CEPT Report 92

Report from CEPT to the European Commission in response to the Mandate to study feasibility of and develop least restrictive harmonized technical conditions for the potential shared use of the 6425-7125 MHz frequency band for the provision of WBB ECS and by WAS/RLAN

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

Report approved on 26 June 2026 by the ECC

0 EXECUTIVE SUMMARY

This Report responds to Task 1 of the European Commission Mandate to assess the coexistence and compatibility of wireless broadband electronic communications services (WBB ECS) and wireless access systems including radio local area networks (WAS/RLAN) with incumbent services and applications in the 6425-7125 MHz band and adjacent bands and their potential evolution.

These services and applications include the fixed service (FS), fixed satellite service (FSS) (Earth-to-space and space-to-Earth), radio astronomy service (RAS), earth exploration satellite service (EESS-passive), programme making and special events (PMSE), and ultra-wideband (UWB). The report also considers WAS/RLAN operation in the lower 6 GHz band (5945-6425 MHz) and other adjacent services such as space research service (SRS) and EESS TT&C.

The studies assumed a channel bandwidth of 100 MHz for WBB ECS operation and channel bandwidths of 20 to 320 MHz for WAS/RLAN operation. In WBB ECS coexistence studies, only ETSI power class 3 UEs (maximum transmit power of 23 dBm) were considered, noting that no study considered fixed type UE (i.e. FWA CPE). In WAS/RLAN coexistence studies, only LPI and VLP devices (maximum transmit power of 23 and 14 dBm, respectively) were considered, noting that no study considered higher power WAS/RLAN devices.

Studies for the frequency range 6425-7125 MHz

For the fixed service:

- Co-channel sharing between WBB ECS and FS could only be feasible through site-specific coordination between WBB ECS and FS systems, although it may represent challenges for widespread WBB ECS and FS deployments (potentially limiting their evolution and flexibility). Depending on the assumptions, studies indicate geographical separation distances ranging from 42 km to 321 km in the main beam of the FS receiver antenna and from 2 km to 56 km outside of the main beam of the FS receiver antenna. These distances can be reduced by applying some technical measures during the coordination;
- co-channel sharing with WAS/RLAN is feasible by applying some technical conditions to restrict the operation of LPI devices to indoor environments.

For the fixed satellite service (Earth-to-space):

- CEPT did not perform technical studies of coexistence with WBB ECS considering that the outcome of WRC-23 (see Resolution 220 (WRC-23), considering (d) and resolves (2)), which specifies expected e.i.r.p. masks for WBB ECS BS, applies in order to protect FSS in the Earth-to-space direction;
- co-channel sharing with WAS/RLAN is feasible when operation of LPI devices is restricted to indoor environments.

For the fixed satellite service (space-to-Earth):

- the co-channel sharing with WBB ECS would be feasible when site-specific coordination is applied. According to studies, geographical coordination distances of 12 km to 30 km may be required depending on terrain, clutter and orbital parameters;
- co-channel sharing with WAS/RLAN is feasible. Site-specific studies of four ground stations in Europe confirm that WAS/RLAN can coexist with FSS downlinks under the High deployment Scenario A of ECC Report 364, with all stations meeting the I/N ≤ −10.5 dB protection criterion.

For the earth exploration satellite service (Passive), sea surface temperature (SST) measurements:

- CEPT did not consider technical studies of coexistence with WBB ECS nor WAS/RLAN.

For the radio astronomy service:

- The coexistence with WBB/ECS could be feasible when site-specific coordination is applied. Depending on the assumptions (e.g. terrain, weather dependant propagation conditions, clutter), studies indicated that geographical separation distances ranging from 60 km to 220 km or 130 km to 380 km will be needed for the in-band case. For the adjacent channel and spurious domain cases, the resulting maximum geographical separation distances were 100 km and 25 km, respectively;
- co-channel sharing with WAS/RLAN is feasible and requires mitigation techniques or exclusion from the 6650-6675.2 MHz band.

For Video PMSE applications:

- This application operates under a national individual licensing regime. Coexistence with WBB ECS or WAS/RLAN was not assessed in the technical studies, but it is expected to be manageable at a national level (through local coordination).

For ultra-wideband applications:

- The operation of WBB ECS will cause degradation to the UWB end user experience for the devices operating outdoors. UWB operates under a general authorisation regime and on a non-interference, non-protected basis;
- The compatibility with WAS/RLAN has not been assessed under this EC Mandate since it was studied in ECC Report 302 [2] (see also CEPT Report 73 [14]).

Studies for adjacent bands to the frequency range 6425-7125 MHz

For WAS/RLAN in the 5945-6425 MHz frequency band:

- Depending on the assumptions and methodologies used, the study results indicated a range of different probabilities of interference from WBB ECS into WAS/RLAN in the adjacent band, both with and without frequency separation. ECC Report 375 did not reach a conclusion on whether frequency separation was needed.

No assessment was made for other adjacent services/applications (e.g. EESS, SRS, space operation, PMSE and UWB) as compatibility issues are not expected and/or due to the regulatory status of the relevant application.

TABLE OF CONTENTS

0 EXECUTIVE SUMMARY 2

1 INTRODUCTION 7

2 EXISTING USAGES AND THEIR POTENTIAL EVOLUTION 8
2.1 Frequency Range 6425-7125 MHz 8
2.1.1 Fixed service (FS) 8
2.1.2 Fixed-satellite service (FSS) (Earth-to-space) 8
2.1.3 Fixed-satellite service (FSS) (space-to-Earth) 8
2.1.4 Radio astronomy (RAS) 8
2.1.5 Earth exploration satellite service (passive) sea surface temperature (SST) measurements 9
2.1.6 Programme making and special events (PMSE) 9
2.1.7 Ultra-wideband (UWB) 9
2.2 Adjacent Bands to the frequency range 6425-7125 MHz 9
2.2.1 Fixed service 9
2.2.2 Wireless access systems / radio local area network (WAS/RLAN) 10
2.2.3 Earth exploration satellite service (EESS) 10
2.2.4 Space research service (Earth-to-space) 10
2.2.5 Video programme making and special events (Video PMSE) 10
2.2.6 Ultra-wideband (UWB) 10

3 ASSESSMENT ON COMPATIBILITY AND COEXISTENCE OF WIRELESS BROADBAND ELECTRONIC COMMUNICATIONS SERVICE (WBB ECS) IN 6425-7125 MHZ WITH SERVICES AND APPLICATIONS IN BAND AND ADJACENT BANDS 11
3.1 Conclusions of ECC Report 375 11
3.1.1 Sharing between WBB ECS and FS 11
3.1.2 Sharing and compatibility between WBB ECS and RAS 13
3.1.3 Adjacent band coexistence between WBB ECS and WAS/RLAN 14
3.1.4 Sharing between WBB ECS and non-GSO FSS downlink 16
3.1.5 Sharing between WBB ECS and UWB 17
3.1.6 Sharing between WBB ECS and Fixed satellite service (FSS) (Earth-to-space) 17
3.1.7 Observations on WBB ECS BS antenna location 17
3.2 Other Studies and considerations 17
3.2.1 Fixed-satellite service (FSS) (Earth-to-space) 17
3.2.2 Radio astronomy (RAS) 17
3.2.3 WAS/RLAN in the adjacent band 18
3.2.4 Relevant ITU-R Reports and Recommendations in response to Resolution 220 (WRC-23) 18

4 ASSESSMENT ON COMPATIBILITY AND COEXISTENCE OF WIRELESS ACCESS SYSTEMS AND RADIO LOCAL AREA NETWORKS (WAS/RLAN) IN 6425-7125 MHZ WITH SERVICES AND APPLICATIONS IN BAND AND ADJACENT BANDS 19
4.1 WAS/RLAN considered use cases and scenario of deployment 19
4.2 Assessment on compatibility and coexistence OF WAS/RLAN with services and applications in band 19
4.2.1 Sharing between WAS/RLAN and Fixed service (FS) 19
4.2.2 Sharing between WAS/RLAN and fixed-satellite service (Earth-to-space) 20
4.2.3 Sharing between WAS/RLAN and fixed-satellite service (space-to-Earth) 21
4.2.4 Sharing between WAS/RLAN and radio astronomy service (RAS) 21

5 CONCLUSIONS 22

ANNEX 1: CEPT MANDATE 24

ANNEX 2: LIST OF REFERENCES 33

LIST OF ABBREVIATIONS

Abbreviation	Explanation
ACLR	Adjacent channel leakage ratio
ACS	Adjacent channel selectivity
AP	Access point
BS	Base station
CDC	Country determination capability
CEPT	European Conference of Postal and Telecommunications Administrations
DSCF	Dynamic spectrum coordination function
ECC	Electronic Communications Committee
ECS	Electronic communications services
ECP	European common proposal
EESS	Earth exploration satellite service
e.i.r.p.	Effective isotropic radiated power
EN	European standards (German: Europäische Norm)
ETSI	European Telecommunications Standards Institute
EU	European Union
FDP	Fractional degradation in performance
FM	Frequency modulation
FS	Fixed service
FSS	Fixed-satellite service
GSO	Geostationary orbit
IEEE	Institute for Electrical and Electronics Engineers
IMT	International mobile telecommunications
I/N	Interference to noise ratio
ITU-R	International Telecommunications Union for Radiocommunications
LEO	Low Earth orbit
LPI	Low power indoor
MCL	Minimum coupling loss
MEO	Medium Earth orbit
MSS	Mobile-satellite service
PMSE	Programme making and special event
PPDR	Public protection and disaster relief
RAS	Radio astronomy service
RLAN	Radio local area networks

Abbreviation	Explanation
RR	Radio Regulations
SEM	Spectrum emission mask
SST	Sea surface temperatures
STA	Station (WAS/RLAN client device)
TT&C	Tracking, telemetry and control
UE	User equipment
UWB	Ultra-wideband
VLP	Very low power
VLBI	Very long baseline interferometry
WAS/RLAN	Wireless access systems including radio local area networks
WBB	Wireless broadband
WBB ECS	Wireless broadband electronic communications services
WRC	World Radiocommunications Conference

1 INTRODUCTION

The European Commission issued a mandate (ANNEX 1) to CEPT to study the 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 electronic communications services (WBB ECS) and by wireless access systems including radio local area networks (WAS/RLAN).

The mandate consists of three Tasks and this CEPT Report is the response to 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 enable future evolution of terrestrial systems capable of providing WBB ECS and WAS/RLANs, additional spectrum in the mid-bands is considered for both applications. In the framework of Task 1, this CEPT Report presents the outcomes of studies and assessments of compatibility and coexistence scenarios both for (i) terrestrial systems capable of providing WBB ECS and (ii) WAS/RLAN with identified existing uses in 6425-7125 MHz and with existing WAS/RLAN in 5925-6425 MHz, and their potential evolution. The identification of coexistence parameters and conditions to be implemented in the regulatory framework in order to enable coexistence, without constraining relevant incumbent users in various Member States within and adjacent to the 6425-7125 MHz band, including at the EU's external border, is presented.

This Report is based on the results of ECC Report 375 [1] on the coexistence of WBB ECS with incumbent spectrum users, and ECC Report 364 [5] on the coexistence of WAS/RLANs with incumbent spectrum users, and also considers other 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.

2 EXISTING USAGES AND THEIR POTENTIAL EVOLUTION

2.1 FREQUENCY RANGE 6425-7125 MHZ

2.1.1 Fixed service (FS)

Fixed service (FS) is a primary user of the frequency band in Europe.

The situation in CEPT countries (including among EU Member States) differs significantly both in their current use and regarding the possible future developments of the fixed service in this band. Some countries consider the FS links will remain important in the future for applications such as long-distance fixed links including for mobile backhaul, public protection and disaster relief (PPDR) networks and feeder links for FM Radio stations and digital terrestrial television stations. Other countries have reported a continued decline in the need for these FS links, driven by the transition from radio links to alternative technologies such as fibre, or by the migration of FS links to other frequency bands.

According to data provided for the last update of the ECC Report 173 [3], approved in June 2023, 20 European countries (including 16 EU Member States) operate a total of 12554 links within the 6425-7125 MHz frequency range. The situation varies largely from country to country in the number, location, and usage of fixed links. Six countries have 1000 links or more in the band. In contrast, a number of countries have a limited number of fixed links in the upper 6 GHz range, with one country reporting a complete lack thereof. Current FS usage in 6425-7125 MHz is a mixture of rural and urban deployment within CEPT countries, with some of the links belonging to critical infrastructure.

2.1.2 Fixed-satellite service (FSS) (Earth-to-space)

Fixed satellite service FSS (Earth-to-space) operates as primary service in the 6425-7075 MHz frequency band. A selection of satellites has been taken as representative of those requiring protection in the portion of the geostationary orbit visible from Europe. In these frequency bands, the satellite beams cover very large areas of the Earth (using global, hemispherical, zonal or regional beams).

It should be noted that the band 6425-7075 MHz is widely used by FSS satellite networks worldwide and therefore the protection of this service should be in line with the relevant international regulatory framework. Most satellites and earth stations operating in the satellite “C-band” over Europe use the core uplink FSS band 5925-6425 MHz paired with the downlink band 3700-4200 MHz.

2.1.3 Fixed-satellite service (FSS) (space-to-Earth)

The frequency band 6700-7075 MHz is allocated to the FSS (space-to-Earth) globally for feeder links for non-geostationary satellite systems of the mobile-satellite service (MSS). This is not subject to provision RR No. 22.2 as per footnote RR No. 5.458B.

In CEPT countries, there are currently a limited number of earth stations (space-to-Earth) in the frequency bands 6725-7025 MHz and 7025-7075 MHz, operating with low Earth orbit (LEO) and medium Earth orbit (MEO) satellites.

Due to the foreseen satellite usage, the total number of receiving Earth stations using the 6700-7075 MHz feeder link allocation is expected to increase but will remain limited within CEPT countries.

2.1.4 Radio astronomy (RAS)

Radio astronomy service uses the 6650.0-6675.2 MHz frequency band (see ITU Radio Regulations footnote No. 5.149) for observations of the methanol spectral line, crucial for studying massive star formation. Resolution 220 (WRC-23) invites administrations to take all practical steps to protect the radio astronomy service from harmful interference in the frequency band 6650-6675.2 MHz.

2.1.5 Earth exploration satellite service (passive) sea surface temperature (SST) measurements

In the band 6425-7075 MHz, passive microwave sensor measurements are carried out over the oceans (see ITU Radio Regulations footnote No. 5.458). The introduction of the European Common Proposal (ECP) on WRC-23 AI 1.2 for the band 6425-7125 MHz stated that:

> "Some studies submitted to ITU-R Working Party 7C indicate that the introduction of high-density deployments of applications in the mobile service in the frequency range 6425-7125 MHz, depending upon the application, could interfere with SST measurements in locations up to several thousand kilometres[1] from the coast.
>
> These studies indicate that, SST measurements by satellite in the frequency range 6425-7125 MHz could be significantly degraded in the next years due to the amount of interference from the foreseen increased usage under the existing mobile allocation.
>
> The SST is a vital component of climate system as it exerts a major influence on the exchange of energy momentum and gases between ocean and atmosphere. SST largely controls the atmospheric response of the ocean to meteorological and climatic time scales. Continuous measurements are crucial to ensure the protection of populations from major climatic events. These measurements could be achieved in different frequency bands presenting similar response to SST and good situation in regards of potential interference.
>
> Therefore, in order to achieve this continuous SST measurement in a long-term basis, due to the ongoing studies and consequently to the IMT identification of the frequency band 6425-7125 MHz, new primary EESS (passive) allocations are proposed in the 4.2-4.4 GHz and 8.4-8.5 GHz frequency bands, complementarily to the frequency ranges 6425-7075 MHz and 7075-7250 MHz."

Agenda item 1.19 (WRC-27) was adopted by WRC-23 to consider possible primary allocations in all Regions to the Earth exploration satellite service (passive) in the frequency bands 4200-4400 MHz and 8400-8500 MHz, in accordance with Resolution 674 (WRC-23).

2.1.6 Programme making and special events (PMSE)

The ERC Recommendation 25-10 [4] includes tuning ranges for the shared use of frequency bands for terrestrial audio and video programme making and special events (PMSE) applications. In accordance with the aforementioned Recommendation, the band 7-8.5 GHz is used in CEPT countries at national level through individual licensing regimes (temporary and in specific geographical locations) for cordless cameras, portable video links, mobile video links and temporary point-to-point video links.

No technical studies were conducted in ECC Report 375 [1] or ECC Report 364 [5] regarding coexistence of video PMSE with WBB ECS or with WAS/RLAN.

2.1.7 Ultra-wideband (UWB)

The 6-8.5 GHz band is used in Europe for UWB applications through a general authorisation regime, on a non-interference and non-protection basis (ECC Decision (06)04 [6], ECC Decision (07)01 [7] and Commission Implementing Decision (EU) 2019/785, as amended). UWB applications operating in this range include communications, high accuracy measurements, location tracking, imaging, surveillance and medical systems.

2.2 ADJACENT BANDS TO THE FREQUENCY RANGE 6425-7125 MHZ

2.2.1 Fixed service

Fixed service operates in both lower (below 6425 MHz) and upper (above 7125 MHz) adjacent bands. The context of the use of this service in the adjacent bands is the same as the one described in section 2.1.1.

[1] Note: These distances apply in the case of IMT with parameters used in WRC-23 study cycle

2.2.2 Wireless access systems / radio local area network (WAS/RLAN)

Wireless access system / radio local area network (WAS/RLAN) operates in the lower adjacent band below 6425 MHz. WAS/RLAN is harmonised in a general authorisation regime at European level through ECC Decision (20)01 [8] and Commission Implementing Decision (EU) 2021/1067 [9]. The continued operation of WAS/RLANs in the lower adjacent band (5945-6425 MHz) needs to be ensured, in accordance with the harmonised technical conditions defined in Commission Decision (EU) 2021/1067 as amended.

2.2.3 Earth exploration satellite service (EESS)

Earth exploration satellite service (EESS) operates in the upper adjacent band above 7125 MHz. The range 7125-7250 MHz is used for passive microwave sensor measurements carried out over the oceans, land and coastal areas.

In the context of EESS, the frequency band 7190-7250 MHz is only used for tracking, telemetry and control (TT&C). It should be noted that ITU-R Radio Regulations footnote No. 5.460A applies to the frequency range 7190-7250 MHz.

2.2.4 Space research service (Earth-to-space)

Space research service (SRS) operates in the upper adjacent band in the frequency range 7145-7190 MHz used for tracking and communications with spacecraft in the space research service (deep space) (Earth-to-space).

The frequency range 7190-7235 MHz is used for tracking and communications with spacecraft in the space research service (near-Earth) (Earth-to-space). It should be noted that ITU-R Radio Regulations footnote No. 5.460 applies to the frequency range 7190-7235 MHz.

2.2.5 Video programme making and special events (Video PMSE)

Video programme making special events (Video PMSE) operates in the upper adjacent band above 7125 MHz. The context of the use of this application in the adjacent band is the same as the one described in section 2.1.6.

2.2.6 Ultra-wideband (UWB)

Ultra-wideband operates in the upper adjacent band above 7125 MHz. The context of the use of this application in the adjacent band is the same as the one described in section 2.1.7.

3 ASSESSMENT ON COMPATIBILITY AND COEXISTENCE OF WIRELESS BROADBAND ELECTRONIC COMMUNICATIONS SERVICE (WBB ECS) IN 6425-7125 MHZ WITH SERVICES AND APPLICATIONS IN BAND AND ADJACENT BANDS

When developing this Report, CEPT also took into account the type of incumbent use that would be present at the EU's external border. ECC Report 375 used the ERC Report 025 [13] (European Common Allocation (ECA) Table) which is intended to reflect the main usage of spectrum within CEPT countries. The ERC Report 025 also contains the allocations in the Radio Regulations for Region 1.

3.1 CONCLUSIONS OF ECC REPORT 375

Studies were conducted in accordance with WBB ECS deployment parameters and scenarios as defined in ECC Report 375, section 3 [1] and with the "Parameters and assumptions for sharing and compatibility studies with incumbent and adjacent band services and applications" in ECC Report 375 section 4 [1]. Options/deviations from these parameters and assumptions are provided in the studies in ECC Report 375, section 6. This includes full power and reduced power base stations, operating with a channel bandwidth of 100 MHz. Some studies used site-specific parameters. The geographic extent of usage of the different users was also taken into account in the studies. Most of the studies were conducted considering urban or suburban WBB ECS deployment. In addition to that, when considering the UE contribution to the interference, only UE power class 3 with a maximum 23 dBm e.i.r.p. was considered and no studies were performed with fixed type UE, i.e. FWA CPE.

It should be noted that the study numbers in this section 3.1 relate to the studies that were undertaken in ECC Report 375.

3.1.1 Sharing between WBB ECS and FS

In-band/co-channel sharing between WBB ECS and FS was studied in this Report. These studies used minimum coupling loss (MCL) and Monte Carlo analyses and compared the results against the long-term and the fractional degradation in performance (FDP) protection criteria for the FS. The studies estimated the minimum geographical separation between a WBB ECS base station and a FS receiver at which the interference at the input of the FS receiver would not exceed the protection criteria.

Studies assessed urban and suburban scenarios as it has been assumed that contiguous coverage by the WBB ECS BSs is not expected in rural areas in the 6425-7125 MHz band. Study 1, additionally, assessed the coexistence conditions considering rural WBB ECS base stations.

Studies in ECC Report 375 indicate that the separation distance for co-channel sharing depends on multiple factors, e.g. the protection criteria used (i.e. I/N or FDP), the extent to which radio clutter (e.g. vegetation and buildings) is assumed to impact interference paths and the application of the propagation models (e.g. time percentages, percentage of locations). For example studies assuming clutter applied to a higher proportion of interference paths (up to 100%) and/or applying the long-term protection criterion and/or using propagation models with higher attenuation reported shorter separation distances.

In summary, studies have indicated separation distances ranging from 42 km to 321 km in the main beam of the FS receiver, and from 2 km to 56 km outside of the main beam of the FS receiver, specifically:

- A Monte Carlo study (Study 2) applied clutter loss to all interference paths. Based on the long-term criterion, it indicated separation distances of 42 to 56 km within the FS receiver main lobe, and 2 to 4 km for the side lobes. Based on the FDP criterion, it evaluated separation distances up to 68 km within the FS receiver main lobe;
- Two Monte Carlo studies (Studies 3 and 7) applied clutter loss to 65% of the interference paths. These studies have indicated separation distances of 67 to 105 km within the FS main lobe for the long-term criterion and 244 to 310 km when the FDP criterion was considered. If clutter loss is applied to 100% of interference paths, separation distances are in the range between 51 to 72 km within FS main lobe for the long-term protection criterion, and between 59 to 124 km if the FDP criterion is used. Outside the FS receiver main lobe, separation distances ranged from 33 km to 53 km for the long-term and the FDP criteria. A Monte Carlo study (Study 5) found that the required separation distance in the main lobe ranges from 52 km to 87 km depending on the WBB ECS deployment configuration using the long-term criterion,

assuming no clutter loss applied to any interference path and with an antenna steering range limited to 3 degrees below the horizon;

- A Monte Carlo study (Study 6) used the Recommendation ITU-R P.452-18 propagation loss model which accounts for WBB ECS BS, UE, FS and representative clutter heights and yields lower clutter loss estimates. These estimates were applied to all interference paths. Under the long-term protection criterion, the study found separation distances of 165 km within the FS receiver main lobe for the long-term criterion, increasing to 314 km when using the FDP criterion. Outside the FS receiver main lobe, distances remained below 10 km but could go up to 29 km for higher WBB ECS base stations at a height of 22.5 m;
- An MCL study (Study 1) considers the actual FS deployment in the band in a CEPT country and the actual terrain elevation. In addition to assuming WBB ECS BS peak gain and e.i.r.p. in the direction of victim FS receiver, it includes a scenario where the WBB ECS BS emission above the horizon is reduced by up to 36 dB to comply with the expected e.i.r.p. mask from Resolution 220 (WRC-23). Clutter loss was applied to all interference paths, with different location probabilities depending on the simulated environment. For full power WBB ECS base stations, the study reports median separation distances ranging from 53 km to 129 km within the FS receiver main lobe depending on the clutter environment for the long-term criterion. This study also considered a reduced WBB ECS BS e.i.r.p. of 57 dBm/100 MHz) which resulted in shorter separation distances in the range of 31 to 61 km again for the long-term criterion.

For Monte Carlo studies, the use of joint or separated time and location statistics[2] impacts the results. Study 7 indicated that even when applying the separation distances computed using joint location/time Monte Carlo, not all location morphologies using separated location/time Monte Carlo would comply with the protection criteria.

Some studies assessed interference using FS data from administrations (operating in the upper 6 GHz band), and in some cases (Study 4 and 8) also using real WBB ECS deployment sites in the 2.6 GHz and/or 3.6 GHz band:

- An MCL study (Study 1) assuming WBB ECS BS peak gain and e.i.r.p. in the direction of victim FS receiver, evaluated interference against the long-term protection criterion. This study also examined a case where the WBB ECS BS emissions above the horizon were reduced by up to 36 dB to comply with the expected e.i.r.p. mask from the Resolution 220 (WRC-23). The results indicated that 58% of the national territory under study would be excluded from WBB ECS deployment when the expected e.i.r.p. mask was applied and 86.6% without the expected e.i.r.p. mask. When assuming reduced WBB ECS e.i.r.p. of 57 dBm/100 MHz, the impacted areas dropped to 34.9% with the expected e.i.r.p. mask applied and 54.5% without that expected e.i.r.p. mask;
- An MCL study (Study 4) applied the long-term protection criterion, including both full power WBB ECS BSs and up to a 36 dB power reduction to comply with the expected e.i.r.p. mask. Clutter loss was applied to all interference paths, with different location probabilities depending on the simulated environment. At full e.i.r.p. level, 10% of WBB ECS BSs (expected e.i.r.p. mask not applied) up to 40% of WBB ECS BSs (with the expected e.i.r.p. mask applied) in urban areas, could operate without impacting FS. These increased to 55% and 85% respectively for a reduced WBB ECS BS e.i.r.p. level of 57 dBm/100 MHz;
- A site-specific separated time and location Monte Carlo study (Study 8) was used to evaluate interference against the long-term and FDP protection criteria. The study found that about 30% of the studied FS receivers had the long-term protection criterion met, while only 20% met the FDP criterion.

The calculated separation distances give an indication of the size of the geographic areas within which coordination between WBB ECS and the existing services might be required, although in practice these will vary depending on location-specific conditions such as terrain and clutter.

The main method to enable coexistence between WBB ECS and FS receivers is to apply a sufficient separation distance between WBB ECS base station transmitters and FS receivers, and to limit WBB ECS base stations

[2] The studies used two different Monte Carlo approaches:

- Joint location/time Monte Carlo: Location- and time-dependent parameters are randomly sampled together during each Monte Carlo event. The results are expressed as the percentage of events (i.e. joint location and time instances) where interference exceeds a given threshold;
- Separated location/time Monte Carlo: Location-dependent parameters are sampled in one loop (the morphology loop), and time-dependent parameters in a separate loop (the time loop). The results are expressed as the percentage of locations (morphologies) where interference exceeds a threshold with a certain probability over time.

The time variation is due to beamforming activity at the base station.

to not transmit in FS main beam directions. Some studies considered the following mitigation techniques to improve coexistence between WBB ECS base station transmitters and FS receivers:

- Limiting the WBB ECS BS beam steering to reduce the interference towards the relevant receiver, including limiting the beam directions so that they point at 3 degrees or more below the horizon (Study 5);
- Adjusting the WBB ECS antennas' mechanical downtilt (Study 5) and azimuth (considered in all studies) to avoid coupling with the FS main lobe;
- Downlink subcarrier blanking in the WBB ECS signals to avoid the use of specific parts of the band during downlink transmissions (Study 5);
- Operating WBB ECS base stations at a lower e.i.r.p. level (Studies 1 and 4).

According to Study 5, combining the first three techniques reduced the required separation distance in the FS side lobe to around 1 km when considering the long-term protection criterion for the FS link.

3.1.1.1 Risk of interference and possible aspects for the regulatory framework for the implementation of WBB ECS

Studies assessing co-channel sharing between WBB ECS and FS within the same area conclude that coexistence could only be feasible through site-specific coordination between WBB ECS and FS systems, even though it represents challenges for widespread WBB ECS deployments, particularly in urban areas. Cross-border agreements will be needed due to anticipated size of certain coordination zones.

The exact exclusion area for WBB ECS around a FS station depends on several site-specific factors, including antenna height, local clutter conditions and FS antenna gain and pointing direction.

The following mitigation measures implemented by WBB ECS can reduce the separation distance between FS and WBB ECS:

- Limiting the WBB ECS beam steering to 3 degrees or more below the horizon;
- Adjusting the WBB ECS antenna's physical downtilt and azimuth to avoid coupling with the FS main lobe;
- Downlink subcarrier blanking - avoiding the use of specific parts of the band during downlink transmission;
- Reducing the WBB ECS transmission power.

The application of such measures implies restrictions to the WBB ECS systems, which could limit the evolution and flexibility of WBB ECS network deployment. Their efficiency and implementation complexity needs to be further studied at a national level.

The impact on WBB ECS in a given area or country will depend on the number of FS links present in that area or country. Coexistence requires large separation distances when a WBB ECS base station antenna is directed towards the FS antenna and located within the main beam of the FS link. This implies that national strategies – such as re-farming and/or site-specific coordination – are required to be defined and implemented. In some cases, cross-border coordination agreements may be necessary due to the size of coordination zones.

Administrations may choose to allow the future evolution of FS systems by applying geographical separation between FS and WBB ECS deployments e.g. FS in rural areas and WBB ECS in urban and sub-urban areas. This would align with expected WBB ECS deployment model in the band, as contiguous coverage in rural areas is not foreseen in the 6425–7125 MHz band.

3.1.2 Sharing and compatibility between WBB ECS and RAS

Sharing and compatibility between WBB ECS and RAS was studied through MCL and Monte Carlo simulations. The estimated separation distances provided below, indicate the areas in which coordination (e.g. interference mitigation measures) might be needed. Key modelling parameters affecting the separation distance are:

- the assumption made about the propagation changes with respect to atmospheric conditions, in particular temporal variability;
- the extent to which clutter is assumed to impact interference paths.

In studies, which assume that not all interference paths are impacted by clutter, for the in-band case, the resulting separation distances range from 130 km to 380 km depending on the assumptions used, specifically:

- Studies assuming annual-average atmospheric conditions (time percentage = 50%) estimated separation distances of 150 to 170 km (Studies 3 and 4), noting that RAS is usually afforded protection for larger proportion of time;
- Studies that considered variable atmospheric conditions (time percentage between 0% and 100% as appropriate, see ECC Report 375, section 5.1 [1]) found larger separation distances of 370 to 380 km (Studies 2 and 5). Study 1 used terrain and clutter along the path, and included an additional assumption about the tropospheric propagation, leading to a separation distance of 130 km. Study 1 also examined separation distances for a network of local VLBI RAS stations with 29 dB less stringent protection criterion than a single dish, resulting in separation distances of 70 km to 85 km.

In studies, which assume that all interference paths are impacted by radio clutter, for the in-band case, the resulting separation distances range from 60 km to 220 km, depending on the assumptions used, specifically:

- Studies assuming annual-average atmospheric conditions estimated separation distance of 60 km (Studies 3 and 4);
- Studies that considered variable atmospheric conditions found longer separation distances of 90-220 km (Studies 2, 5 and 6).

For the adjacent channel and spurious domain cases, the resulting separation distances were 100 km and 25 km respectively (Study 2).

The calculated separation distances give an indication of the size of the geographic areas within which coordination between WBB ECS and the existing services might be required, although in practice these will vary depending on location-specific conditions such as terrain and clutter.

In addition, some studies considered the following mitigation techniques to improve coexistence between WBB ECS and RAS receivers i.e.:

- Avoiding WBB ECS antenna beam pointing toward RAS receivers (Study 2);
- Adjusting the WBB ECS antennas' azimuth (Studies 2 and 6) to avoid pointing towards the RAS receivers;
- Operating WBB ECS base stations at a lower e.i.r.p. level (Study 1);
- Applying frequency separation (Study 2);
- Ensuring that clutter is present between WBB ECS BS and RAS sites (Studies 2 and 6).

3.1.2.1 Risk of interference and possible aspects for the regulatory framework for the implementation of WBB ECS

The geographic extent of usage of RAS is provided in the list of RAS stations in CEPT countries operating in the frequency band 6650-6675 MHz in ECC Report 375, table 12 [1]. The studies indicated some site-specific risks of interference, however the coexistence between RAS and WBB ECS could be feasible by applying site-specific coordination. Separation distances can be reduced and therefore coexistence can be improved when performing site-specific coordination if some of the measures described in sections 3.1.2 and 3.2.3 are applied.

If existing WBB ECS antenna installations were to be augmented with WBB ECS equipment in the upper 6 GHz band, the assumption that 100% of base stations are affected by significant clutter loss may not be realistic in a number of countries depending on the terrain. Also, in this case not all mitigation measures may be feasible.

3.1.3 Adjacent band coexistence between WBB ECS and WAS/RLAN

Adjacent band coexistence between WBB ECS in the upper 6 GHz band and WAS/RLAN in the lower 6 GHz band, was evaluated through a number of Monte Carlo studies and a Minimum Coupling Loss analysis. Most of the studies focused on two types of WAS/RLAN deployments: low power indoor (LPI) APs and very low power (VLP) outdoor equipment, but some studies also considered client devices indoor and outdoor (with and without body loss) as well as VLP equipment indoor. All of the studies analysed the impact on the individual WAS/RLAN receiver.

In the Monte Carlo studies, the locations of WBB ECS UEs and WAS/RLAN equipment were modelled as independent random variables and without any correlation.

The simulations considered scenarios with no edge-to-edge frequency separation (0 MHz) as well as cases with frequency separation of more than 0 MHz between the two systems. Interference statistics were presented in two formats: one where location and time statistics are combined; and another where location and time statistics are presented separately.

The calculated level of interference at WAS/RLAN receivers from WBB ECS BSs depends on several key assumptions:

- The amount of out-of-band emission of WBB ECS transmitters;
- The adjacent channel selectivity of WAS/RLAN receivers, depending on whether ETSI or IEEE specifications are used;
- The sensitivity of WAS/RLAN receivers;
- Whether joint (combined) or separated location and time statistics are considered in the case of WAS/RLAN LPI APs (joint location and time statistics only are considered for VLPs);
- Distances and the minimum distance between WAS/RLAN equipment and WBB ECS BSs as assumed in the simulations;
- Location of WBB ECS UEs, particularly whether indoor users are assumed to be positioned at a range of heights over a number of building floors and accordingly draw the WBB ECS BS beams towards them.

The probabilities of interference-to-noise ratio (I/N) at the WAS/RLAN receivers exceeding nominal values of 0 dB and −6 dB are assessed in the studies and reported below.

Studies based on the ETSI specified absolute basic limits on WBB ECS BS ACLR equivalent to −6 dBm/MHz and modelled as +7 dBm over a measurement bandwidth of 20 MHz provide the following results:

- Studies 1 and 2 examined interference from WBB ECS BSs to WAS/RLAN LPI APs, with BS beams directed towards UEs positioned 1.5 m above ground. A minimum BS-UE and BS-AP separation of 35 m was assumed, along with IEEE-compliant WAS/RLAN receiver selectivity. Analysing joint location and time statistics and assuming 0 MHz frequency separation, the studies indicate that LPI APs experience an I/N which exceeds 0 dB and −6 dB with probabilities of 0.8% and 1.5% (Study 1) and 0.9% and 1.8% (Study 2), respectively. The above results correspond to the distribution of WAS/RLAN channel bandwidths of 20, 40, 80, 160 and 320 MHz as specified in ECC Report 364 [5];
- Studies 1, 3 and 4 also examined interference from WBB ECS BSs to WAS/RLAN LPI APs with similar assumptions as above, but with WBB ECS UEs positioned at a range of heights consistent with WAS/RLAN equipment distribution from ECC Report 364 [5]. Analysing joint location and time statistics, and assuming a 0 MHz frequency separation, the studies indicate that LPI APs experience an I/N which exceeds 0 dB and −6 dB with probabilities of less than 1.5% and 3% in Study 1, 1% and 2% in Study 3, 0.5% and 1.2% in Study 4, respectively. Study 1 also combined the results for different WAS/RLAN receiver types, based on the distribution of LPI APs, and STAs/VLPs indoor and outdoor (both with and without body loss) specified in ECC Report 364 [5]. This showed that mixed population of WAS/RLANs experience an I/N which exceeds 0 dB and −6 dB with probabilities of 1.2% and 2.4%, respectively;
- Studies 5 and 7 examined interference from WBB ECS BSs to WAS/RLAN LPI APs, assuming UEs at a range of heights consistent with ECC Report 364. A minimum BS-UE separation of 35 m and a minimum BS-AP separation of about 10 m was assumed, and in the case of Study 7, a minimum UE-AP separation of 1 m. ETSI-specified WAS/RLAN receiver selectivity was assumed for Study 5, whereas IEEE-specified WAS/RLAN receiver selectivity was assumed for Studies 5 and 7. Referring to separated location and time statistics for WAS/RLAN with a channel bandwidth of 20 MHz and assuming a 0 MHz frequency separation, Study 7 shows that 7% of LPI APs experienced an I/N which exceeds −6 dB with a probability of more than 10% over time using WBB ECS BS ACLR and IEEE WAS/RLAN ACS. This percentage of affected LPI APs could rise to around 30% (Study 7, using WBB ECS BS SEM and IEEE WAS/RLAN ACS) or 47% (Study 5, using WBB ECS BS ACLR and ETSI WAS/RLAN ACS) when considering only LPI AP locations within 75 m of an WBB ECS BS (this area captures up to 6% of the total number of locations simulated). Study 5 shows that if LPI APs in this area were more sensitive (−92 dBm/20MHz) then 50% of them would experience an I/N which exceeds −6 dB more than 26% of the time. Both studies indicate that a 100 MHz frequency offset can reduce the proportion of impacted LPI APs experiencing interference exceeding the I/N of −6 dB. Larger bandwidths (above 160 MHz) did not benefit significantly more from the 100 MHz offset compared to the smaller bandwidth channels (20 MHz, 40 MHz and 80 MHz).

As a sensitivity analysis, Studies 5 and 7 also provided results assuming WBB ECS BS emissions limits at the level of the ETSI-specified operating band unwanted emissions (see ECC Report 375, table 2 [1]). Results can be found in ECC Report 375, section 6.

Regarding the outdoor VLP use case (with body loss), the level of interference observed for a 0 MHz frequency separation was examined by Studies 1 and 6 based on joint location and time Monte Carlo analysis, IEEE-specified WAS/RLAN ACS values. These studies found that 1.5% (Study 1) and 4-7% (Study 6 depending on the bandwidth) of VLP links would experience an I/N which exceeds −6 dB. The percentages reduce to 0.7% (Study 1) and 2-4% (Study 6 depending on the bandwidth) for an I/N of 0 dB. Study 6 also indicated that if using the SEM on the WBB ECS side, those exceedance rates can range between 4 to 9% depending on the bandwidth.

The above results for Study 1 correspond to the distribution of WAS/RLAN channel bandwidths of 20, 40, 80, 160 and 320 MHz as specified in ECC Report 364 [5], whereas the results for Study 6 correspond to a range of WAS/RLAN channel bandwidths from 20 MHz to 320 MHz.

In addition to the above studies, further assessments were made:

- Study 4 also looked at the impact on WAS/RLAN throughput. Using joint location/time statistics and a 0 MHz frequency separation, it estimated that interference from WBB ECS could lead to a throughput degradation of less than 0.65%;
- Study 8 analysed potential interference levels from WBB ECS UEs in upper 6 GHz band to WAS/RLAN equipment in the lower 6 GHz band and compared these to interference from WBB ECS UEs in 2300 MHz band to WAS/RLAN in the 2.4 GHz band. A minimum coupling loss (MCL) analysis indicated that for similar geometries with an WBB ECS UE transmitter in free-space line-of-sight of a WAS/RLAN receiver, the I/N at the receiver would be around 12 dB to 15 dB lower in the lower 6 GHz band (with a 0 MHz frequency separation) than in the 2.4 GHz band (with WBB ECS operating at the high-frequency end of its band, just below 2390 MHz implying a 12 MHz frequency separation).

3.1.3.1 Risk of interference and possible aspects for the regulatory framework for the implementation of WBB ECS

For WAS/RLAN in the 5945-6425 MHz frequency band, depending on the assumptions and methodologies used, the study results indicated a range of different probabilities of interference from WBB ECS into WAS/RLAN in the adjacent band, both with and without frequency separation.

ECC Report 375 did not reach a conclusion on whether frequency separation was needed. Further technical studies are needed to conclude on possible need for adjacent band protection.

3.1.4 Sharing between WBB ECS and non-GSO FSS downlink

Two site-generic studies explored in-band sharing between WBB ECS and non-GSO FSS downlink. They investigated separation distances in order to protect the operation of non-GSO FSS earth stations for communication mode (Satellite elevations above 10°). The separation distances range from 12 km to 30 km, based on long-term protection criteria. These protection distances are site specific and depend on several elements such as the propagation parameters, local terrain topography, clutter surrounding the earth station, orbital parameters of the non-GSO system, satellite selection strategy and WBB ECS BS orientation towards the earth station.

3.1.4.1 Risk of interference and possible aspects for the regulatory framework for the implementation of WBB ECS

The study indicated some site-specific risks of interference, however the coexistence between WBB ECS and FSS (space-to-Earth) would be feasible by applying site-specific coordination procedures. Elements such as the propagation parameters, local terrain topography, clutter surrounding the stations, orbital parameters of the non-GSO system, satellite selection strategy and base station antenna direction in relation to the Earth station should be accounted for in the coordination process.

3.1.5 Sharing between WBB ECS and UWB

A Monte Carlo study considered sharing between WBB ECS and UWB (channel 5). It assessed interference to a handheld UWB device from a 19-site WBB ECS cluster operating at full power at varied network load levels.

The findings indicated that, an interference threshold of −78 dBm/500 MHz (as measured and reported in ECC Report 302 [2], and approximately corresponding to an I/N of 0 dB) is exceeded in 75% of simulated events. The time domain aspect of WBB ECS and UWB operation has not been investigated in this Report. An analysis of some technical documentations and measurements suggest that this threshold may be relaxed depending on the UWB use case.

3.1.5.1 Risk of interference and possible aspects for the regulatory framework for the implementation of WBB ECS

Results indicated that the operation of WBB ECS will cause degradation to the UWB channel 5 end user experience for the devices operating outdoors. An analysis of some technical documentations and measurements suggests that the UWB receiver interference threshold of −78 dBm/500 MHz may be relaxed without impacting user experience depending on the use case. Taking into account the general authorisation regime of UWB which operates on a non-protected basis, there are no plans to require the implementation of mitigations techniques for WBB ECS.

3.1.6 Sharing between WBB ECS and Fixed satellite service (FSS) (Earth-to-space)

FSS uplink has not been studied in the ECC Report 375.

3.1.6.1 Risk of interference and possible aspects for the regulatory framework for the implementation of WBB ECS

Compliance with Resolves 2 of ITU-R Resolution 220 (WRC-23) (the expected e.i.r.p. elevation mask) would ensure protection of FSS in the Earth-to-space direction and has to be considered as a part of the regulatory conditions.

3.1.7 Observations on WBB ECS BS antenna location

In addition to the coexistence studies, an analysis of actual base stations in the 3400-3800 MHz band in Paris (see ECC Report 375, section 6.26 [1]) was performed. FS study 4 also performed an analysis of the actual WBB ECS BS deployment in a CEPT country in the 3.6 GHz band.

3.2 OTHER STUDIES AND CONSIDERATIONS

When developing this Report, CEPT also considered available conclusions for coexistence with incumbent radiocommunication services, such as the outcomes of the WRC-23 and technical studies performed by CEPT and ITU-R.

3.2.1 Fixed-satellite service (FSS) (Earth-to-space)

WBB ECS shall comply with Resolves 2 of ITU-R Resolution 220 (WRC-23) (the expected e.i.r.p. elevation mask) and this provision was developed to ensure protection of FSS in the Earth-to-space direction.

3.2.2 Radio astronomy (RAS)

Use of WBB ECS downlink sub-carrier blanking (as described for FS in section 3.1.1), could be applied to avoid transmission in the RAS frequency range while allowing a 100 MHz WBB ECS channel raster to be maintained. In the part of the WBB ECS network where sub-carrier blanking is applied, this would reduce WBB

ECS downlink capacity for the affected channel, because some frequency resources would be deliberately left unused, but could also reduce the separation distances towards those found in the adjacent channel cases. This technique has not been studied for RAS.

3.2.3 WAS/RLAN in the adjacent band

The impact of WBB ECS interference on network capacity and coverage of WAS/RLAN operating in the 5945-6425 MHz frequency band (see methodologies in ECC Report 366 [12]) has not been studied.

3.2.4 Relevant ITU-R Reports and Recommendations in response to Resolution 220 (WRC-23)

ITU-R developed Report ITU-R M.2560 "Guidance for national and bilateral coordination of stations in the fixed service with IMT stations in the frequency band 6 425-7 125 MHz". This Report recognises that the studies undertaken under WRC-23 agenda item 1.2 revealed that co-channel coexistence between IMT and the fixed service in the frequency band 6425-7125 MHz can be achieved but would require site-by-site coordination if IMT and fixed service (FS) are deployed in the same or in adjacent geographical areas. This coordination is crucial to mitigate potential interference issues.

This Report provides methodologies and some example calculations of coordination areas around FS stations and IMT BS, in order to address potential interference into FS and IMT BS receivers, respectively. In addition it provides the following possible approaches that, individually or in combination, could be considered to manage co-channel or adjacent channel coexistence between IMT and FS systems: separation in geography/space, separation in frequency and angular discrimination. The Report clarifies that these approaches are not exhaustive and may not be universally applicable in all countries.

At the time of writing this Report, an ITU-R Recommendation is being developed in WP 5D. This Recommendation contains methodologies for calculating coordination areas between fixed satellite (FSS) non-geostationary (non-GSO) downlink (space-to-Earth) earth stations (ES) operating in the frequency band 6700 7075 MHz, and IMT base stations operating in the frequency band 6425-7125 MHz.

At the time of writing this Report, an ITU-R Report is being developed in WP 7D on the methods to address the determination of the coordination area around existing RAS stations from IMT stations in the frequency band 6650-6675.2 MHz. The Report presents possible scenarios for calculation of the coordination area including single entry scenarios, aggregation scenarios and mixed scenarios.

ITU-R developed Report ITU-R M.2561 "Coordination between space research service (deep space) stations operating in the band 7 145-7 190 MHz and IMT stations operating in the band 6 425-7 125 MHz". This Report provides a generic methodology and some example implementations for the calculations of coordination areas around transmitting SRS earth stations in order to address potential interference into IMT BS receivers.

4 ASSESSMENT ON COMPATIBILITY AND COEXISTENCE OF WIRELESS ACCESS SYSTEMS AND RADIO LOCAL AREA NETWORKS (WAS/RLAN) IN 6425-7125 MHZ WITH SERVICES AND APPLICATIONS IN BAND AND ADJACENT BANDS

4.1 WAS/RLAN CONSIDERED USE CASES AND SCENARIO OF DEPLOYMENT

The detailed use cases identified for use by WAS/RLAN in the frequency band 6425-7125 MHz in ECC Report 364 section 3.1 [5] include the following characteristics which are identical to those used in ECC Report 302 [2] and ECC Report 316 [10]:

- Low power indoor (LPI) use, maximum mean 200 mW e.i.r.p., with no outdoor use allowed;
- Very low power (VLP) portable use, maximum mean 25 mW e.i.r.p., VLP devices may operate both indoor and outdoor.

ECC Report 302 [2] and ECC Report 316 [10] studied the WAS/RLAN coexistence in 5925-6425 MHz band with services in band and in adjacent band. ECC Report 364 studied WAS/RLAN coexistence in 6425-7125 MHz, albeit with updated parameters (Scenario A) and with the addition of a second scenario aiming at investigating denser use of WAS/RLAN (Scenario B). Each scenario had three deployment assumptions: Low, Mid and High. By defining the active RLAN densities as proportional to the population density, the model allows the consideration of multiple-entry interference studies in both site-general and site-specific approaches. The WAS/RLAN deployment model is based on projections such as population, data consumption per person during busy hour, and the market penetration of WAS/RLAN devices in an assumed mature market (year 2030 was used). Further information on the differences between the WAS/RLAN deployment models between scenarios A and B can be found in ECC Report 364, section 3.2 [5].

The simulations carried out in ECC Report 364 are based on the baseline scenario of 1% outdoor VLPs and 99% of LPI, as per ECC Report 316 [10], with some slight modifications, taking into account some accidental LPI client outdoor usage. For both LPI and VLP devices, details on the distribution of WAS/RLAN channel bandwidths of 20, 40, 80, 160 and 320 MHz can be found in ECC Report 364, section 3.1.1 [5]. Consideration of use cases with powers higher than those described in this Report including for outdoor use would require further investigations.

WAS/RLAN systems can be described by two common configurations: centralised systems, where multiple devices are connecting to an access point (AP), and non-centralised systems, where multiple devices communicate peer to peer directly (using VLP power levels) in a small area on an ad-hoc basis, all sharing the same spectrum.

WAS/RLAN LPI use is intended to be permanent in buildings, in aircraft or in trains and not outdoors in order that a general authorisation regime can meet the protection requirements of other radio services. The VLP use is intended to cover short range applications for small area direct communications. The same use cases were also considered in the development of the regulatory framework in the 5945-6425 MHz, ECC Decision (20)01 [8] RLAN 6 GHz Lower band and in European standard draft ETSI EN 303 687 [11].

4.2 ASSESSMENT ON COMPATIBILITY AND COEXISTENCE OF WAS/RLAN WITH SERVICES AND APPLICATIONS IN BAND

Sharing and compatibility studies between wireless access systems including radio local area networks (WAS/RLAN, also called RLAN in this Report) low-power indoor (LPI) and very low power (VLP) and existing incumbent systems in the 6425-7125 MHz frequency band were performed in ECC Report 364 [5]. The outcomes and conclusions are presented in this section.

4.2.1 Sharing between WAS/RLAN and Fixed service (FS)

Fixed service characteristics and typical deployments are contained in ECC Report 364, section 4.1 [5]. Statistics about the population density around FS links were used for the technical studies and the detailed method of the information treatment can be found in ECC Report 364, section 4.1.2 [5]. Minimum coupling loss studies and Monte Carlo simulations were carried out.

Minimum coupling loss (MCL) studies have been performed for urban and suburban areas[3] with no terrain profile. MCL studies identified potential interference zones but did not allow definitive conclusions on likelihood. Peak interference distances vary depending on deployment and receiver height.

The Monte Carlo studies used two different approaches:

- Joint location/time Monte Carlo: The location and time dependent parameters used in the calculations are randomly sampled at each Monte Carlo event (jointly changed), independently of each other.
- Separated location/time Monte Carlo: The location dependent parameters are randomly sampled in a separated loop (morphologies loop) from the time dependent parameters (time loop).

The methodologies of each approach are described in detail, in ECC Report 364, sections 5.1.3 to 5.1.9 [5].

Monte Carlo simulations (joint and separated location/time) showed that most scenarios respect FS long-term protection thresholds (I/N < −10 dB for less than 20% of the time). Example scenarios using site-specific studies using actual FS links and population data showed that long-term protection thresholds were not exceeded.

In addition, fractional degradation in performance (FDP) values were below 10%, for Monte Carlo simulations using joint location/time. Site-specific studies using actual FS links and population data showed a similar result. Monte Carlo simulations using separated location/time also showed that for most scenarios the FDP values were below 10%.

4.2.1.1 Risk of interference and possible aspects for the regulatory framework for the implementation of WAS/RLAN

The statistical results from the Monte Carlo simulations range from respecting the FS interference protection criteria, to low probabilities of exceeding the criteria. Although in rare cases, a combination of factors such as WAS/RLAN located near the line of sight (coordinates and relative height) of the FS radio link, and/or unfavourable conditions (e.g. clutter loss, building entry loss and e.i.r.p.) may lead to potential exceedance of the FS protection criteria. The simulations indicate that the chances that all of these factors occur simultaneously in reality is quite low.

Based on the results of the technical studies, the overall conclusion is therefore that coexistence for low-power indoor (LPI) and very low power (VLP) WAS/RLAN devices with FS is feasible. Appropriate measures for LPI WAS/RLAN could be useful in order to restrict operation to indoor use or to mitigate the effects in cases of accidental WAS/RLAN outdoor use (e.g. requirements for wired connection and integrated antenna, prohibitions on battery powered and weatherized equipment).

4.2.2 Sharing between WAS/RLAN and fixed-satellite service (Earth-to-space)

Simulations have been assessed on all possible satellite beam types of the fixed-satellite service (FSS) uplinks in the upper 6 GHz band (6425-7125 MHz): a Global, a Regional, a Zone and two Spot Beams. The study also used precise maps of real population density. Results have shown that in all cases studied using High WAS/RLAN deployment assumptions from Scenario A of ECC Report 364, the I/N for all satellite receivers is more than 15 dB below the −10.5 dB threshold. This is consistent with the results already obtained in the lower 6 GHz band (5945-6425 MHz) that led to ECC Decision (20)01 [8] for that band.

4.2.2.1 Risk of interference and possible aspects for the regulatory framework for the implementation of WAS/RLAN

Based on the results of studies in ECC Report 364 [5], it can be concluded that the deployment of LPI (Low Power Indoor) and VLP (Very Low Power) WAS/RLANs will not impact the operation of the FSS uplinks in the 6425-7125 MHz frequency band. This confirms the results already obtained in the lower 6 GHz (ECC Report 302 [2]) band that led to allowing the operation of LPI and VLP WAS/RLAN devices in that band as set out in ECC Decision (20)01 [8].

[3] Rural scenarios were not studied in this Report but were studied in ECC Report 302 [2].

4.2.3 Sharing between WAS/RLAN and fixed-satellite service (space-to-Earth)

Monte Carlo site-specific sharing studies were conducted between WAS/RLAN and FSS downlink for four ground stations in Europe, which are located in rural areas with very low surrounding population densities, using the High WAS /RLAN deployment assumptions of Scenario A. In addition to the real ground stations positions and characteristics (e.g. height, gain), the studies also used maps of population density around the FSS ground station receiver. The studies for the ground stations in Spain, Greece and Estonia were conducted with no WAS/RLANs located within 325 m, 500 m and 350 m from the ground stations, respectively, to reflect that there are no buildings within these zones, while in France WAS/RLAN were placed inside real buildings within a distance of 8 km from the ground station receiver. For propagation loss calculations, the terrain profile around the ground station was taken into account. Studies have shown that all stations respected the protection criterion of I/N = −10.5 dB not to be exceeded for more than 20% of the time.

4.2.3.1 Risk of interference and possible aspects for the regulatory framework for the implementation of WAS/RLAN

Technical studies have shown that the sharing between WAS/RLAN and fixed-satellite service (space-to-Earth) is feasible maintaining the operation of low power WAS/RLAN indoors.

4.2.4 Sharing between WAS/RLAN and radio astronomy service (RAS)

Site-specific Monte Carlo simulations using two different scenarios were performed around four radio astronomy sites in CEPT.

Results suggest that some radio astronomy sites may require protection and, in these cases, appropriate technical mitigation measures could be applied to prevent interference from WAS/RLAN to the radio astronomy service (RAS). Other sites do not require such measures. The study also suggests that sharing between RAS and WAS/RLAN is unlikely to become a cross-border issue and is more likely to remain a local/national issue.

4.2.4.1 Risk of interference and possible aspects for the regulatory framework for the implementation of WAS/RLAN

The implementation of mitigation techniques (e.g. geographical protection zone) is needed to protect RAS sites from possible interferences caused by WAS/RLAN. These measures could be implemented at national level following site-specific studies. Some examples of possible measures are:

- Geographical exclusion or coordination zones based on site specific studies;
- Implementation of country determination capability (CDC);
- WAS/RLAN power restriction;
- Use of dynamic spectrum coordination function (DSCF) to allow the operation of WAS/RLAN and enforce the radio astronomy service (RAS) geographical protection zones;
- Prohibiting the use of WAS/RLAN channels that operate in co-channel with radio astronomy service (RAS), e.g. (channels 141, 145, both at 20 MHz bandwidth or within 6650.0-6675.2 MHz as appropriate).

5 CONCLUSIONS

This Report presents the results of Task 1 under the European Commission mandate to assess coexistence and compatibility scenarios both for (i) terrestrial systems capable of providing wireless broadband electronic communications services (WBB ECS) and (ii) WAS/RLANs, with incumbent spectrum users in the 6425-7125 MHz band and their potential evolution, in the context of CEPT countries. For the purpose of this Report, the coexistence scenarios have been assessed for each incumbent user within and adjacent to the 6425-7125 MHz band with WBB ECS and also with WAS/RLAN.

The technical assessment and its analysis concluded the following on the coexistence and compatibility between WBB-ECS[4] with the incumbent services and applications:

In-band incumbents:

- **Fixed service (FS):** Co-channel sharing between WBB ECS and FS could only be feasible through site-specific coordination between WBB ECS and FS systems, although it may represent challenges for widespread WBB ECS and FS deployments (potentially limiting their evolution and flexibility). Depending on the assumptions, studies indicate geographical separation distances ranging from 42 km to 321 km in the main beam of the FS receiver antenna and from 2 km to 56 km outside of the main beam of the FS receiver antenna. These distances can be reduced by applying some technical measures during the coordination (see section 3.1.1);
- **Fixed satellite service (FSS), Earth-to-space:** CEPT did not perform technical studies to assess this topic considering the outcome of WRC-23 (see Resolution 220 (WRC-23), considering (d) and resolves (2)), which specifies expected e.i.r.p. masks for WBB ECS BS, applies in order to protect FSS in the Earth-to-space direction;
- **Fixed satellite service (FSS), space-to-Earth:** The coexistence would be feasible when site-specific coordination is applied. According to studies based on long-term protection criterion, geographical separation distances of 12 km to 30 km may be required depending on terrain, clutter and orbital parameters. Elements such as those in section 3.1.4 are recommended to be considered when performing the coordination;
- **Earth exploration satellite service (EESS (passive)), sea surface temperature (SST) measurements:** CEPT did not consider technical studies to assess this topic under this EC mandate (see section 2.1.5);
- **Radio astronomy service (RAS):** The coexistence could be feasible when site-specific coordination is applied. Depending on the assumptions (e.g. terrain, weather dependant propagation conditions, clutter), studies indicated that geographical separation distances ranging from 60 km to 220 km[5] or 150 km (or 130 km) to 380 km[6] will be needed for the in-band case (see section 3.1.2). For the adjacent channel and spurious domain cases[7], the resulting maximum geographical separation distances were 100 km and 25 km, respectively. Potential mitigation measures are listed in section 3.1.2;
- **Video programme making and special events (Video PMSE):** This application operates under a national individual licensing regime. Coexistence with WBB ECS was not assessed in the technical studies, but it is expected to be manageable at a national level (through local coordination);
- **Ultra-wideband (UWB):** The operation of WBB ECS will cause degradation to the UWB end user experience for the devices operating outdoors. UWB operates under a general authorisation regime and on a non-interference, non-protected basis.

Adjacent band incumbents:

- **WAS/RLAN:** Depending on the assumptions and methodologies used, the study results indicated a range of different probabilities of interference from WBB ECS into WAS/RLAN in the adjacent band, both with and without frequency separation. ECC Report 375 did not reach a conclusion on whether frequency separation was needed. Further technical studies are needed to conclude on possible need for adjacent band protection.

[4] With channel bandwidth of 100 MHz; only 3GPP power class 3 UEs (maximum transmit power of 23 dBm) were considered in the studies, noting that no study considered fixed type UE (i.e. FWA CPE), and most studies considered urban and suburban deployments.
[5] Assuming that all interference paths are impacted by radio clutter (see section 3.1.2). The value of 60 km corresponds to annual-average atmospheric conditions, while 220 km corresponds to variable atmospheric conditions.
[6] Assuming that some interference paths are not impacted by radio clutter (see section 3.1.2). The value of 150 km corresponds to annual-average atmospheric conditions, while 380 km corresponds to variable atmospheric conditions. The value of 130 km results from additional assumptions about the tropospheric propagation and site-specific terrain and clutter.
[7] Clutter assumptions as in footnote 6, and assuming variable atmospheric conditions.

- **Other adjacent services/applications (FS, EESS, Space Research, Space Operation, PMSE, UWB):** No assessment was made on these services and applications in adjacent bands as compatibility issues are not expected.

The technical assessment concluded the following on the co-channel coexistence and compatibility between WAS/RLAN (with maximum channel bandwidth of 320 MHz) with the incumbent services and applications:

- **Fixed service (FS):** Co-channel sharing with WAS/RLAN is feasible by applying some technical conditions to restrict the operation of LPI devices to indoor environments (e.g. requirements for wired connection and integrated antenna, prohibitions on battery powered and weatherized equipment);
- **Fixed satellite service (FSS), Earth-to-space:** Co-channel sharing with WAS/RLAN is feasible when operation of LPI devices is restricted to indoor environments;
- **Fixed satellite service (FSS), space-to-Earth:** Co-channel sharing with WAS/RLAN is feasible. Site-specific studies of four ground stations in Europe confirm that WAS/RLAN can coexist with FSS downlinks under the High deployment Scenario A of ECC Report 364, with all stations meeting the I/N ≤ −10.5 dB protection criterion;
- **Radio astronomy service (RAS):** Co-channel sharing with WAS/RLAN is feasible and requires mitigation techniques (i.e. exclusion zone, power reduction) or exclusion from the 6650-6675.2 MHz band (see the list of possible mitigation techniques in section 4.2.4.1);
- **Earth exploration satellites service (EESS (passive)), sea surface temperature (SST):** CEPT did not perform technical studies to assess this topic as this work is being undertaken in ITU-R (section 2.1.5);
- **Video programme making special events (Video PMSE)**: This application operates under a national individual licensing regime. Coexistence with WAS/RLAN was not assessed in the technical studies;
- **Ultra-wideband (UWB)**: the compatibility with WAS/RLAN was not studied in the framework of this EC Mandate. UWB operates under a general authorisation regime and on a non-interference, non-protected basis.

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

[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 375: “Study and assessment of coexistence and compatibility between MFCN in the frequency band 6425-7125 MHz and incumbent spectrum users”, approved March 2026

[2] ECC Report 302: “Sharing and compatibility studies related to Wireless Access Systems including Radio Local Area Networks (WAS/RLAN) in the frequency band 5925-6425 MHz”, approved May 2019

[3] ECC Report 173: “Fixed Service in Europe Current use and future trends post 2022”, approved June 2023

[4] ERC Recommendation 25-10: “Frequency Ranges for the Use of Terrestrial Audio and Video Programme Making and Special Events (PMSE) applications”, approved 01 May 1995, latest amended June 2023, annex 4 latest amended October 2023, annex 5 latest amended October 2023

[5] ECC Report 364: “Sharing and compatibility studies related to Wireless Access Systems including Radio Local Area Networks (WAS/RLAN) in the frequency band 6425-7125 MHz”, approved January 2025

[6] ECC Decision (06)04: ”Harmonised use, exemption from individual licensing and free circulation of devices using Ultra-Wideband (UWB) technology in bands below 10.6 GHz”, approved March 2006, latest amended November 2022

[7] ECC Decision (07)01: “Harmonised use, exemption from individual licensing and free circulation of Material Sensing Devices using Ultra-Wideband (UWB) technology”, approved March 2007, latest updated July 2022

[8] ECC Decision (20)01: “On the harmonised use of the frequency band 5945-6425 MHz for Wireless Access Systems including Radio Local Area Networks (WAS/RLAN)”, approved November 2020, latest amended November 2024

[9] Decision (EU) 2021/1067: “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)”

[10] ECC Report 316: “Sharing studies assessing short-term interference from Wireless Access Systems including Radio Local Area Networks (WAS/RLAN) into Fixed Service in the frequency band 5925-6425 MHz”, approved May 2020

[11] EN 303 687: “6 GHz RLAN Harmonised Standard for access to radio spectrum”

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

[13] ERC Report 025: “The European table of frequency allocations and applications in the frequency range 8.3 kHz to 3000 GHz”, approved June 1994, latest amended November 2025

[14] CEPT Report 73: “Report from CEPT to the European Commission in response to the Mandate “to study feasibility and identify harmonised technical conditions for Wireless Access Systems including Radio Local Area Networks in the 5925-6425 MHz band for the provision of wireless broadband services” Report A: Assessment and study of compatibility and coexistence scenarios for WAS/RLANs in the band 5925-6425 MHz”, approved March 2020