



Reconfigurable Radio Systems (RRS); Feasibility study on the role of AI/ML techniques for spectrum sharing

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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Reconfigurable Radio Systems (RRS).

Modal verbs terminology

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Executive summary

The present document examines the feasibility and role of AI/ML techniques for Spectrum Sharing (SS). It analyses current regulatory signals and research trends from major regions (US, UK, EU, Australia, and selected Asia-Pacific markets), distils the state of the art in AI-enhanced spectrum awareness/sensing, dynamic allocation, and interference impact reduction, and identifies security and privacy risks together proposing possible mitigations appropriate for AI-enabled Spectrum Sharing.

The present document analyses policy trajectories across jurisdictions, and contemplates AI-assisted spectrum management (e.g. US National Spectrum Strategy and its 2024 Implementation Plan, Ofcom's *hybrid sharing* vision for upper 6 GHz), which make sharing viable in bands that are impractical to clear for exclusive assignment ([i.1] and [i.2]).

Technically, AI/ML improves detection accuracy, prediction, and real-time decision making, enabling improved protection of incumbents and a more efficient utilization of the shared spectrum. However, AI also widens the attack surface (data poisoning, spectrum spoofing, model extraction) and raises privacy concerns, underscoring the need for adversarial robust models, cryptographic protections, certification, and auditing.

Key conclusions:

- i) AI/ML is a *material* enabler of Spectrum Sharing under diverse coexistence regimes;
- ii) regulators increasingly plan for AI-augmented management;
- iii) standardization should cover architectures, metrics, datasets, assurance, and conformance for AI-enabled SS; and
- iv) security/privacy requirements are essential from the outset.

Introduction

The industry is at cross-roads in respect of spectrum needs and its availability. Continuous growth of capacity demand, especially in view of upcoming 6G deployments, highlights the need for additional spectrum. However, the more desirable part of available spectrum is fully saturated with very little possibility of exclusive usage. Thus, regulators are exploring new avenues for making the most efficient use of spectrum, including the possibilities of spectrum sharing.

The scarcity of desirable spectrum for 6G and the rising complexity of coexistence with non-3GPP incumbents (e.g. radars, satellites) make dynamic, automated sharing attractive. AI/ML offers concrete capabilities for enhancing sensing, prediction, optimization, and control that are impractical in fully algorithmic architectures. The US National Spectrum Strategy (NSS) and the 2024 Implementation Plan explicitly pursue technology-enabled sharing and band studies [i.3].

In Europe, Ofcom's 6 GHz *hybrid sharing* concept and BEREC's analyses of AI in telecoms point to future regulatory models where *sharing-by-design* is embedded in equipment standards. The EU **AI Act** will also shape deployment of AI in network functions, including spectrum functions [i.2].

The present document captures an early perspective of the possible impacts of AI on spectrum sharing in the foreseeable future.

Artificial Intelligence (AI) techniques are expected to impact the capabilities of transmitters and receivers of virtually all telecommunication services, and AI is also likely to have impact on similar communication services that use spectrum and the ways in which devices access and share spectrum.

AI thus can potentially manage transmissions in particular frequencies, in particular directions and at particular time-windows, thus reducing interference towards other users of the same spectrum. AI can also potentially allow reception of certain levels of interference by reducing its impact on the desired signal. Additionally, AI has the potential to improve interference estimates, spectrum occupation forecast and manages automatically and transparently dynamic spectrum access and sharing. All of the above may allow less conservative deployment scenarios to protect incumbents.

These enhanced capabilities may allow regulators to regulate and manage spectrum in ways that were unimaginable even a few years ago.