CEPT ECC
Electronic Communications Committee

CEPT Report 94

Report from CEPT to the European Commission in response to the Mandate on 6425-7125 MHz – Task 2. Study of feasibility and scenarios for the potential shared use between terrestrial systems capable of providing WBB ECS and WAS/RLANs

Report approved on 30 October 2026 by the ECC

0 EXECUTIVE SUMMARY

In response to Task 2 of the EC Mandate to CEPT (Annex 1) on the upper 6 GHz band, this Report examines the technical feasibility of and possible scenarios for the potential shared use of the 6425–7125 MHz band between terrestrial systems capable of providing Wireless Broadband Electronic Communication Systems (WBB ECS) and Wireless Access Systems, including RLAN (WAS/RLANs). The assessment takes into account the results and analysis in ECC Report 366 [1] and the RSPG Opinion "on the long-term vision for the upper 6 GHz band" [2], as appropriate.

The studies in ECC Report 366 indicate that relying solely on WAS/RLAN using energy detection as a coexistence mechanism for the purposes of sharing is simple to implement but may not prevent mutual interference. This is not considered to be a feasible standalone sharing approach for WAS/RLAN LPI devices. No definitive conclusion on use of VLP WAS/RLAN devices in the upper 6 GHz band could be reached. Further studies are required to assess the feasibility of sharing between VLP devices and prioritised WBB ECS. ECC has adopted a work item to develop an ECC Report that will further analyse the possibility of introducing VLP WAS/RLAN[1].

While reduced WBB ECS base station powers can improve indoor WAS/RLAN access, ECC Report 366 also indicates that reducing WBB ECS base station e.i.r.p. negatively impacts WBB ECS coverage and capacity, including outdoors and is therefore also not considered to be a viable approach. To counteract the coverage and capacity reductions resulting from reduced WBB ECS BS e.i.r.p., operators might significantly densify their WBB ECS deployments in the upper 6 GHz. In regions where densification results in extensive mobile deployment, this could raise the aggregate interference level experienced by WAS/RLAN almost back to that experienced with full power WBB ECS BS e.i.r.p.

Therefore, this Report identifies a prioritised band split approach as the preferred scenario for the long term use of the upper 6 GHz band. Under this approach, non-prioritised WAS/RLAN LPI could access the portion of the band designated for prioritised WBB ECS use under specific conditions, while not causing harmful interference to WBB ECS. This is consistent with the prioritised band split in the RSPG Opinion:

- the frequency band 6585–7125 MHz for prioritised full power WBB ECS use; and
- the frequency band 6425–6585 MHz reserved as a guard band (together with a BEM applicable to WBB ECS in the 6585-7125 MHz) to protect WAS/RLAN operation in the lower 6 GHz band (5945–6425 MHz), with no release for WBB ECS nor for WAS/ RLANs until after WRC-27.

Following WRC-27, a decision will be taken on the exact use of the 6425–6585 MHz band.

Mechanisms to enable non-prioritised operation of WAS/RLANs within the portion of the band prioritised for WBB ECS were assessed in this Report, including:

- cross-technology signalling (XTS) (transmission of IEEE 802.11bc signals, 5G NR Synchronisation Signal Block (SSB) signals, and on-off keying (OOK) signals by WBB ECS base stations);
- smartphone-assisted awareness;
- database-assisted awareness and coordination.

Based on its investigations, CEPT has identified a database-assisted mechanism as a viable option for enabling non-prioritised LPI WAS/RLAN operation in the upper 6 GHz band. Administrations could implement such mechanism within their national framework on a voluntary basis under either an individual licensing regime or a general authorisation regime, subject to regulatory conditions established in accordance with national requirements.

XTS may be further assessed at a later stage to support more granular sharing.

[1] Detailed analysis of the possibility of introducing Very Low Power (VLP) WAS/RLAN as a non-prioritised application in 6425-7250 MHz, while ensuring the protection of incumbent services and MFCN and safeguarding the long-term use of the band for MFCN as the key 6G primary band.

Planning certainty for WAS/RLAN deployment can be supported for example under an individual authorisation regime through the issuing of time-limited individual authorisations (e.g. up to 5 years) for the operation of non-prioritised WAS/RLANs in order to timely manage local transitions.

Conversely, under a general authorisation regime, the potential impact of a new WBB ECS BS using the upper 6 GHz band being switched on in the vicinity of a public or private entity equipped with WAS/RLAN may occur without transition measures, depending on the coexistence mechanism implemented.

The implementation of a Country Determination Capability (CDC) as a mandatory requirement is intended to ensure that WAS/RLAN equipment does not use a frequency band in countries where operation is not authorised by the competent national administration.

The conclusions section of this Report also provides information on further CEPT work on the upper 6 GHz band agreed by the ECC.

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
AP	Access Point
BEM	Block Edge Mask
BS	Base Station
CDC	Country Determination Capability
CEPT	European Conference of Postal and Telecommunications Administrations
DDPP	Digital Decade Policy Programme
EC	European Commission
ECC	Electronic Communications Committee
EDT	Energy Detection Threshold
EESS	Earth Exploration-Satellite Service
EDT	Energy Detection Threshold
ETSI	European Telecommunications Standards Institute
FS	Fixed Service
FSS	Fixed Satellite Service
IEEE	Institute of Electrical and Electronics Engineers
ITU	International Telecommunication Union
LPI	Low Power Indoor
MAC	Medium Access Control
MFCN	Mobile/Fixed Communications Networks
OOK	On-Off Keying
PHY	Physical Layer
RAS	Radio Astronomy Service
RSPG	Radio Spectrum Policy Group
RSPP	Radio Spectrum Policy Programme
SINR	Signal-to-Interference-plus-Noise Ratio
SSB	Synchronisation Signal Block
STA	Station
UE	User Equipment
VLP	Very Low Power
WAS/RLAN	Wireless Access Systems including Radio Local Area Networks
WBB ECS	Wireless Broadband Electronic Communications Systems
WRC27	World Radio Conference 2027
XTS	cross-technology signalling

1 INTRODUCTION

In response to Task 2 of the EC Mandate to CEPT on the upper 6 GHz band (see Annex 1), this Report addresses the technical feasibility of possible scenarios for the potential shared[2] use of the 6425-7125 MHz frequency band by terrestrial systems capable of providing Wireless Broadband Electronic Communications Systems (WBB ECS)[3] and Wireless Access Systems including Radio Local Area Networks (WAS/RLAN). It takes into account the results and analysis in ECC Report 366 [1] and the RSPG Opinion "on the long-term vision for the Upper 6 GHz band" ("RSPG Opinion" hereafter for convenience) [2], as appropriate.

This Report provides the main conclusions from ECC Report 366 in section 2 and looks at the main potential sharing approaches and enabling mechanisms that were examined, along with the potential benefits and drawbacks of such mechanisms.

In section 3, the preferred scenario based on the RSPG Opinion is discussed, i.e., in addition to incumbents, a prioritised band split[4] with the frequency band 6585–7125 MHz recommended for prioritised use for full power WBB ECS and the frequency band 6425–6585 MHz reserved as a guard band until WRC-27.

In section 4, the mechanisms for enabling non-prioritised WAS/RLAN use in the portion of the band prioritised for WBB ECS are also assessed, including database-assisted coordination and cross-technology signalling.

In section 5, the overall conclusions of this Report are presented.

[2] "The notion of "shared use" for the purpose of this Mandate should at least include the simultaneous use of the upper 6 GHz band, or portions thereof, by both systems in the same geographical area.": source EC Mandate in Annex 1:.

[3] Also referred to in ECC deliverables as Mobile/Fixed Communication Networks (MFCN).

[4] This "prioritised band split" would allow WAS/RLAN to access the portion of the band prioritised for WBB ECS if it does not cause harmful interference to WBB ECS.

2 TECHNICAL FEASIBILITY OF POTENTIAL SHARING APPROACHES AND ENABLING MECHANISMS FROM ECC REPORT 366

This section summarises the main potential sharing approaches and enabling mechanisms that were examined in ECC Report 366 [1], along with the evaluation of the potential benefits and drawbacks of such mechanisms. Section 3 provides a more detailed analysis of the preferred scenario which is aligned with the recommendations of the RSPG Opinion.

2.1 POTENTIAL SHARING APPROACHES THAT WERE EXAMINED

2.1.1 Shared use with full power WBB ECS BS e.i.r.p. and WAS/RLAN energy detection only

This sharing approach assumes a coexistence framework where:

- WBB ECS base stations (BS) operate at full power in a mobile broadband deployment scenario, as described in ECC Report 366, section 2.4;
- WAS/RLAN equipment use only energy detection (based on the relevant energy detection threshold (EDT)) to avoid simultaneous and co-channel transmissions with WBB ECS;
- No further coordination or additional interference mitigation mechanisms are applied.

Studies in ECC Report 366 [1] indicate that this approach leads to negative consequences for WAS/RLAN spectrum access and user experience. Furthermore, in some cases, interference to WBB ECS would also be caused from WAS/RLAN Low Power Indoor (LPI) equipment.

Specifically, studies indicated that full power WBB ECS macro BS negatively impacts WAS/RLAN spectrum availability, and that depending on WBB ECS BS density and loading, the majority (up to 90% according to some studies) of indoor locations could become unavailable for WAS/RLAN use. This is because the WAS/RLAN "listen before talk" mechanism is triggered where the WBB ECS signal levels exceed the relevant EDT. Even where WBB ECS signals are below the EDT, studies indicate that WAS/RLAN throughput may be significantly reduced due to SINR degradation caused by interference due to WBB ECS.

With energy detection alone, WAS/RLAN transmissions can also cause harmful interference to WBB ECS. One study indicated 26% degradation in median downlink throughput and 53% degradation in the cell edge downlink throughput. Another study showed worse impact when a LPI WAS/RLAN equipment and an WBB ECS user equipment (UE) are both located indoors and separated by 10 metres. In this scenario, WBB ECS downlink throughput could be reduced to zero in around 49% of locations where the LPI WAS/RLAN equipment transmits at the same time as the UE is receiving, this figure decreases to 40% of locations if the WBB ECS UE is outdoors.

For Very Low Power (VLP) operation, two different studies presented in ECC Report 366 reached different conclusions. One study indicated that VLP WAS/RLANs operating at activity factors of around 2% do not cause significant degradation to WBB ECS uplink or downlink performance, subject to the modelling assumption that the locations of active WBB ECS UEs and VLP devices are uncorrelated, such that the likelihood of them being located in close proximity is close to zero. When much higher activity factors (20%) are considered with correlated (clustered) deployment scenarios, median WBB ECS downlink throughput was found to be degraded by around 9%, while cell edge throughput was degraded by 40% due to interference from VLP devices. Another study using the same 20% activity factor as a sensitivity analysis indicated that WBB ECS UE uplink performance was degraded by about 2 Mbps as a result of interference from VLP devices.

An input study was received during the public consultation of ECC Report 366 [1], which concludes that the operation of WAS/RLAN VLP equipment in the upper 6 GHz would result in substantial interference to both the MFCN uplink and downlink, and that co-channel spectrum sharing between MFCNs and WAS/RLAN VLP devices at the same time and place is not feasible.

An input study was received while developing this CEPT Report that considers the feasibility of co-channel sharing between VLP WAS/RLAN devices and WBB ECS (both UEs and BSs) operating in the 6425-7125 MHz band in close proximity to each other, based on both measurements and theoretical analysis. The conclusion from this study indicates that the probability of detrimental impact on WBB ECS is negligible in

cases where the EDT is successfully triggered, while it is noted that further work is needed to understand the impact at lower signal levels. It has been noted that the impact of shadow fading and building losses and their associated variability across the WBB ECS cell would also need to be taken into account to quantify this impact more accurately.

The two studies mentioned above received during the public consultation of ECC Report 366 and at a later stage were not reviewed in detail.

In summary, the studies presented indicated that relying solely on WAS/RLAN using energy detection for the purposes of sharing is simple to implement but may not prevent mutual interference. This is not considered to be a feasible standalone sharing approach for WAS/RLAN LPI devices. Further studies are required to assess the feasibility of sharing between VLP devices and prioritised WBB ECS. ECC has adopted a work item to develop an ECC Report that will further analyse the possibility of introducing VLP WAS/RLAN[5].

2.1.2 WBB ECS outdoor coverage and WAS/RLAN indoor coverage through reduced WBB ECS BS e.i.r.p.

This sharing approach assumes a coexistence framework where:

- WBB ECS BSs operate with reduced power to reduce the likelihood of interference to co-channel WAS/RLAN, while maintaining the same inter-site distance used for WBB ECS BS full power studies summarised in the previous section;
- WAS/RLAN equipment relying solely on energy detection to avoid simultaneous and co-channel transmissions with WBB ECS;
- No further coordination or additional interference mitigation mechanisms are applied.

ECC Report 366 [1] generally acknowledged that there are negative impacts on WBB ECS performance due to reduced WBB ECS BS e.i.r.p.

Sharing could potentially be improved with reduced WBB ECS BS e.i.r.p. in the range of 50 to 57 dBm/100 MHz. Some studies indicated that around 80% of indoor locations could support the WAS/RLAN use of the upper 6 GHz band at a reduced WBB ECS BS e.i.r.p. of 57 dBm/100 MHz. The remaining 20% locations would likely not support WAS/RLAN use as the WBB ECS signal would be above the EDT. One study indicated that the combined capacity of indoor WAS/ RLAN and outdoor WBB ECS can be higher than the capacity of either system alone in a non-shared scenario and could potentially result in more efficient use of spectrum and overall benefit greater than that of exclusive use by one application.

As this approach would not require additional standardisation, it can be considered relatively simple to implement compared to some of other sharing approaches mentioned in this Report.

However, reduced WBB ECS BS e.i.r.p. negatively impacts WBB ECS coverage and capacity, including outdoors. One study indicated that reducing WBB ECS BS e.i.r.p. from 81 dBm/100 MHz to 60 dBm/100 MHz results in a 22% reduction in average outdoor WBB ECS downlink throughput, and a 99% reduction in the cell-edge outdoor WBB ECS downlink throughput.

A reduced WBB ECS BS e.i.r.p. for sharing purposes would make it challenging for mobile network operators to use the existing 3.6 GHz macro BS deployment grid to deliver both outdoor and, in particular, indoor connectivity, noting that most WBB ECS traffic occurs indoors. Under this approach, mobile network operators would need to rely on costly network densification to provide additional capacity and in addition, where possible, refarm existing WBB ECS bands to deliver coverage comparable to that provided by the 3.6 GHz band.

In practice, results may be affected by variable building entry losses, which depend on construction materials and architectural design (modern building practices, driven by energy efficiency goals, are increasingly introducing materials that increase RF isolation, while there are also solutions available on the market to reduce building penetration losses). In buildings with higher isolation, sharing between indoor WAS/RLAN and

[5] Detailed analysis of the possibility of introducing Very Low Power (VLP) WAS/RLAN as a non-prioritised application in 6425-7250 MHz, ensuring the protection of incumbent services and MFCN and safeguarding the long-term use of the band for MFCN as the key 6G primary band.

reduced power outdoor WBB ECS could be improved, whereas in buildings with lower isolation, interference can occur to both applications.

To counteract the coverage and capacity reductions resulting from reduced WBB ECS BS e.i.r.p., operators might significantly densify their WBB ECS deployments in the upper 6 GHz. In regions where densification results in extensive mobile deployment, this could raise the aggregate interference level experienced by WAS/RLAN almost back to that experienced with full power WBB ECS BS e.i.r.p.

2.1.3 Prioritised band split approaches

Where full power WBB ECS BS e.i.r.p. is assumed to be deployed , there are likely to be very limited indoor locations and no outdoor locations where WAS/RLAN use is possible within the same geographical area as WBB ECS. On the other hand, where reduced WBB ECS BS e.i.r.p. is assumed, this negatively impacts WBB ECS coverage and capacity both for outdoors and in particular for indoor WBB ECS uses. Therefore, in order to enable full power WBB ECS BS and WAS/RLAN use in the band, additional frequency or geographical separation between WBB ECS and WAS/RLAN may be considered.

Accordingly, ECC Report 366 [1] discusses different forms of frequency separation, including a "prioritised band split" and "database-assisted separation in frequency".

Specifically, a “prioritised band split” would allow WAS/RLAN to access the portion of the band prioritised for WBB ECS if it does not cause harmful interference to WBB ECS. For instance, this can be beneficial in geographical areas where WBB ECS in its priority portion of the band is not present due to factors like prioritised incumbent services, limited demand, deployment timelines, or areas where no deployment is foreseen.

On the notion of “prioritisation”, ECC Report 366 notes that in most cases a priority to one technology or another would likely have to be applied at a particular location, frequency or time. A minimum level of certainty on spectrum availability is likely to be required for both networks.

This approach could potentially be enabled with the adoption of the sharing mechanisms assessed to be feasible and suitable in section 2.2.

In particular, sections 2.2.1.1 to 2.2.1.3 assess a range of detect and avoid mechanisms using an appropriate sensing mechanism that aim at allowing non-prioritised WAS/RLAN operation in the portion of the band prioritised for WBB ECS.

Alternatively, section 2.2.3 also assesses the possibility to enable the prioritised band split approach through the adoption of geolocation databases, where the operator of a WAS/RLAN – or the WAS/RLAN equipment itself – would need to query an appropriate database (or other source of information) and would receive instructions or information with regards to permitted powers and available upper 6 GHz channels (if any) at its location, otherwise transmission would not be authorised in accordance with the applicable regulatory framework.

The practical implementation of these band split options has not been assessed in detail in ECC Report 366 and would require further consideration.

Adjacent band issues and the specific size of the bands prioritised for each of WBB ECS or WAS/RLAN are not addressed in ECC Report 366.

2.2 POTENTIAL ENHANCED SHARING MECHANISMS

This section provides an assessment of the enhanced sharing mechanisms that would be required to enable the sharing approaches discussed above. Enhanced detection using cross-technology signalling (XTS) or assistance from smartphones acting as sensors could potentially improve the detection of WBB ECS by WAS/RLAN equipment compared to conventional WAS/RLAN using energy detection. Use of databases can be another potential mechanism for awareness of one application by the other. Such awareness of the other

application, followed by appropriate mitigating action can improve the shared use of the band. All of these mechanisms would need to be standardised, harmonised and tested for compliance.

2.2.1 Cross-technology signalling

2.2.1.1 Sensing based on detection of IEEE 802.11bc signal transmissions by WBB ECS BS

In this mechanism, WBB ECS BSs broadcast IEEE 802.11bc signals to enable detection by WAS/RLAN LPI access points (APs) and stations (STAs). Upon successful processing of these signals, the WAS/RLAN devices would trigger mitigation actions, such as vacating the band or refraining from transmission. The incorporation of IEEE 802.11bc signalling into WBB ECS transmissions would introduce additional signalling overhead and implementation complexity. While the implementation of the 802.11bc mechanism may have little or no impact on the performance and cost of Wi-Fi equipment, it may affect the performance and cost of WAS/RLAN equipment that is not based on IEEE standards.

The required SINR at the Wi-Fi receiver for the decoding of IEEE 802.11bc signals can lead to high probabilities of missed detection (false negative). Studies show probabilities of 55% to 90% for correct detection of 802.11bc. These probabilities are not sufficient to ensure avoidance of harmful interference to WBB ECS. WBB ECS UEs may also be required to transmit 802.11bc signals in order to improve the probabilities of correct detection, but the hardware/software cost of implementing this mechanism is likely to increase the cost of a UE transmitter and would result in higher power consumption and reduced battery life, although these factors have not been quantified.

The incorporation of 802.11bc transmissions in WBB ECS BSs and the implementation of appropriate mitigation actions to be undertaken by WAS/RLAN equipment would need to be standardised, harmonised and tested for compliance. This would have implications on availability timelines for both WBB ECS (incorporation of 802.11bc signalling) and for WAS/RLAN equipment (integration of appropriate mitigation actions).

It should be noted that detection of WBB ECS by WAS/RLAN based on the detection of IEEE 802.11bc signal transmissions by WBB ECS BS would result in additional costs and burdens for the prioritised user (WBB ECS).

2.2.1.2 Sensing based on detection of 5G NR Synchronisation Signal Block (SSB) transmissions by WBB ECS BS

In this mechanism, WAS/RLAN APs and STAs decode 5G NR SSB pilot signals that are normally broadcasted from WBB ECS BSs, and which WAS/RLAN equipment process to trigger mitigation actions such as vacating the band or refraining from transmission. This mechanism is more robust than using WAS/RLAN using energy detection and allows correct detection at much lower signal levels in noise-limited environments. Studies indicate very high probabilities of correct detection: 98% to 99% in indoor locations for a maximum WBB ECS BS e.i.r.p. of 81.6 dBm/80 MHz. With a reduced WBB ECS e.i.r.p. of 57 dBm/80 MHz, the probabilities of correct detection reduce to 65% to 75%. The detection probabilities based on full power WBB ECS BSs are the highest of the three cross-technology signalling mechanisms that were assessed.

However, the implementation of this mechanism would require WAS/RLAN equipment to incorporate additional radio hardware and software capabilities to decode 5G NR SSB signals. Such requirements would introduce implementation complexity and potential cost implications for WAS/RLAN equipment. This, and the appropriate mitigation actions to be undertaken by WAS/RLAN equipment would need to be standardised, harmonised and tested for compliance, and this would have implications on availability timelines and cost for WAS/RLAN equipment. The development of next generation WBB ECS radio interfaces (e.g. 6G) would also need to be taken into account to verify that equivalent SSB transmissions can be detected by WAS/RLAN.

2.2.1.3 Sensing based on on-off keying (OOK) signal transmissions by WBB ECS BS

OOK has been proposed as a dedicated pilot signal type offering higher flexibility and easier implementation with basic encoding compared to higher-order modulation signals. The detection probability is expected to be higher depending on the implemented detection threshold.

This mechanism requires new standardisation for both WBB ECS and WAS/RLANs which could mean implications on timelines for equipment availability and cost for both WBB ECS and WAS/RLANs. Aspects related to channel alignment, detection threshold, and cybersecurity should be considered. This mechanism has not been studied in detail in ECC Report 366 [1] and would require further technical evaluation.

2.2.2 Smartphone-assisted awareness

In these mechanisms, WBB ECS UEs act as distributed sensors to report on the presence of WBB ECS or WAS/RLAN. In most cases, UE in the form of smartphones would support both IMT and Wi-Fi technologies, and could, in principle, contribute to improved awareness of either system.

As with other sensing-based approaches, radio propagation conditions can lead to missed detections (false negatives). The mechanism would introduce additional complexity in UE design, including increased signalling and potential impacts on power consumption and battery life. The sensing and reporting processes, as well as the appropriate mitigation actions to be undertaken by WBB ECS and WAS/RLAN equipment would need to be standardised, harmonised, and tested for compliance, and this would have implications on availability timelines for both WBB ECS and WAS/RLAN equipment.

The feasibility and performance of such approaches would depend on factors including device participation rates, reporting reliability, and coordination mechanisms, which were not comprehensively assessed in the available studies.

2.2.3 Awareness based on database systems

A database-assisted mechanism could facilitate the sharing between WBB ECS and WAS/RLAN LPI equipment in geographic location, time, or frequency, offering flexibility for national regulators to tailor spectrum access.

Most studies in ECC Report 366 [1] focused on sharing within the same geographic area. While the concept of database-assisted geographic separation was examined, no quantitative analysis of this approach was carried out.

Under a database-assisted mechanism for the non-prioritised WAS/RLAN usage of the band, the operator of a WAS/RLAN — or the WAS/RLAN equipment itself — would need to regularly query an appropriate database system (or another trusted information source). As a result of the regular queries, it would receive instructions and information regarding available channels (if any) and permitted transmission power levels at its specific location, otherwise transmission would not be authorised. While the technical conditions for voluntary non-prioritised use of WAS/RLAN taking into account the protection of WBB ECS are planned to be harmonised at a European level, the administration would be responsible for defining the relevant regulatory parameters and operational conditions as a part of its national regulatory framework. The resulting operational parameters communicated to WAS/RLAN equipment may be derived through calculations performed by the database system, or provided through predefined datasets established, for example, by the administration, or other implementation methods consistent with the applicable regulatory framework.

For implementation of geographic sharing, such database-assisted operation would have limited or no impact on the PHY/MAC layers of the radio technologies. This is not the case for sharing in time or frequency, especially when sharing is at a fine granularity, e.g. with enhanced sensing techniques.

Guidance for the national implementation of a regulatory framework for database-assisted spectrum-coordination has already been developed for TV White Space Devices (see ECC Report 236 [3]). This framework was implemented by one CEPT administration for protection of TV broadcasts using ETSI harmonised standard EN 301 598 [4]. Additionally, a European framework is currently under development to enable coordination of higher power WAS/RLAN deployments with existing incumbent services in the lower 6 GHz band. Further investigations into the database-assisted solution are essential in order to support the development of a sharing framework and facilitate the proof-of-concept of implementation by administrations. The technical requirements for a database-assisted mechanism, including the required information exchanges and mitigation actions, as well as tests for demonstration of compliance, would need to be defined by ETSI in the relevant harmonised standards. Parameters deemed to be critical in the mitigation of interference to other radio services should be subject to User Access Restriction (UAR) clauses.

For cases where WAS/RLAN operation in the WBB ECS-prioritised portion of the upper 6 GHz band is enabled through database systems, WAS/RLAN LPI access points would require additional positioning capabilities in order to provide their geographic location as part of the query. When WAS/RLAN equipment queries the database system, information on its geographic location may be obtained through internal or external positioning capabilities through the Global Navigation Satellite System (GNSS) or other means consistent with regulatory requirements. The database system would take into account the location uncertainty when determining the operational parameters that can be authorised.

A database-assisted mechanism could give national regulators the flexibility to prioritise full power WBB ECS while allowing the non-prioritised operation of WAS/RLAN in areas where there is no expected demand for or deployment of WBB ECS at the time, while ensuring the protection of WBB ECS from both co-channel and adjacent channel interference. A database system could provide in a machine-readable format information on geographical areas where non-prioritised WAS/RLAN use may be authorised. In this way, usage can be managed according to local demand and national circumstances, potentially improving overall efficient use of spectrum and user experience.

If WBB ECS deployment in a specific geographic area occurs after the introduction of WAS/RLAN equipment, the WAS/RLAN equipment may experience a degradation in performance, in particular, due to the reduction in the availability of spectrum. Whether this performance change is perceived by the end users depends on many factors (e.g. demand for WAS/RLAN, remaining channels within the WBB ECS spectrum, the density of WBB ECS deployments, etc.). The national implementation of a database-assisted regulatory framework would require practical considerations to offer adequate planning predictability to WBB ECS and WAS/RLAN.

The general concept of a “database-assisted mechanism” may apply either under an individual or a general authorisation regime.

2.2.4 Country determination capability

The implementation of a Country Determination Capability (CDC) is intended as a mandatory requirement to ensure that WAS/RLAN equipment does not use a frequency band in countries where operation is not authorised by the competent national administration. The CDC requirement would be technology-neutral and would not prescribe any specific mechanism.

To operate in the portion of the band prioritised for WBB ECS, WAS/RLAN LPI access points should first use CDC to determine whether the use of the band is permitted in the country in which they are operating. The technical and regulatory implementation, as well as the corresponding equipment requirements and compliance tests, would be defined by ETSI in the relevant harmonised standard. To ensure conformity, the WAS/RLAN equipment shall be constructed such that its hardware and/or software settings are not accessible for the user to alter the identity of the country of operation and/or the operating frequency band. CEPT could consolidate and update the information indicating whether and how national administrations permit WAS/RLAN use in the portion of the band prioritised for WBB ECS.

3 PREFERRED SCENARIO FOR THE LONG-TERM USE OF THE UPPER 6 GHZ BAND

In determining the preferred scenario(s) under the upper 6 GHz band mandate (see Annex 1), CEPT has taken due account of the RSPG Opinion on the upper 6 GHz band.

Section 5.1 [2] of the RSPG Opinion "on the long-term vision for the upper 6 GHz band" considered current usage of the band and emphasised the need for flexibility, allowing countries to maintain existing services (FS, FSS, RAS, EESS), while also supporting additional mobile applications (WBB ECS and WAS/RLAN). Section 5.2 assessed future developments, recommending shared use of the band and flexibility for Member States not to award spectrum where no demand arises for WBB ECS in the band. Section 5.3 provided recommendations on a prioritised band split within the upper 6 GHz band, section 5.4 outlined further considerations, and section 5.5 recommended studying the possibility of WAS/RLAN operation as a non-prioritised user.

The CEPT has considered the RSPG Opinion and identified the following relevant aspects from the RSPG Opinion for the preferred scenario:

- A prioritised full power WBB ECS use of the band 6585-7125 MHz has been agreed, shown in Figure 1 by MFCN in the layer '1st'.
- There is the need to ensure continuous operation of WAS/RLAN in the adjacent lower 6 GHz band (5945-6425 MHz) in accordance with the harmonised technical conditions defined in Commission Decision (EU) 2021/1067 [5];
- 6425-6585 MHz is reserved as a guard band (together with a BEM applicable to WBB ECS in the 6585-7125 MHz) to protect WAS/RLANs in the lower 6 GHz band (5945-6425 MHz), shown in grey 'undefined' in Figure 1, with no release for WBB ECS nor for WAS/RLAN until WRC-27;
- Explore and propose practical sharing options for the non-prioritised WAS/RLAN (shown in Figure 1 in the layer '2nd') within the full power WBB ECS segment, ensuring adequate planning security and avoiding harmful interference to WBB ECS;
- After WRC-27, a decision will be taken on the exact use of 6425-6585 MHz:
  - If WRC-27 identifies the 7125-7250 MHz band for IMT and no significant new developments or insights suggest otherwise, there is a strong case for designating the 6425-6585 MHz band for primary WAS/RLAN use;
  - If WRC-27 does not identify the 7125-7250 MHz band for IMT and no significant new developments or insights suggest otherwise, there is a strong case for designating the 6425-6585 MHz band for primary WBB ECS use;
- In countries with radio astronomy (6650-6675.2 MHz) or with WBB ECS stations operating within the coordination zone, there will be a need to ensure protection of RAS by coordinating WBB ECS usage in this and in adjacent bands.

Figure 1 from the RSPG Opinion depicts the upper 6 GHz band (6425-7125 MHz) with incumbent services (FS, FSS, EESS, RAS), WAS/RLAN, MFCN, non-prioritised WAS/RLAN, and undefined. The prioritised split of the band is shown with a dotted rectangle below the layers.

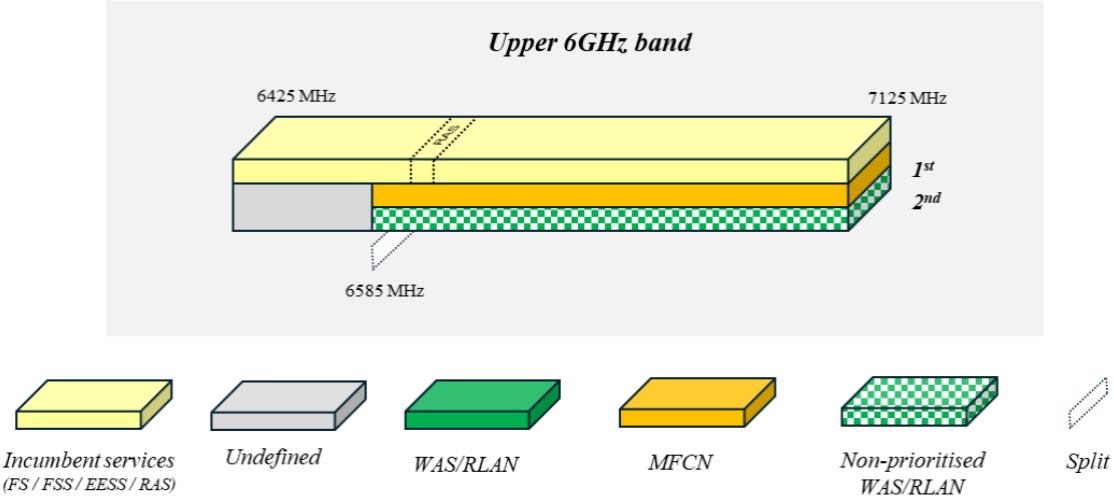


Figure 1 Prioritised band split 6585-7125 MHz for MFCN [2]

4 ASSESSMENT ON POSSIBLE NON-PRIORITISED USE OF WAS/RLAN IN 6585-7125 MHZ BAND

CEPT has considered the recommendation of the RSPG Opinion to study the shared use of the upper 6 GHz band, as well as the possibility of non-prioritised WAS/RLAN use in 6585-7125 MHz in areas where WBB ECS coverage is not available, and has identified the following relevant aspects that such considerations should, among others, take into account:

- Studying potential WAS/RLAN operation as a non-prioritised user in areas without WBB ECS coverage and for specific use cases that would benefit from access to the full upper 6 GHz band (e.g. large factories in rural areas);
- Studying the risk of service disruption for WAS/RLAN installations operating in the upper 6 GHz band when a new WBB ECS BS is activated, particularly in sensitive or high-density locations such as hospitals, stadiums, schools, universities and factories in urban or sub-urban areas;
- Ensuring adequate protection of WBB ECS within its prioritised portion of the band;
- Developing solutions for administrations who wish to allow non-prioritised WAS/RLAN access to the 6585-7125 MHz band, either under an individual licensing or a general authorisation regime.

4.1 NON-PRIORITISED WAS/RLAN LOW POWER INDOOR (LPI) USE OF THE 6585-7125 MHZ

4.1.1 Spectrum sharing mechanisms

Section 2 presents all mechanisms studied in ECC Report 366 [1] to identify the feasibility of the potential shared use of the upper 6 GHz band by WBB ECS and WAS/RLAN. However, not all of these mechanisms are applicable to the potential introduction of non-prioritised use of WAS/RLAN in the upper 6 GHz band as recommended by the RSPG in its Opinion [2]. A database-assisted mechanism and cross-technology signalling (XTS) could be considered as potential options to automatically enable non-prioritised WAS/RLAN LPI while avoiding harmful interference from WAS/RLAN to WBB ECS in the 6585–7125 MHz frequency band. Database-assisted mechanisms could be considered at a national level for WAS/RLAN LPI use, either under an individual authorisation or a general authorisation regime subject to certain regulatory conditions in accordance with national requirements. These database-assisted mechanisms may provide administrations with increased flexibility in the management of the deployment of LPI WAS/RLAN under nationally determined conditions, in geographic areas where co-channel WBB ECS in the upper 6 GHz band is not expected or planned to be deployed.

The baseline function of a database-assisted mechanism would consist of delivering national information on geographical areas and channels where non-prioritised WAS/RLAN may be authorised in accordance with the applicable national regulatory conditions, where no WBB ECS is deployed nor expected to be deployed, e.g. for large factories in rural areas. National database-assisted mechanisms may be refined over time in view of enhancing the potential for sharing.

For more efficient use of spectrum and more granular sharing, cross-technology signalling (XTS) solutions, mainly based on IEEE 802.11bc or SSB detection, were also considered (see section 2.2.1). However, the studies for IEEE 802.11bc acknowledged that it could not prevent interference in a significant percentage of locations. On the other hand, SSB detection was determined to be more successful. In both cases, the potential implementation costs were not studied or quantified, and no conclusion was reached on any potential trade-off against the level of protection required for WBB ECS. XTS may be further assessed at a later stage to support more granular sharing.

4.1.2 Regulatory approach

National administrations would have to decide on the authorisation regime they apply for the operation of non-prioritised WAS/RLAN within the territory under their jurisdiction, either individual licensing regime or general authorisation regime.

In addition, national administrations would need to establish a regulatory approach that addresses cases in which WBB ECS deployment is introduced at a later stage in specific geographic areas where there are existing WAS/RLAN deployments. The risk of existing WAS/RLAN installations using the upper 6 GHz band being disrupted when a new WBB ECS BS is switched on, particularly in locations such as hospitals, stadiums,

schools, universities and factories in urban or sub-urban areas, should also be carefully considered. The deployment of enterprise WAS/RLAN installations within an individual private or public entity requires local network planning (i.e. careful installation and connection of access points) to support effective WAS/RLAN connectivity services within its premises. Networks that would seek to rely on the upper 6 GHz band to support higher capacity needs via non-prioritised WAS/RLAN may face congestion and capacity loss due to the reduction in the availability of spectrum once WBB ECS BSs are deployed.

Given these considerations, national administrations should ensure transparency with respect to the conditions under which the upper 6 GHz band is made available on a non-prioritised basis to WAS/RLAN in the longer run.

Planning certainty for WAS/RLAN deployment can be supported for example under an individual authorisation regime through the issuing of time-limited individual authorisations (e.g. up to 5 years). This individual authorisation can be granted either through case-by-case coordination or a database-assisted mechanism. Administrations could then effectively manage local spectrum use and potential transitions over time by authorising the deployment of new WBB ECS BSs in certain areas (i.e. in areas where no demand for WBB ECS was previously anticipated) taking into account the duration of the individual authorisations that had been granted for WAS/RLAN operation.

Conversely, under a general authorisation regime, the potential impact of a new WBB ECS BS using the upper 6 GHz band being switched on in the vicinity of a public or private entity equipped with WAS/RLAN may occur without transition measures, depending on the coexistence mechanism implemented[6].

CEPT administrations should in any case maintain the authority to determine whether non-prioritised WAS/RLAN usage is allowed in the upper 6 GHz band. CEPT is developing a dedicated ECC Recommendation on the voluntary non-prioritised WAS/RLAN use of the frequency band 6585-7125 MHz. This Recommendation would provide a harmonised frequency arrangement and the least restrictive harmonised technical conditions for voluntary non-prioritised use of WAS/RLAN LPI equipment in the 6585 - 7125 MHz frequency band, taking into account the protection of prioritised WBB ECS.

4.2 NON-PRIORITISED WAS/RLAN VERY LOW POWER (VLP) USE OF THE 6585-7125 MHZ

VLP WAS/RLAN devices are portable devices and are intended to provide client-to-client connectivity, and may not be subject to control by WAS/RLAN APs and their geographical deployment would not be controlled. As an option to realise VLP in the upper 6 GHz band, the database-assisted mechanism may need to be extended to manage the operation of VLP.

Based on the modelling assumptions, particularly colocation of UEs and VLP devices and activity factors, the two studies in ECC Report 366 [1] show varying results from minimal to significant interference into WBB ECS.

As no definitive conclusions could be reached within the framework of this EC mandate ECC has adopted a work item to develop an ECC Report that will study the feasibility of non-prioritised VLP use and include an analysis of the impact of the VLP use on WBB ECS, as also mentioned in section 2.1.1.

[6] For example, a national administration should be able to distinguish under a database-assisted mechanism between geographic areas within its national territory based on different status.

5 CONCLUSIONS

In response to Task 2 of the EC Mandate to CEPT on the upper 6 GHz band, this Report examines the technical feasibility of and possible scenarios for the potential shared use of the 6425–7125 MHz band between terrestrial systems capable of providing Wireless Broadband Electronic Communication Systems (WBB ECS) and Wireless Access Systems, including RLAN (WAS/RLANs). The assessment takes into account the results and analysis in ECC Report 366 [1] and the RSPG Opinion "on the long-term vision for the upper 6 GHz band" [2], as appropriate.

The studies in ECC Report 366 indicate that relying solely on WAS/RLAN using energy detection as a coexistence mechanism for the purposes of sharing is simple to implement but may not prevent mutual interference. This is not considered to be a feasible standalone sharing approach for WAS/RLAN LPI devices. No definitive conclusion on use of VLP WAS/RLAN devices in the upper 6 GHz band could be reached. Further studies are required to assess the feasibility of sharing between VLP devices and prioritised WBB ECS. ECC has adopted a work item to develop an ECC Report that will further analyse the possibility of introducing VLP WAS/RLAN[7].

While reduced WBB ECS base station powers can improve indoor WAS/RLAN access, ECC Report 366 also indicates that reducing WBB ECS base station e.i.r.p. negatively impacts WBB ECS coverage and capacity, including outdoors and is therefore also not considered to be a viable approach.

In alignment with the RSPG Opinion, the prioritised band split approach is selected and addressed in this Report according to the following:

- A prioritised full power WBB ECS use of the band 6585–7125 MHz has been agreed;
- There is a need to explore and propose practical sharing options for the non-prioritised WAS/RLAN operation within the full power WBB ECS segment, ensuring adequate planning security and avoiding harmful interference to WBB ECS in the 6585-7125 MHz band;
- The band 6425–6585 MHz is reserved as a guard band (together with a BEM applicable to WBB ECS in the 6585-7125 MHz) to protect WAS/RLANs in the lower 6 GHz band (5945-6425 MHz), with no release for WBB ECS nor for WAS/RLANs until after WRC-27;
- After WRC-27, a decision will be taken on the exact use of the band 6425-6585 MHz;
- If WRC-27 identifies the 7125–7250 MHz band for IMT and no significant new developments or insights suggest otherwise, there is a strong case for designating the 6425-6585 MHz band for primary WAS/RLAN use;
- If WRC-27 does not identify the 7125–7250 MHz band for IMT and no significant new developments or insights suggest otherwise, there is a strong case for designating the 6425-6585 MHz band for primary WBB ECS use.

Further on the upper 6 GHz band

- There is the need to ensure continuous operation of WAS/RLAN in the adjacent lower 6 GHz band (5945-6425 MHz) in accordance with the harmonised technical conditions defined in Commission Decision (EU) 2021/1067 [5];
- There is a need to analyse the possibility and feasibility of WAS/ RLAN Very Low Power (VLP) equipment to operate as a non-prioritised user in the upper 6 GHz band;
- There is a need to assess the necessary technical conditions to enable coexistence between WBB ECS in the 6585-7125 MHz and WAS/ RLANs within the lower 6 GHz band;
- There is a need to establish a coordination zone around RAS sites for WBB ECS stations operating in the 6650–6675.2 MHz band and adjacent bands, in order to protect the RAS and this may require cross border coordination on a case-by-case basis as well as bilateral or even multilateral agreements between neighbouring countries.

Mechanisms to enable non-prioritised operation of WAS/RLANs within the portion of the band prioritised for WBB ECS were assessed in this Report, including:

[7] Detailed analysis of the possibility of introducing Very Low Power (VLP) WAS/RLAN as a non-prioritised application in 6425-7250 MHz, ensuring the protection of incumbent services and MFCN and safeguarding the long-term use of the band for MFCN as the key 6G primary band.

- cross-technology signalling (transmission of IEEE 802.11bc signals, 5G NR Synchronisation Signal Block (SSB) signals, and on-off keying (OOK) signals by WBB ECS base stations);
- smartphone-assisted awareness;
- database-assisted awareness and coordination.

Each of the above mechanisms presents different trade-offs in terms of implementation complexity, cost, technical performance and their ability to avoid harmful interference to prioritised WBB ECS, which would require careful assessment for future standardisation and deployment.

Based on its investigations, CEPT has identified a database-assisted mechanism as a viable option for enabling non-prioritised LPI WAS/RLAN operation in the upper 6 GHz band. Administrations could implement such mechanism within their national framework on a voluntary basis under either an individual licensing regime or a general authorisation regime, subject to regulatory conditions established in accordance with national requirements.

For more efficient use of spectrum and more granular sharing, cross-technology signalling (XTS) solutions mainly based on IEEE 802.11bc and SSB were considered (see section 2.2.1). However, the studies for IEEE 802.11bc detection acknowledged that it could result in interference in an unacceptable percentage of indoor WAS/RLAN locations. On the other hand, SSB detection was determined to be more successful. In both cases, the potential implementation cost was not studied or quantified, and no conclusion was reached on the potential trade-offs against the level of protection required for WBB ECS. XTS may be further assessed at a later stage to support more granular sharing.

The database-assisted mechanism would give administrations the flexibility to prioritise full power WBB ECS while allowing non-prioritised WAS/RLAN operation under nationally determined conditions, in areas where there is no expected demand for or deployment of co-channel WBB ECS at the time, while ensuring protection of WBB ECS from harmful interference. This approach would enable specific WAS/RLAN use cases – such as large factories in rural areas – to access the entire upper 6 GHz band. It would also provide the capability to apply or update restrictions for non-prioritised WAS/RLAN in order to protect new WBB ECS deployments introduced in the same geographic area. Importantly, this solution would have limited or no impact on the existing radio technologies.

National administrations would need to implement a regulatory mechanism to account for cases where WBB ECS deployment is introduced at a later stage in specific geographic areas where there are existing WAS/RLAN deployments. The risk of existing WAS/RLAN installations using the upper 6 GHz band being disrupted when a new WBB ECS base station is switched on, particularly in locations such as hospitals, stadiums, schools, universities and factories in urban or suburban areas should also be carefully considered. Planning certainty for WAS/RLAN deployment can be supported for example under an individual authorisation regime through the issuing of time-limited individual authorisations (e.g. up to 5 years) for the operation of non-prioritised WAS/RLANs in order to timely manage local transitions. Conversely, under a general authorisation regime, the potential impact of a new WBB ECS BS using the upper 6 GHz band being switched on in the vicinity of a public or private entity equipped with WAS/RLAN may occur without transition measures, depending on the coexistence mechanism implemented.

The implementation of a Country Determination Capability (CDC) as a mandatory requirement is intended to ensure that WAS/RLAN equipment does not use a frequency band in countries where operation is not authorised by the competent national administration.

The ECC has agreed to develop least restrictive harmonised technical conditions for WBB ECS in the 6425 – 7125 MHz band in response to Task 3 of the EC mandate on upper 6 GHz.

The work will focus in particular on the development of a harmonised frequency arrangement and technical conditions for WBB ECS deployment in the 6585–7125 MHz band, including the development of an ECC Decision on harmonised technical conditions for WBB ECS in that range.

In addition, the ECC agreed to initiate further technical studies on the potential introduction of WBB ECS in 6425–6585 MHz.

In addition, studies will be initiated concerning potential WAS/RLAN use, including investigations in the 6425 – 6585 MHz frequency band, and work towards harmonised conditions for non-prioritised WAS/RLAN operation on a voluntary basis in 6585–7125 MHz.

Finally, in the context of the broader discussions on the future use of the upper 6 GHz range, the ECC agreed to launch exploratory studies on possible WBB ECS deployment in the 7125–7250 MHz band.

The developed harmonised technical conditions will be subject to review following WRC-27 to incorporate the results of WRC-27 and the RSPG position regarding the 6425-6585 MHz band and the 7125-7250 MHz band.

ANNEX 1: CEPT MANDATE

Ref. Ares(2024)8891662 - 12/12/2024

EUROPEAN COMMISSION
Communications Networks Content & Technology Directorate-General
Digital Decade and Connectivity
Radio Spectrum Policy

MANDATE TO THE CEPT
TO STUDY FEASIBILITY OF AND DEVELOP LEAST RESTRICTIVE HARMONISED TECHNICAL CONDITIONS FOR THE POTENTIAL SHARED USE OF THE 6425-7125 MHZ FREQUENCY BAND FOR THE PROVISION OF WIRELESS BROADBAND BY TERRESTRIAL SYSTEMS CAPABLE OF PROVIDING WIRELESS BROADBAND ELECTRONIC COMMUNICATIONS SERVICES AND BY WIRELESS ACCESS SYSTEMS, INCLUDING RADIO LOCAL AREA NETWORKS

1. PURPOSE

The objective of this Mandate is to study feasibility of and develop harmonised technical conditions for the efficient use on a shared basis of the 6425-7125 MHz ('upper 6 GHz') frequency band for the most recent and future technologies for terrestrial systems capable of providing wireless broadband (WBB) electronic communications services (ECS) and for wireless access systems including radio local area networks (WAS/RLANs). Provided that at least one preferred usage scenario for the shared use of the upper 6 GHz band by WBB ECS and WAS/RLANs (hereafter 'the two systems' or 'both systems') is deemed feasible, which also addresses their coexistence with, and the evolution and development of, relevant[1] incumbent systems within this band and in the adjacent frequency bands, the corresponding harmonised technical conditions should be developed for the implementation of that / those scenario(s). If shared use does not prove to be feasible, harmonised technical conditions should be developed for an alternative recommended scenario for the usage of the band (or portions thereof) by both or one of the two systems. Within the scope of studies of this Mandate, terrestrial systems capable of providing WBB ECS and WAS/RLANs should be treated equally and without any prior constraints or order of preference.

2 BACKGROUND

The upper 6 GHz band, in accordance with the ITU Radio Regulations (RR) and the European Table of frequency allocations and applications in the frequency range 8.3 kHz to 3 000 GHz (the ECA Table in the ERC Report 25 (as revised)[2]), includes primary allocations to the Mobile Service, Fixed Service and Fixed Satellite Service in the ITU Region 1, which includes the European Union. According to the ECA Table, the upper 6 GHz band is also allocated on a secondary basis to the Earth Exploration-Satellite Service (EESS) (passive).

[1] "Relevant" denotes incumbent services/applications with long-term usage perspective and coexistence requirements, in line with the international and EU-level regulatory framework (e.g. FSS, FS, EESS (passive), RAS).

[2] ERC Report 25 available at https://docdb.cept.org/document/593, EFIS database at https://efis.cept.org

Radio applications in this band (or portions thereof) include Fixed Service systems (point-to- point links), Fixed Satellite Service (FSS) (Earth-to-space and space-to-Earth), Passive Sensors (on satellites), Radio Astronomy stations, Short-Range Devices (SRD – radio determination), Programme Making and Special Events (PMSE) and Ultra-Wideband (UWB) applications.

The ITU RR recognize the use of this band (or portions thereof) by the Radio Astronomy Service (RAS), through the RR No. 5.149 urging administrations to "take all practicable steps to protect the RAS from harmful interference" in the 6650-6675.2 MHz frequency band. This is also echoed in Resolution 220[3] (WRC-23), which invites administrations to take all practical steps to protect the RAS from harmful interference in the frequency band 6650-6675.2 MHz, which covers spectral lines of importance for current astronomical investigations, in accordance with RR No. 5.149 and by the EESS (passive), through the RR No. 5.458 stating that "Administrations should bear in mind the needs of the Earth exploration-satellite (passive) and space research (passive) services in their future planning of the frequency bands 6425-7075 MHz and 7075-7250 MHz". However, adequate protection of these services should be studied in response to this mandate despite the fact that ITU RR do not provide any allocation and any rights to these usages as recognised by the Radio Regulation Board.

The WRC-23 amended the ITU RR by identifying, through the new footnote No 5.457E[4], the upper 6 GHz band in ITU Region 1 for the terrestrial component of IMT[5]. This identification does not preclude the use of this frequency band by any application of the radio services to which it is allocated and does not establish priority in the RR. Relevant technical conditions have been defined in ITU-R Resolution[6] 220 (WRC-23), in particular in terms of an expected e.i.r.p. mask for IMT for the protection of FSS, which is of international importance.

The aforementioned footnote 5.457E additionally states that the upper 6 GHz band is also used for the implementation of wireless access systems including radio local area networks. This leaves full flexibility for a sovereign decision to be taken at the EU level regarding the most appropriate option(s) of using this frequency band to achieve the EU Digital Decade connectivity targets. In this regard, its potential shared use for the implementation of both WBB ECS and WAS/RLAN systems should become the initial priority of studies under this Mandate.

Furthermore, the WRC-23 decided (Resolution 674) on studies for the WRC-27 on (a) the possible new global primary allocations to the EESS (passive) performing sea surface temperature (SST) measurements within the frequency bands 4.2-4.4 GHz and 8.4-8.5 GHz, without protection from existing services in these bands and in adjacent bands, in order to determine some complementary[7] bands to the upper 6 GHz band, where they currently operate, and (b) technical, operational and regulatory issues as well as on sharing and compatibility with incumbent uses, pertaining to the possible use of the terrestrial component of IMT in the adjacent 7125-7250 MHz frequency band in all ITU Regions, which offers a potential extension of the upper 6 GHz band for wireless broadband (WBB ECS) use. The 7750-8400 MHz

[3] Final Acts (WRC-23), Resolution 220 at https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.16-2024-PDF-E.pdf

[4] Final Acts (WRC-23), Agenda item 1.2, footnote 5.457E at https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.16-2024-PDF-E.pdf

[5] IMT stands for 'International Mobile Telecommunications', including 5G and beyond.

[6] https://www.itu.int/pub/R-RES

[7] The use of complementary bands for SST measurements might improve radio-frequency interference mitigation.

frequency band will also be studied for possible IMT identification for the WRC-27. In this regard, the EU took a negative position at WRC-23 on identifying spectrum for IMT in the 7-8 GHz frequency range due to strategic military use and other satellite and scientific usages.

The RSPG Opinion[8] on the ITU-R WRC-23 recommends that the Commission explicitly clarifies the EU's intention to consider, by 2024 or later, the best usage of the frequency band 6425-7125 MHz for WBB in the future: either IMT, or WAS/RLANs or a shared framework between IMT and WAS/RLANs, possibly depending on the portion of this frequency band, noting that an IMT identification does not exclude other use of the band, for example a shared future use between IMT and WAS/RLANs or WAS/RLANs alone.

In total, 1018.5 MHz of mid-band spectrum is harmonised at the EU level for WAS/RLANs by means of Commission Decisions 2006/771/EC[9] on short-range devices regarding the 2.4 GHz band [2400-2483.5 MHz], (EU) 2022/179[10] regarding the 5 GHz band [5150-5350 MHz and 5470-5725 MHz], and (EU) 2021/1067[11] regarding the lower part of the 6 GHz band [5945- 6425 MHz]. The Article 3 of the latter Decision stipulates that Member States shall not adopt technical and operational conditions applicable to any new application that unduly restrict the continued use of WAS/RLAN in the 5945-6425 MHz frequency band when introducing new applications into the 5945-6425 MHz frequency band or into adjacent frequency bands after the entry into force of that Decision. The current EU-harmonised mid-band spectrum for WAS/RLANs allows the use of up to five 160 MHz channels[12], and one 320 MHz channel can be used by Wi-Fi 7, the latest generation[13] of Wi-Fi technology. The operation of WAS/RLAN systems in the 2.4 GHz and 5 GHz bands is subject to general authorisation only, pursuant to Commission Recommendation 2003/203/EC[14].

The existing regulatory framework for WAS/RLAN systems using the 2.4 GHz, 5 GHz and the lower 6 GHz frequency bands has led to a progressive take-up of WAS/RLAN usage within the internal market, which is based on the availability of a nearly-globally harmonised spectrum resource that fosters large economies of scale for chipset and equipment manufacturers. WAS/RLAN access points provide licence-exempt WBB access for private and commercial use and form a vital connectivity infrastructure bridging gigabit connections for the benefit of all types of end-users, as well as allowing for public hotspot access which, together with WBB

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[8] https://radio-spectrum-policy-group.ec.europa.eu/document/download/61378c81-1e03-45a6-aa49-6190809ee3ed_en?filename=RSPG22-040final-RSPG_Final_Opinion_on_WRC23.pdf

[9] Commission Decision 2006/771/EC of 9 November 2006 on harmonisation of the radio spectrum for use by short-range devices (OJ L 312, 11.11.2006, p. 66), as last amended by Commission Implementing Decision (EU) 2022/180.

[10] Commission Implementing Decision (EU) 2022/179 of 8 February 2022 on the harmonised use of radio spectrum in the 5 GHz frequency band for the implementation of wireless access systems including radio local area networks and repealing Decision 2005/513/EC (OJ L 29, 10.2.2022, p. 10), as amended by Commission Implementing Decision (EU) 2022/2307.

[11] Commission Implementing Decision (EU) 2021/1067 of 17 June 2021 on the harmonised use of radio spectrum in the 5945-6425 MHz frequency band for the implementation of wireless access systems including radio local area networks (WAS/RLANs) (OJ L 232, 30.6.2021, p. 1).

[12] The availability of 160 MHz channels may be limited in some regions across the Union, as it is subject to ensuring coexistence with other uses, such as radars, in particular in the 5 GHz frequency band.

[13] Basic information about Wi-Fi 7 is available at https://www.wi-fi.org/discover-wi-fi/wi-fi-certified-7

[14] Commission Recommendation of 20 March 2003 on the harmonisation of the provision of public R-LAN access to public electronic communications networks and services in the Community (OJ L 78, 25.3.2003, p. 12).

ECS provided by mobile networks, is important in order to achieve the EU Digital Decade connectivity targets.

Pursuant to Article 3 of the RSPP, regarding the policy objective of identifying a suitable portion of spectrum to best meet the increasing demand for WBB ECS, as well as the respective spectrum requirements set out by the EU 5G Action Plan[15], an ambitious 5G spectrum roadmap has already been fulfilled. In addition to the EU-harmonised millimetre-wave frequency bands (both the 26 GHz and the 42 GHz frequency bands), it comprises in total 1160 MHz of low/mid- band spectrum[16], harmonised at the EU level for terrestrial systems capable of providing WBB ECS by Decisions (EU) 2016/687 [694-790 MHz][17], 2010/267/EU [790-862 MHz][18], (EU) 2022/173 [880-915/925-960 MHz and 1710-1785/1805-1880 MHz][19], (EU) 2015/750 [1427-1517 MHz][20], 2012/688/EU [1920-1980 MHz and 2110-2170 MHz][21], 2008/477/EC [2.5-2.69 GHz][22], and 2008/411/EC [3.4-3.8 GHz][23].

The policy initiatives at the EU level and the existing regulatory framework for WBB ECS have led to the progressive take-up of 5G within the internal market, triggering investments to the benefit of the EU economy and the citizens.

Under its Work Programme[24] for 2024 and beyond, the RSPG intends to adopt in February 2025 a Report/Opinion on a 6G strategic vision, including the evaluation of coverage and capacity needs for 6G use cases and usage scenarios. Subsequently, the RSPG also intends to develop a 6G spectrum roadmap. In the context of this Work Programme and further to a request

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15 https://digital-strategy.ec.europa.eu/en/library/communication-5g-europe-action-plan-and-accompanying-staff-working-document

16 For the purpose of this Mandate, low-band spectrum is spectrum below 1 GHz, while mid-band spectrum is spectrum from 1 GHz to 7 GHz.

17 Commission Implementing Decision (EU) 2016/687 of 28 April 2016 on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union (OJ L 118, 4.5.2016, p. 4).

18 Commission Decision 2010/267/EU of 6 May 2010 on harmonised technical conditions of use in the 790-862 MHz frequency band for terrestrial systems capable of providing electronic communications services in the European Union (OJ L 117, 11.5.2010, p. 95).

19 Commission Implementing Decision (EU) 2022/173 of 7 February 2022 on the harmonisation of the 900 MHz and 1 800 MHz frequency bands for terrestrial systems capable of providing electronic communications services in the Union and repealing Decision 2009/766/EC (OJ L 28, 9.2.2022, p. 29).

20 Commission Implementing Decision (EU) 2015/750 of 8 May 2015 on the harmonisation of the 1427-1517 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union (OJ L 119, 12.5.2015, p. 27), as amended by Commission Implementing Decision (EU) 2018/661.

21 Commission Implementing Decision 2012/688/EU of 5 November 2012 on the harmonisation of the frequency bands 1920-1980 MHz and 2110-2170 MHz for terrestrial systems capable of providing electronic communications services in the Union (OJ L 307, 7.11.2012, p. 84), as amended by Commission Implementing Decision (EU) 2020/667.

22 Commission Decision 2008/477/EC of 13 June 2008 on the harmonisation of the 2500-2690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community (OJ L 163, 24.6.2008, p. 37), as amended by Commission Implementing Decision (EU) 2020/636.

23 Commission Decision 2008/411/EC of 21 May 2008 on the harmonisation of the 3400-3800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community (OJ L 144, 4.6.2008, p. 77), as last amended by Commission Implementing Decision (EU) 2019/235.

24 https://radio-spectrum-policy-group.ec.europa.eu/document/download/d4e46670-313b-4bac-8d8d-760d92f4649b_en?filename=RSPG24-008final-RSPG_WP24_and_beyond_0.pdf

from the European Commission, an RSPG Opinion on a long-term vision for the upper 6 GHz band, which is planned for adoption in June 2025, should build a long-term vision for the upper 6 GHz band by providing policy recommendations on how to best organise the future use of this band in Europe.

Additional spectrum in the mid-bands for both, terrestrial systems capable of providing WBB ECS and WAS/RLANs, needs to be considered to enable their future evolution. Mid-band spectrum represents a good balance between coverage and capacity, notably providing a good compromise between the propagation characteristics of lower bands and the capacity of higher bands. Due to this balanced performance of mid-band spectrum, there are challenges related to its scarcity. Making available additional spectrum resources on a shared basis, taking into consideration the EU Digital Decade connectivity targets, for licence-exempt WAS/RLANs and licensed terrestrial systems capable of providing WBB ECS could generate additional socio-economic benefits, under the condition that the protection and the future evolution and development of relevant[1] incumbent spectrum users in this band, as well as the coexistence with spectrum users in the adjacent bands, is ensured. In this context, harmonised standards to be developed by the European Telecommunications Standards Institute (ETSI) should be consistent with the developed harmonised technical conditions for the future harmonised use of the band and include operational conditions for WAS/RLANs and terrestrial systems capable of providing WBB ECS in order to enable their coexistence with existing systems in the upper 6 GHz band and in the adjacent bands.

3. JUSTIFICATION

Pursuant to Article 4(2) of the Radio Spectrum Decision[25], the Commission shall issue mandates to the CEPT for the development of technical implementing measures with a view to ensuring harmonised conditions for the availability and efficient use of radio spectrum necessary for the functioning of the internal market. Such mandates shall set the tasks to be performed and their timetable.

Pursuant to Article 6(1) of the Radio Spectrum Policy Programme (RSPP)[26], Member States shall, in cooperation with the Commission, ensure the availability of sufficient spectrum for coverage and capacity purposes within the Union, in order to enable the Union to have the fastest broadband speeds in the world, thereby making it possible for wireless applications and European leadership in new services to contribute effectively to economic growth. Under Article 6(7) of the RSPP, the Commission shall, in cooperation with Member States, assess the justification and feasibility of extending the allocations of unlicensed spectrum for wireless access systems, including radio local area networks.

The Digital Decade Policy Programme 2030[27] (DDPP) sets out digital connectivity targets for 2030, including for the deployment of networks with gigabit speeds and highlights the

[25] Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community (Radio Spectrum Decision) (OJ L 108, 24.4.2002, p. 1).

[26] Decision No 243/2012/EU of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy programme (OJ L 81, 21.3.2012, p. 7).

[27] Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030 (OJ L 323, 19.12.2022, p. 4).

importance of connectivity infrastructure. All end users at a fixed location should be covered by a gigabit network up to the network termination point and all populated areas should be covered by a next-generation wireless high-speed network with performance at least equivalent to that of 5G. In the context of technology neutrality, which is a guiding principle for digital connectivity infrastructure of the highest performance, resilience, security and sustainability, different types of communications technologies can contribute to the achievement of gigabit connectivity. These include the current and upcoming generations of fibre, satellite, WBB ECS, WAS/RLANs or other systems to be developed in the future, whereby such technologies should be treated equally and without prior constraints regarding their deployment and performance characteristics. Taking into account the Commission Recommendation 2003/203/EC, which refers to WAS/RLANs in the 2.4 GHz and 5 GHz bands, this Mandate should be carried out on the assumption that also WAS/RLANs in the upper 6 GHz band can operate on the basis of a general authorisation only.

In view of the digital connectivity targets as part of the DDPP and considering the increasing amount of data traffic carried through fixed and mobile networks, the European Commission considers the availability of sufficient frequency resource for both systems to be key for the provision of WBB services in the Union. The resulting spectrum should notably support sufficiently wide radio channels required for many applications (including videoconferencing, downloading media, telemedicine, online learning and gaming, holographic communication, augmented reality and virtual reality).

A shared-use case should ensure efficient use of spectrum and proportionate technical impact on both systems, as well as adequate protection of the relevant[1] incumbent radiocommunication services and applications. It will therefore be necessary to carry out the appropriate technical studies and identify suitable compatibility and coexistence conditions to frame the optimum shared use scenario(s) of the upper 6 GHz band by both systems and, at the same time, to ensure, the continuity of the current operation and the future evolution and development of all relevant[1] radiocommunication services and applications currently using this band as well as the adjacent bands.

The CEPT deliverables in response to this Mandate should be considered in the context of the evolving RSPG work items dealing with the long-term vision for the upper 6 GHz band and the 6G strategic vision.

The CEPT should work in cooperation with the ETSI, taking into account the need for consistency between future harmonised standards and the harmonised technical conditions resulting from this Mandate. In order to effectively achieve the harmonisation of additional spectrum for terrestrial systems capable of providing WBB ECS and WAS/RLANs that would strengthen the economies of scale for chipset and equipment manufacturers and thereby benefit all end-users, the work carried out under this Mandate should take into account, as appropriate, the developments outside Europe for both systems.

4. TASK ORDER AND SCHEDULE

This Mandate addresses feasibility, sharing, coexistence and compatibility studies for the introduction of terrestrial systems capable of providing WBB ECS and WAS/RLANs in the 6425-7125 MHz frequency band, while giving due account to existing uses (and their evolution and development) in the 6425-7125 MHz band and in the adjacent bands, including at the EU's

external border, and the development of harmonised technical conditions based on a preferred (sharing) scenario.

The CEPT is hereby mandated to carry out the following tasks:

Task 1 – Study and assessment of coexistence and compatibility of (i) terrestrial systems capable of providing WBB ECS with incumbent spectrum users and (ii) WAS/RLANs with incumbent spectrum users

To study and assess compatibility and coexistence scenarios both for (i) terrestrial systems capable of providing WBB ECS and (ii) WAS/RLANs, with identified existing usages in the 6425-7125 MHz frequency band and their potential evolution, and identify coexistence parameters and conditions to be implemented in the regulatory framework in order to enable such possible coexistence, without constraining relevant[1] incumbent users in various Member States within and adjacent to the 6425-7125 MHz band, including at the EU's external border.

For each compatibility/coexistence scenario, the risk of interference, the deployment assumptions of relevant applications, the geographical extent of usage and any consequential restrictions in deployment of those two systems should be identified as well as requirements for implementing such scenarios, for instance in terms of harmonised least restrictive technical conditions or in terms of other regulatory and operational aspects which support the implementation of a coexistence framework.

This task should also consider available conclusions for coexistence with incumbent radiocommunication services, such as the outcomes of the WRC-23 and technical studies performed by the CEPT and the ITU-R.

Task 2 – Study of feasibility and scenarios for the potential shared use between terrestrial systems capable of providing WBB ECS and WAS/RLANs

Taking into account the results from Task 1 and the outcome of the RSPG work concerning the long-term vision for the upper 6 GHz band, as appropriate, to identify and assess the technical feasibility of possible scenarios for the shared use[28] of the 6425-7125 MHz frequency band for both (i) terrestrial systems capable of providing WBB ECS and (ii) WAS/RLANs. In this regard, seek to determine sharing solutions which:

- ensure efficient spectrum use and proportionate technical impact on both systems, subject to due assessment;
- provide a greater overall benefit for the case of both systems sharing the upper 6 GHz band, than the case, where each of them uses an exclusively allocated portion of this band; the assessment should also consider any need for new technical standards to implement the shared solution;

[28] The notion of "shared use" for the purpose of this Mandate should at least include the simultaneous use of the upper 6 GHz band, or portions thereof, by both systems in the same geographical area.

- ensure the protection of relevant[1] incumbent users within and adjacent to the 6425-7125 MHz band and their future evolution and development.

At least one preferred shared-use scenario should be identified in the outcome of Task 2, which must serve as the basis for performing Task 3.

If no preferred shared-use scenario can be identified, the CEPT must propose a preferred alternative scenario. This preferred alternative scenario must serve as the basis for performing Task 3, for the usage of the band (or portions thereof), preferably by both systems or by one of the two systems.

In determining any preferred scenario(s) under this Task, the CEPT shall take due account of the RSPG Opinion on the upper 6 GHz band[29].

Task 3 – Development of harmonised technical conditions

Taking into account the results of Tasks 1 and 2, and based either on the preferred scenario(s) for the shared use of the 6425-7125 MHz frequency band or the alternative usage scenario identified in Task 2, to develop a harmonised frequency arrangement and the least restrictive harmonised technical conditions for that/those scenario(s). The harmonised technical conditions should, in particular, avoid interference, protect and, enable the future evolution and development of relevant[1] incumbent users within the 6425-7125 MHz frequency band and in the adjacent bands, and facilitate cross-border frequency coordination.

In the work carried out under this Mandate, the overall policy objectives of the RSPP and digital connectivity targets (as part of the DDPP) shall be given utmost consideration. In implementing this Mandate, the CEPT shall, whenever relevant, take utmost account of EU law applicable and support the principles of service and technological neutrality, non-discrimination and proportionality insofar as technically possible.

The CEPT is requested to collaborate actively with all concerned stakeholders, including the RSPG and ETSI, which develops relevant harmonised standards for the presumption of conformity under Directive 2014/53/EU[30]. The CEPT is requested to take into account the results of the RSPG work on the upper 6 GHz band to the extent relevant to this Mandate.

The CEPT should provide deliverables according to the following schedule:

Delivery date	**Deliverable**	**Subject**
November 2025	Draft Report A[31] from the CEPT to the Commission and Progress report on Task (2)	Draft results under Task (1) of this Mandate.

[29] Or the draft Opinion for public consultation, as appropriate.

[30] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC (OJ L 153, 22.5.2014, p. 62).

[31] Subject to a public consultation

Delivery date	Deliverable	Subject
March 2026	Final Report A from the CEPT to the Commission taking into account the outcome of the public consultation	Final results under Task (1) of this Mandate.
March (or July[32]) 2026	Draft Report B[33] from the CEPT to the Commission	Draft results under Task (2) of this Mandate.
July (or November[34]) 2026	Final Report B from the CEPT to the Commission taking into account the outcome of the public consultation	Final results under Task (2) of this Mandate.
March 2027	Draft Report C[35] from the CEPT to the Commission	Draft results under Task (3) of this Mandate.
July 2027	Final Report C from the CEPT to the Commission taking into account the outcome of the public consultation	Final results under Task (3) of this Mandate.

In addition, the CEPT is requested to report on the progress of its work pursuant to this Mandate to all meetings of the Radio Spectrum Committee taking place during the course of this Mandate.

The Commission, with the assistance of the Radio Spectrum Committee and pursuant to the Radio Spectrum Decision, may consider applying the results of this Mandate in the EU, pursuant to Article 4 of the Radio Spectrum Decision.

[32] Depending on the adoption date of the RSPG Opinion on the upper 6 GHz band.

[33] Subject to a public consultation.

[34] Depending on the preceding deadline regarding the adoption of the draft Report B.

[35] Subject to a public consultation.

Electronically signed on 12/12/2024 10:41 (UTC+01) in accordance with Article 11 of Commission Decision (EU) 2021/2121

ANNEX 2: LIST OF REFERENCES

[1] ECC Report 366: “Feasibility of a potential shared use of the 6425-7125 MHz frequency band between Mobile/Fixed Communications Networks (WBB ECS) and Wireless Access Systems including Radio Local Area Networks (WAS/RLAN)”, approved June 2025

[2] RSPG Opinion: “RSPG Opinion on Long-term vision for the upper 6 GHz band”, approved in November 2025, available here

[3] ECC Report 236: “Guidance for national implementation of a regulatory framework for TV White Space Devices (WSD) using geo-location databases”, approved May 2015

[4] ETSI EN 301 598: “TV White Space Devices (TVWSD); Wireless Access Systems operating in the TV broadcast band; Harmonised Standard for access to radio spectrum”

[5] Decision (EU) 2021/1067: “Commission implementing Decision (EU) 2021/1067 of 17 June 2021 on the harmonised use of radio spectrum in the 5945-6425 MHz frequency band for the implementation of wireless access systems including radio local area networks (WAS/RLANs)”