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EU Roadmap

For Ensuring Safe Coexistence Between Mobile Networks and Aircraft Radio Altimeters Within the Frequency Range 3.4-4.4 GHz in the Union

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EU Roadmap
for ensuring safe coexistence
between mobile networks and aircraft radio altimeters
within the frequency range 3.4-4.4 GHz in the Union

1. Objective and scope

The main objective of this ‘EU roadmap’ is to define key activities and milestones towards ensuring the safe coexistence between mobile networks (notably 5G and 6G in the future), and aircraft radio altimeters (RA), setting out a coordinated approach within the frequency range 3.4-4.4 GHz in the Union for both systems. With regard to the use of this frequency range by terrestrial wireless broadband (mobile) electronic communications networks, it is distinguished between universal (including high-power) networks operating within 3.4-3.8 GHz (hereafter ‘WBB’) and low/medium power networks operating within 3.8-4.2 GHz (hereafter ‘LMP WBB’).

This ‘EU roadmap’ indicates the major technical, standardisation, regulatory, and deployment activities, in the aviation and telecom/spectrum domains, their timelines, milestones and the key dependencies between them.

This ‘EU roadmap’ has been developed considering only civil aircraft operating in the Union. It could be extended to address also State¹ aircraft if the relevant information becomes available (e.g. input from EDA).

The acronyms used across this document are explained in section 9.

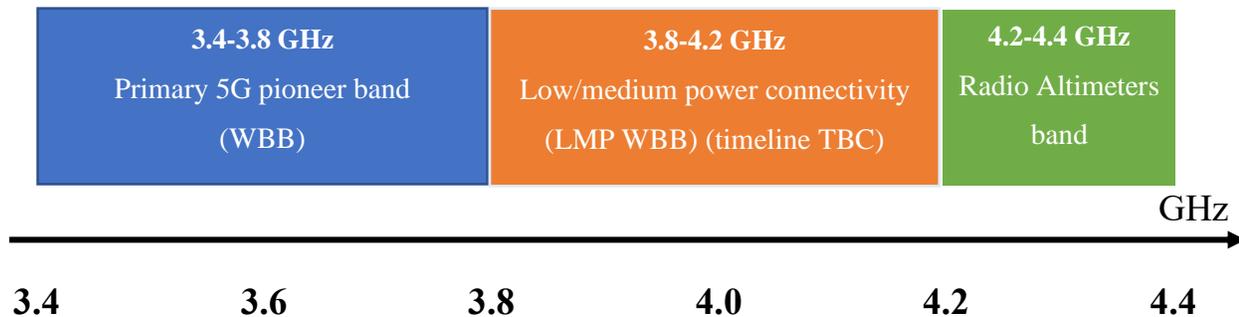
2. Preparation and further development

The engagement from Member States, EEA countries, organisations and other stakeholders, and a reinforced cooperation between entities in aviation and telecom/spectrum domains are key elements for the fulfilment of the objectives of the ‘EU roadmap’. Consequently, this ‘EU roadmap’ has been prepared by the services of the European Commission (DG MOVE and DG CNECT) considering technical inputs from the industrial workshop held on 5 October 2023, and the ongoing work in the CEPT and the EUROCAE/RTCA groups. It has been subject to further updates considering the comments that have been received during and after a dedicated regulatory workshop of 26 October 2023. In addition, DG MOVE and DG CNECT sought the informal views of Member States and EEA countries, in view of the possible adoption of future regulatory measures, respectively through the EASA Committee and the Radio Spectrum Committee (RSC). Both Committees will be invited to regularly review progress in order to provide guidance on further developments. The ‘EU roadmap’ will also be adapted to consider future developments and further inputs.

¹ Aircraft used in military, customs and police services qualify as State aircraft.

3. The need of a coordinated approach and key assumptions

The picture below represents the use of spectrum (only in the context of this roadmap) within the frequency range 3.4-4.4 GHz, including the envisaged one in 3.8-4.2 GHz. Current RA have not been designed to filter out emissions from other usages in the adjacent band below 4.2 GHz.



3.4-3.8 GHz band (primary 5G pioneer band)

5G networks are already deployed and operational using the primary 5G pioneer band (3.4-3.8 GHz) in the Union. EASA so far has not identified conclusive evidence of an unsafe condition affecting the RA and caused by 5G networks already operating in Europe in this band. However, EASA anticipates that if there is any actionable data raising concern related to the 5G use in this band, EASA will require mandatory corrective action (e.g. through instruments such as Airworthiness Directives). It is anticipated that such mandatory action would only apply to a few aircraft types, not on the entire fleet operating in the Union. It is also highlighted that the CEPT is currently assessing the susceptibility of the RA to emissions from mobile networks operating in 3.4-3.8 GHz band (either in-band or unwanted), and the corresponding deliverables are due in Q4/2024. This CEPT work stream is not subject to a European Commission mandate at this juncture. Nevertheless, as its scope is pertinent to ancillary activities identified in this roadmap, its final outcome will be considered accordingly. The outcome of this CEPT work and the EASA safety assessment may result in the potential application of EU-level (regulatory) measures in one or both domains, such as temporary power limits around airports in the telecom domain (for the WBB base stations) and/or retrofit/forward fit of RA in at least some aircraft operating in the Union.

3.8-4.2 GHz band

The European Commission plans to adopt a new technical implementing measure to harmonise the shared use of the 3.8-4.2 GHz frequency band for terrestrial networks capable of providing low/medium power (LMP) wireless broadband (WBB) electronic communications services (ECS) for local-area connectivity, including local vertical applications², while protecting receiving

² Local vertical applications refer to specific use cases and applications of WBB technology (5G) that are tailored to meet the unique needs and requirements of particular industries, businesses, or sectors within a localized or specific geographical area.

satellite earth stations and other existing systems and services within the same band (while also ensuring the further development of the latter) and in adjacent bands, such as RA.

In this regard, the European Commission, under the Radio Spectrum Decision, has mandated the CEPT to develop harmonised technical conditions for the shared use of the band and the corresponding deliverable is due in Q4/2024. This process entails technical studies, simulations, and field measurements around airports to which also aviation representatives are contributing.

This CEPT deliverable should propose a balanced solution to ensure safety in aviation without introducing undue constraints on the deployment of LMP WBB networks providing local-area connectivity. This CEPT deliverable will propose conditions “by design” (from the outset) under which safe coexistence of mobile networks and RA (in their evolution) can be achieved.

The CEPT deliverables, resulting from both aforementioned workstreams, are required to provide justification based on data and expert assessment as evidence on the need for any measures proposed. This will allow Member States and the European Commission (DG CNECT and EASA/DG MOVE) to take informed decisions at regulatory level. **It is anticipated that this ‘EU roadmap’ will be revisited and possibly updated when the CEPT deliverables become available.**

This ‘EU roadmap’ sets out a coordinated approach between the deployment of mobile networks in 3.4-3.8 GHz band and LMP WBB networks providing local-area connectivity in 3.8-4.2 GHz frequency band, and measures on the aviation side. In this regard, CEPT plans to deliver coexistence analysis on the 3.4-3.8 GHz band pursuant to its current work programme (see work item PT1_40) and on the 3.8-4.2 GHz band in response to the European Commission mandate. Particular focus should be set on the orderly transition that needs to be organised well in advance to ensure that the use of the 3.8-4.2 GHz frequency band by LMP WBB networks in Europe will not cause an unsafe condition in aviation and that it won’t introduce undue delays in the deployment of mobile networks. Considering lessons learnt from developments in the US, if no coordination takes place and necessary limitations are not applied, EASA may have to issue an Airworthiness Directive addressing all the fleet, which will result in an unorderly, disruptive, and expensive retrofit of the entire fleet. In addition, the lack of a coordinated approach may result in the application of unforeseen restrictions that would be detrimental for the LMP WBB service provision and business development.

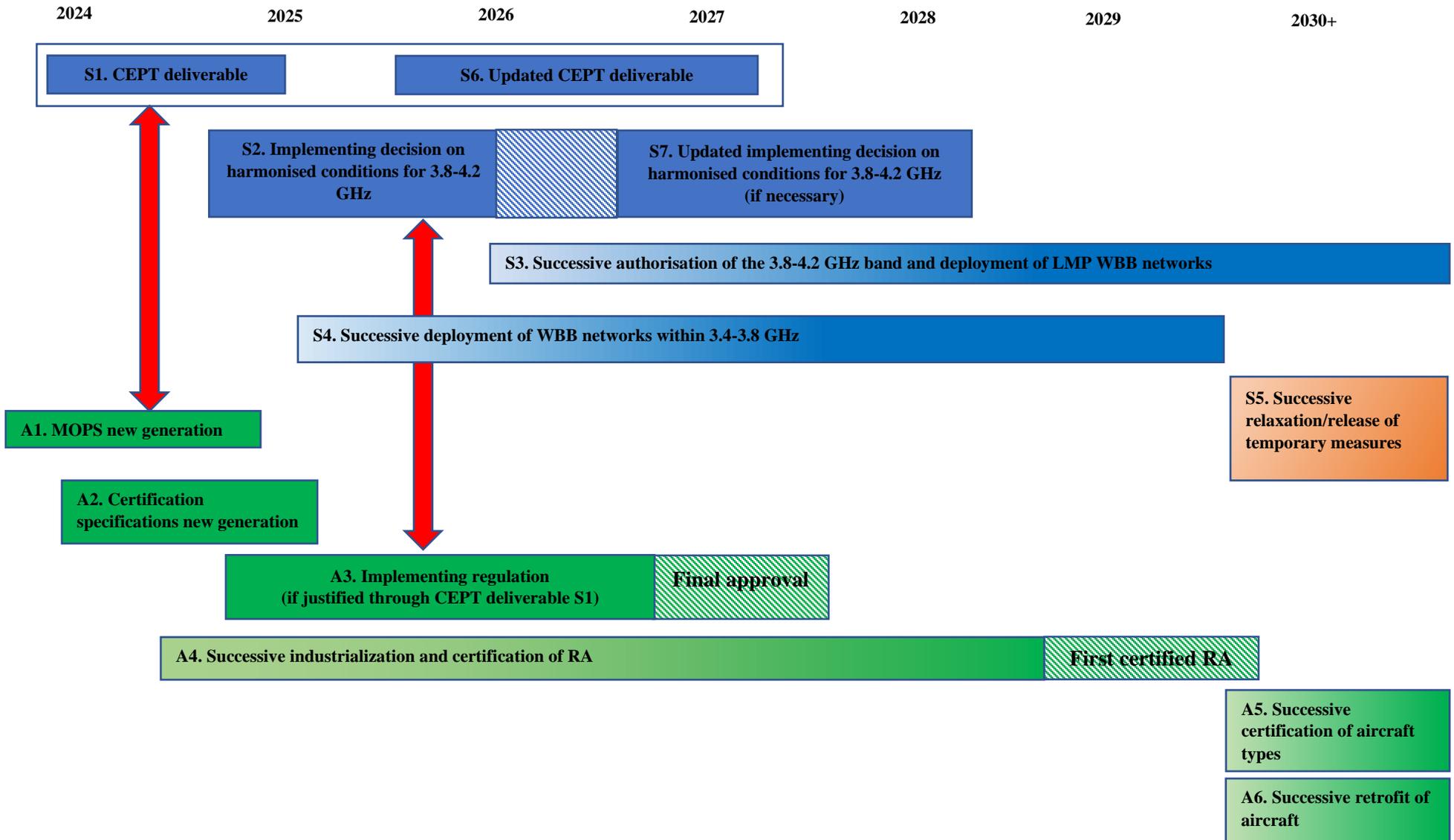
4. European scope and global dimension

While the applicability of the ‘EU roadmap’ is limited to the EU, it has to be developed and implemented considering also the global interoperability dimension of aviation, the mobile networks developments in other regions, and the lessons learnt from international developments in other regions (e.g. activities from FAA and FCC in the US, and the MLIT and MIC in Japan). Aircraft equipped with new generation RA should operate safely not only in the EU but in other regions where the power levels and the frequency bands used by mobile networks are different. Therefore, it is essential that the standards for new generation RA that are being developed by

EUROCAE/RTCA consider the spectrum allocations identified and used for mobile networks at global level.

Considering the global dimension of aviation and telecom industries and also different regional initiatives for mobile usages below 4.2 GHz and potentially above 4.4 GHz, it would be desirable to promote further cooperation at regional and global levels between the aviation and mobile **sectors.**

5. Indicative ‘EU roadmap’ schedule (Gantt chart)



6. Key activities in the telecom/spectrum domain

ID	Activity	Responsible	Milestone and date	Dependencies/status/notes
S1	<p>CEPT deliverable to CNECT: a report in response to the European Commission mandate³, as well as an update with regard to the EU-harmonised use of the 3.4-3.8 GHz frequency band for WBB.</p> <p>LMP WBB - Radio altimeters (RA) co-existence measures in the CEPT report on the harmonized technical conditions for the deployment of verticals in 3.8-4.2 GHz, in particular definition of technical compatibility criteria and parameters.</p> <p>Presentation of conclusions of CEPT studies on “<i>Compatibility between MFCN operating in 3400-3800 MHz and Radio Altimeters (RA) operating in 4200-4400 MHz</i>” to the RSC and the EASA Committee.</p> <p>The CEPT deliverables should indicate the magnitude of the problem in Europe, indicate if measures are required and propose those measures in aviation/telecom domains: temporary measures around airports to protect current RA (link with S4 and S5), and need to retrofit/forward fit part of or all the fleet (A3).</p>	CEPT	Q4 2024	<p>Dependency: MOPS⁴ for new generation of RA to be considered (A1).</p> <p>The CEPT report will be based on the outcome of work Item PT1_47 on the “<i>Feasibility and sharing studies on the shared use of the 3.8-4.2 GHz frequency band by terrestrial wireless broadband systems providing local-area (i.e. low/medium power) network connectivity</i>”.</p> <p>CEPT agreed on 2 sets of RA parameters in September 2023 as outcome of cooperation between aviation and telecom industries. It is expected that by mid-2024, the representatives of telecom and aviation industries will agree on the consolidated CEPT deliverables for final review and approval.</p> <p>In the upcoming CEPT report priority is given to existing RA. Retrofitted RA and future RA (based on MOPS for new generation of RA) to be considered by CEPT in a next deliverable to CNECT (S6).</p> <p>The outcome of the related work Item PT1_40, under which the CEPT is studying the “<i>Compatibility between MFCN operating in 3400-3800 MHz and Radio Altimeters (RA) operating in 4200-4400 MHz</i>”, is not directly related to the European Commission mandate.</p>
S2	Commission Implementing Decision on the harmonised use of the 3.8-4.2 GHz frequency band – to ensure its use	COM/RSC	end-2025	Dependency: Availability of CEPT deliverables (S1)

³ [Mandate to CEPT](#) on technical conditions regarding the shared use of the 3.8-4.2 GHz frequency band for terrestrial wireless broadband systems providing local-area network connectivity in the Union.

⁴ MOPS: Minimum Operational Performance Standards.

ID	Activity	Responsible	Milestone and date	Dependencies/status/notes
	for terrestrial systems capable of providing LMP WBB ECS for local connectivity.			
S3	Successive authorisation, across the EU, of the 3.8-4.2 GHz band, and deployment of LMP WBB considering harmonised technical conditions at EU level.	Member States, EEA countries / Undertakings (telecom industry, vertical users (e.g. airports, harbours), etc.)	In accordance with the EECC / Individual commercial decisions	Dependency: Commission Implementing Decision (S2).
S4	Further to consideration of results of CEPT studies on 3.4-3.8 GHz and any follow up action (including potential temporary measures) as appropriate, successive deployment, across the EU, of WBB networks within the 3.4-3.8 GHz.	COM/RSC / Undertakings	End 2024/early 2025	Dependency: Availability of CEPT deliverables (S1).
S5	Successive relaxation or release (as appropriate) of the temporary measures.	Member States, EEA countries/ Undertakings	TBD	Dependency: Authorisation (S4; if relevant S3) Dependency: Successive retrofit of aircraft with new RA equipment (A6)
S6	Updated CEPT deliverable to CNECT, based on MOPS for new generation of RA.	CEPT	Q1/2027	Dependency: MOPS for new generation of RA (A1). This activity item could potentially necessitate beforehand a new European Commission mandate or an extension of the current one, which, in either case, could be finalised by end of 2024 .
S7	Update of Commission Implementing Decision on the harmonised use of the 3.8-4.2 GHz frequency band – to address next generation RA, if necessary, pursuant to CEPT input by Q1/2027.	COM/RSC	Q1/2028	Dependency: Updated CEPT deliverable to CNECT (S6)

7. Key activities in the aviation domain

ID	Activity	Responsible	Milestone and date	Dependencies/status/notes
A1	<p>MOPS for new generation of RA.</p> <p>Sub-activities: A 1.1 Development A 1.2. Consultation A 1.3 Adoption by EUROCAE Council</p>	EUROCAE/RT CA	Publication of MOPS by end 2024 (TBC)	The outcome of the CEPT deliverables to be considered in this activity. Design evolutions for the new generation RA to be included in the MOPS are highly more complex than filters required by the FAA in the US. The new generation of RA would be a long term (to last 20+years) and robust solution to mobile networks worldwide.
A2	<p>Certification specifications (CS-ETSO) for new generation of RA.</p> <p>A 2.1 Planning and preparation (impact assessment, technical/operational work,...).</p> <p>A 2.2 Publication of Notice of Proposed Amendment (Consultation process).</p> <p>A 2.3 Executive Decision by EASA.</p>	EASA	Publication by Q1 2025 (TBC)	<p>Dependency: EUROCAE MOPS (A1).</p> <p>It is anticipated that CS-ETSO would be largely based on the MOPS and can be expedited.</p> <p>Consultation process for RA certification specifications (A2.2) and consultation for Airspace usage regulation (A3.3) could be combined.</p>
A3	<p>Implementing regulation under EASA Basic Regulation Part AUR if justified through CEPT deliverable (S1).</p> <p>Sub-activities:</p> <p>A.3.1. Assessment of the European context based on the results of CEPT studies and inclusion in EASA EPAS (European Plan for Aviation Safety) and establishment of RMT (Rule Making Task).</p> <p>A 3.2 Rule making task (Impact assessment to justify need for updates, compatibility assessment, coordination with FAA and other non-EU entities,...) might include a potential mandate (if justified in CEPT deliverables) requiring targeted aircraft types or the entire fleet to</p>	EASA /MOVE/ EASA Committee	Indicative timeframe: From Q1 2025 to Q4 2026/Q2 2027 (TBC)	<p>Dependency: Certification specifications for new generation of RA (A2).</p> <p>Dependency: CEPT deliverable (S1).</p> <p>Dependency: Commission Implementing Decision (S2), possibly linked to the temporary measures on the mobile network.</p> <p>Typical duration 2-3 years. Process could be expedited.</p> <p>Consultation process for certification specifications (A 2.2) and consultation for Airspace usage regulation (A 3.3) could be combined.</p>

ID	Activity	Responsible	Milestone and date	Dependencies/status/notes
	<p>retrofit in accordance with Certification specifications (A2) .</p> <p>A 3.3. Consultation with stakeholders, including airspace users (publication of Notice of Proposed amendment)</p> <p>A 3.4. EASA opinion to MOVE</p> <p>A 3.5. Adoption at EASA Committee</p> <p>A 3.6. Commission Implementing Decision.</p>			
A4	<p>Successive industrialisation and certification of new generation of RA (demonstration of compliance with certification specifications).</p>	<p>Equipment manufacturers and aviation certification authorities (EASA, FAA,..)</p>	<p>Indicative date for first certified new generation RA: Q3 2028-Q4 2029 (TBC)</p>	<p>Dependency: Certification specifications for new generation of RA (A2).</p> <p>Dependency: Equipment mandate (A3)</p> <p>Industrial operation including system design, development, validation, integration, certification and production is a complex and lengthy process for safety critical avionics that could take 4-5 years.</p> <p>Duration will depend on the MOPS complexity. Some activities could be put in parallel (e.g. start developments/prototype on the basis of consolidated draft MOPS) to expedite the process.</p>
A5	<p>Successive certification of aircraft types.</p>	<p>Aircraft manufacturers and aviation certification authorities (EASA, FAA,..)</p>	<p>Indicative date for first certified aircraft type: Q3 2029-Q4 2030 (TBC)</p>	<p>Dependency: Certification of new generation of RA (A4).</p> <p>Certification of aircraft types with new generation of RA would typically take 1 year.</p>

ID	Activity	Responsible	Milestone and date	Dependencies/status/notes
				This activity includes retrofit (for existing aircraft) and forward fit (for new aircraft).
A6	Successive retrofit of aircraft with new RA equipment (e.g. procurement and installation during planned maintenance).	Airspace users	Indicative start date: 2029-2030 (TBC)	<p>Dependency: Successive certification of aircraft types (A5).</p> <p>It is assumed that a retrofit mandate would be published 2-3 years before the retrofit deadline to avoid unplanned and expansive retrofits.</p> <p>Industry needs to be prepared to avoid that installation of equipment is constrained by production capacity and supply chain.</p> <p>Airspace users may equip during planned maintenance cycles before the retrofit deadline once certified new generation RA are available (A4) and aircraft types are re-certified.</p> <p>Needs to be discussed with airspace users.</p>

8. Key inter-dependencies between both domains

CEPT deliverables (activity S1 and S6) should define technical parameters and criteria, and propose temporary measures in mobile/aviation domain considering current RA and MOPS for new generation of RA under development by EUROCAE/RTCA (activity A1).

Implementation of the technical harmonised conditions for use of the 3.8-4.2 GHz frequency band to be defined in a Commission Implementing Decision (activity S2) linked to possible temporary measures, have to be consistent with airspace usage regulation (forward fit/retrofit mandate) in the aviation side (activity A3), if required.

9. Acronyms

AMC	Acceptable Means of Compliance
CEPT	European Conference of Postal and Telecommunications Administrations
CS	Certification Specifications
EASA	European Union Aviation Safety Agency
ECS	Electronic Communications Services
EDA	European Defence Agency
EEA	European Economic Area
EECC	European Electronic Communications Code
EUROCAE	European Organisation for Civil Aviation Equipment
FAA	Federal Aviation Administration (US)
FCC	Federal Communications Commission (US)
GM	Guidance Material
LMP	Low/Medium Power
MOPS	Minimum Operational Performance Standards
MIC	Ministry of Internal Affairs and Communications (Japan)
MLIT	Ministry of Land Infrastructure and Transport (Japan)
RTCA	Radio Technical Commission for Aeronautics (US)
WBB	Wireless Broadband