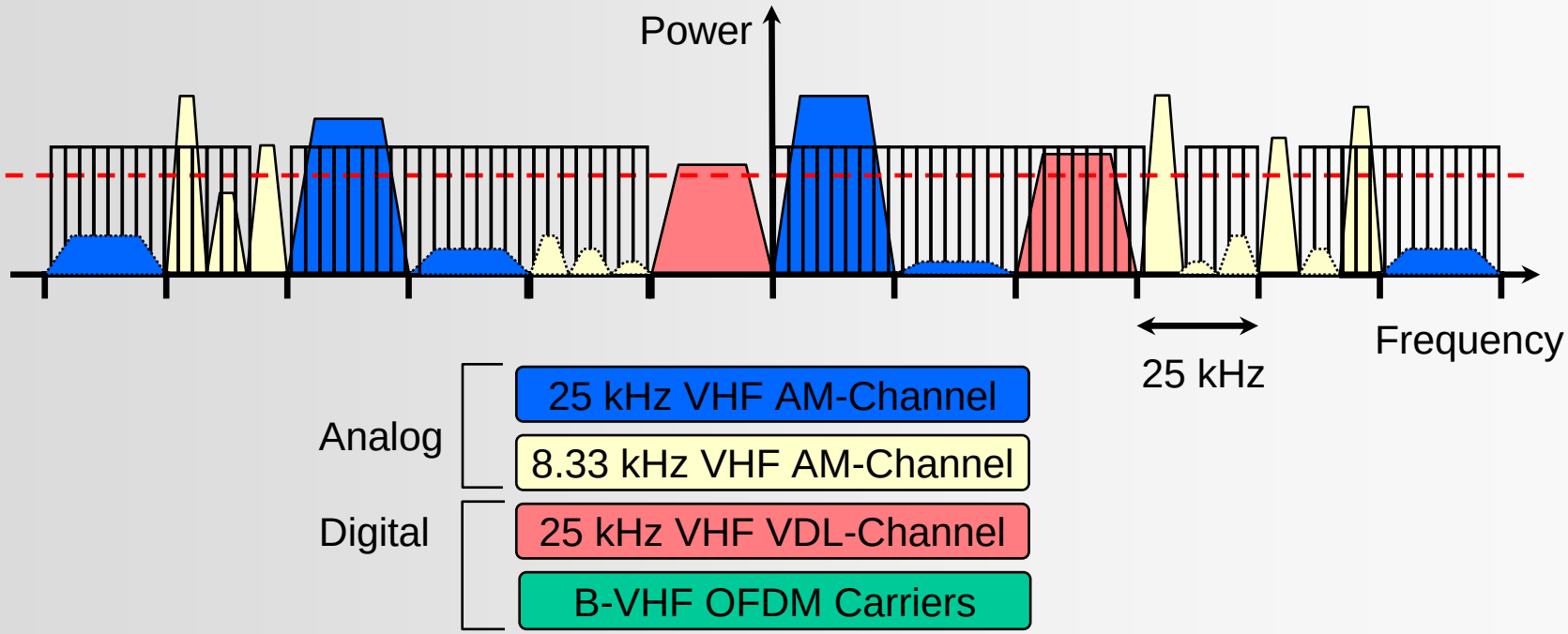
- What is B-VHF System?
  - Broadband terrestrial cellular system based on multi-carrier OFDM technology
  - High capacity/high performance integrated voice and data link system tailored for specific aeronautical needs
    - Supporting existing and emerging applications and services
- Why OFDM?
  - OFDM is proven by high-capacity bandwidth-efficient techniques (DAB, DVB-T, W-LAN)
    - COTS products are already available - 4G development will create additional re-usable components
  - **OFDM enables in-band deployment (overlay concept)**

System Introduction Based on Overlay



- Local narrowband allocations remain in operation
  - B-VHF system avoids areas occupied by legacy VHF systems
- Distant VHF channels are locally re-used for B-VHF
  - If maximum received power remains below some threshold

Transition



- DSB-AM & VDL channels are progressively withdrawn and replaced by the B-VHF OFDM carriers

B-VHF Project and Consortium

- Partners
  - **Frequentis GmbH (FRQ)** - project co-ordinator
  - German Aerospace Center (DLR)
  - National Air Traffic Services (En Route) plc (NERL)
  - Polytechnic University of Madrid (UPM)
  - Gent University (UGent)
  - BAE Systems (Operations) Ltd (BAES)
  - University of Salzburg (UniSBG)
  - Scientific Generics Ltd (SGL)
  - Lufthansa German Airlines (LH)
  - Deutsche Flugsicherung GmbH (DFS)
  - University of Las Palmas de Gran Canaria (ULPGC)
- Project website: www.b-vhf.org