



CEPT Report 82

Report from CEPT to the European Commission in response to the Mandate

“to develop least restrictive harmonised technical conditions suitable for next-generation (5G) terrestrial wireless systems for priority frequency bands above 24 GHz”

Harmonised least restrictive technical conditions for the 40.5-43.5 GHz frequency band

Report approved on 18 November 2022 by the ECC

0 EXECUTIVE SUMMARY

This Report addresses Tasks 1, 2 and 4, concerning 40.5-43.5 GHz, of the EC Mandate to CEPT to develop least restrictive harmonised technical conditions suitable for next-generation (5G) terrestrial wireless systems for priority frequency bands above 24 GHz (EC Mandate – see ANNEX 1). Taking into account the technical conditions identified, this Report addresses sharing and compatibility conditions to ensure protection of other users of spectrum in the 40.5-43.5 GHz frequency band (e.g. FS, RAS and FSS) and in adjacent bands (FSS and FS).

The harmonised technical conditions proposed for Wireless Broadband Electronic Communications Services (WBB ECS) systems in the 40.5-43.5 GHz band (see ANNEX 2) have been developed based on the main assumptions of synchronised operation and knowledge of location of the WBB ECS base stations. Depending on the authorisation regime applied in this band and in order to ensure appropriate co-existence of terrestrial systems capable of providing WBB ECS with other services in the band and in adjacent bands, there is a need for administrations to assess if it is necessary to impose additional measures (see ANNEX 3) while still respecting the least restrictive harmonised technical conditions in ANNEX 2. For an authorisation regime where the locations of base stations are not known in advance of installation, implementation of sharing conditions implies the need for information on relative location of/ or distance between interferer and victim, or on the location of one of these when planning the location of the other stations.

The least restrictive technical conditions (LRTC) includes provisions related to the coexistence between WBB ECS systems in the form of a block Edge Mask (BEM). When developing the BEM, CEPT took into consideration elements of 3GPP/ETSI standardisation and made the assumption of a hotspot deployment approach. In the case where locations of base stations are not known in advance of installation further measures may need to be considered. To assist administrations in sharing and co-existence with other services, CEPT developed guidelines in two separate ECC Recommendations.

CEPT developed guidelines to support the introduction of 5G WBB ECS while ensuring, in a proportionate way, the use of FSS receiving earth stations in the frequency band 40.5-42.5 GHz and the use of FSS transmitting earth stations in the frequency band 42.5-43.5 GHz and the possibility for future deployment of these earth stations (see ECC Recommendation (22)01). In addition, CEPT developed guidelines on measures to facilitate compatibility between WBB ECS in 40.5-43.5 GHz and receiving FSS earth stations in 39.5 - 40.5 GHz to prevent and/or resolve interference issues (see ECC Recommendation (22)02 [2]).

A review of the current and planned use of the 40.5-43.5 GHz frequency band taking into account the radio applications according to ERC Report 25 (ECA Table) [3] was done and the results of an ECC Questionnaire from 2016 were evaluated. No additional questionnaire was needed as the incumbent services to be protected in preparation for WRC-19 stayed the same i.e.: fixed service (FS), radio astronomy (RAS) and fixed-satellite service (FSS). Depending on the national situation and according to the assumption for usage of this band in this Report, a need was identified to maintain appropriate provisions in WBB ECS authorisation in 40.5-43.5 GHz for protection of fixed links and RAS in 42.5-43.5 GHz (see in section 2.2, the list of identified RAS sites). It should be noted that in some countries there are no fixed links or RAS sites.

Moreover, there is also a need in WBB ECS authorisation to maintain appropriate provisions to ensure, in a proportionate way, the use and the possibility for future deployment of FSS receiving earth stations in the frequency band 40.5-42.5 GHz and FSS transmitting earth stations in the frequency band 42.5-43.5 GHz, while protecting WBB ECS in 42.5-43.5 GHz.

Based on the results of the review of the current and planned use of the 40.5-43.5 GHz frequency band, the frequency arrangements and common and minimal (least restrictive) technical conditions were developed, including sharing conditions for the band which are suitable for terrestrial wireless systems, including 5G, in compliance with the principles of technology and service neutrality.

The technical conditions identified in this Report address sharing and compatibility conditions to ensure protection of other users of spectrum in the 40.5-43.5 GHz frequency band (e.g. FS, RAS and FSS) and in adjacent bands (e.g. FSS and FS) [4]. It is noted that sharing with active services in frequency bands above 40 GHz may be easier than systems operating at lower frequencies for several reasons [5]: high transmitting directivity can be easily achieved with antennas of practical size; the line-of-sight and atmospheric attenuation

is higher at these frequencies, diffraction is weaker (leading to stronger shielding by obstacles); the scattering of signals by the troposphere decreases with increasing frequency.

The FSS framework in the 40.5-43.5 GHz band is referenced in the revision of ECC Decision (02)04 [11].

For the protection of FSS satellite receivers in 42.5-43.5 GHz, CEPT proposes to implement a similar approach as for the protection of FSS satellite receivers at 26 GHz (CEPT Report 68 [6], ECC Decision (18)06 [7] and the 26 GHz EC Decisions (EU) 2020/590 amending Decision (EU) 2019/784) [8] including the need to monitor the evolution of WBB ECS. Under authorisation regimes where there are no means to monitor the evolution of WBB ECS density and its deployment characteristics, an in-band limit for the TRP for WBB ECS equipment could be defined at national level.

In consequence, CEPT intends to assess on regular basis the deployment of WBB ECS system including characteristics of network deployments. Administrations are invited to monitor and report annually to ECO on deployment of 40.5-43.5 GHz WBB ECS in their country and encouraged to rapidly report to ECO on cases of interference to FSS caused by WBB ECS above 40.5 GHz and the measures they have taken to resolve them.

For the protection of radio astronomy, generic compatibility studies between RAS and WBB ECS systems concluded that for the frequency band 40.5-43.5 GHz, exclusion zones around RAS stations are required. These could be managed on a case-by-case basis at a national level.

During the development of this Report, it was noted that various high bit-rate WBB ECS aerial UE applications might use this band or parts of the band in the future in some countries. No studies have been performed.

In response to Task 4, CEPT supports the current bilateral cross-border coordination process between relevant CEPT countries and intends to develop an ECC Recommendation relevant for this frequency band.

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
5G	5 th Generation mobile systems
AAS	Active Antenna Systems
BEM	Block Edge Mask
BS	Base Station
BSS	Broadcasting Satellite Service
CEPT	European Conference of Postal and Telecommunications Administrations
EC	European Commission
ECA	European Common Allocations
ECC	Electronic Communications Committee
ECS	Electronic Communication Services
EESS	Earth Exploration Satellite Service
ERC	European Radiocommunication Committee (former name of the ECC)
FS	Fixed Service
FSS	Fixed-Satellite Service
GSO	Geostationary Orbit
ITU-R	International Telecommunications Union-Radiocommunication sector
LRTC	Least Restrictive Technical Conditions
MS	Mobile Service
MSS	Mobile Satellite Service
NGSO	Non-Geostationary Orbit
OOBE	Out of Band Emissions
RAS	Radio Astronomy Service
TG	Task Group
TRP	Total Radiated Power
TS	Terminal Stations
UE	User Equipment
WBB	Wireless Broadband
WRC-19	World Radiocommunication Conference 2019

1 INTRODUCTION

This Report addresses Tasks 1, 2, and 4 of the EC Mandate to CEPT to develop least restrictive harmonised technical conditions suitable for next-generation (5G) terrestrial wireless systems for priority frequency bands above 24 GHz (EC Mandate - see ANNEX 1):

- “1. Review the current and planned use of the 40.5-43.5 GHz frequency band and identify relevant scenarios for shared spectrum use between those uses and next-generation (5G) wireless broadband electronic communications services, in order to ensure co-existence and further development of all relevant services within the band.
2. Based on the results under Task 1, develop frequency arrangements and common and minimal (least restrictive) technical conditions, including sharing conditions, for the aforementioned frequency band, which are suitable for terrestrial wireless systems, including 5G, in compliance with the principles of technology and service neutrality. In this regard, consider the need to ensure coherence of the harmonised frequency arrangements within the 40.5-43.5 GHz frequency band with the envisaged use of the 37-40.5 GHz frequency range in other world regions.”
3. *Task 3 is not in the scope of this report, as it relates to the 66-71 GHz band*
- “4. Assess the need for and develop, if necessary, guidance for cross-border coordination.”

Noting that the EC Mandate stated that the conditions under Task 2 “should take into account relevant authorisation modes and be sufficient to mitigate interference and to ensure co-existence with incumbent radio services/applications in the same band or in adjacent bands, in line with their regulatory status, including at the EU outer borders.”

This Report provides an overview of the current and planned use in 40.5-43.5 GHz and in adjacent frequency bands, describes the relevant 5G characteristics, and analyses the various coexistence issues in the band and adjacent bands. It assesses requirements for cross-border coordination, wherever relevant, including at the EU outer borders.

The relevant technical conditions to be included in the future EC Decision for WBB ECS in the 40.5-43.5 GHz frequency band under the Radio Spectrum Decision [9] are provided in ANNEX 2. This Report also analyses coexistence issues with other services in the band and in adjacent bands and assess issues to be addressed at national level taken into account the harmonised technical conditions applicable to WBB ECS.

2 EXISTING, PLANNED AND FUTURE USE OF 40.5-43.5 GHz

This frequency band is allocated to BSS, FSS, FS, MS, broadcasting service and RAS. The relevant incumbent services are described below.

2.1 FIXED SERVICE

The frequency band 40.5-43.5 GHz is allocated to the fixed service on a primary basis. ECC Report 173 [10] provides an overview of current usage and future trends of fixed service in CEPT countries. The majority of countries report an increasing usage of the frequency band 40.5-43.5 GHz for the FS in the latest update of ECC Report 173. Typical hop lengths are between 1 km and 4 km. These kinds of short links are mainly deployed in urban and suburban areas.

2.2 RAS

From the RAS perspective, there are relatively few mm-wave observatories to be protected and they are mostly located in areas of low population density.

Until recently, there have been relatively few active services operating above 40 GHz and therefore few cases of interference to the RAS have been reported.

The sites listed in Table 1 are currently operating (or capable of operating) at 42.5-43.5 GHz and should be appropriately protected from WBB ECS emissions.

Table 1: RAS sites currently operating (or capable of operating) at 42.5-43.5 GHz

Station name	Responsible administration	Location	
		Latitude	Longitude
Metsahovi	Finland	60° 13' 05" N	24° 23' 36" E
Bure	France	44° 38' 02" N	05° 54' 28" E
Effelsberg	Germany	50° 31' 29" N	06° 53' 01" E
Wetzell	Germany	49° 8' 38" N	12° 52' 40" E
Noto	Italy	36° 52' 33" N	14° 59' 20" E
Sardinia	Italy	39° 29' 34" N	09° 14' 42" E
Medicina	Italy	44° 31' 15" N	11° 38' 49" E
Torun	Poland	53° 05' 43" N	18° 33' 46" E
Yebeles	Spain	40° 31' 29" N	03° 05' 13" W
Robledo	Spain	40° 25' 38" N	04° 14' 57" W
Pico Veleta	Spain	37° 3' 58" N	3° 23' 34" W
Onsala	Sweden	57° 23' 45" N	11° 55' 35" E
Cambridge	United Kingdom	52° 09' 59" N	00° 02' 20" E

2.3 FSS

The frequency band 40.5-43.5 GHz is part of the generally known "Q/V band" (Q/V band also includes 37.5 - 47 GHz, 47.2-50.2 GHz and 50.4-52.4 GHz). Many satellite operators have already launched or are developing systems that will use the Q/V band allocations in the near future including in Europe and some

operators have already obtained authorisations in other regions. Earth stations operating with GSO and non-GSO satellites are planned for these bands.

Therefore, the satellite users will need access to spectrum for gateway stations and for terminals. There are plans for gateway earth stations use which implies the need for access to large amounts of spectrum required for feeder links. There are also future plans for the introduction of user terminals including mobile terminals (e.g. using phased array antennas).

The frequency band 40.5-42.5 GHz is allocated to the FSS in the space-to-Earth direction and to the BSS. The interest in this band in Europe is primarily for receiving gateway FSS earth stations where a relatively limited number of stations is needed, which are feasible to operate on a shared basis with terrestrial services.

The frequency band 42.5-43.5 GHz is allocated to the FSS in the Earth-to-space direction. The interest in this band in Europe is primarily for transmitting gateway FSS earth stations, which are feasible to operate on a shared basis with terrestrial services. For this frequency band, there are also satellite space station receivers planned, for which studies have shown that sharing is feasible.

CEPT updated the FSS framework in the 40.5-43.5 GHz band accordingly (revision of ECC Decision (02)04 [11]) and developed guidelines (ECC Recommendation (22)01) [1] to ensure in a proportionate way:

- the use of FSS receiving earth stations in the frequency band 40.5-42.5 GHz;
- the use of FSS transmitting earth stations in the frequency band 42.5-43.5 GHz;
- the possibility for future deployment of these earth stations.

2.4 FSS AND MSS ADJACENT BAND USE

The band 39.5-40.5 GHz is allocated to the FSS and the MSS, both services in the space-to-Earth direction and is subject to a relevant designation within CEPT for the usage of coordinated and uncoordinated FSS earth stations (see revised ERC Decision (00)02 [12]). CEPT has retained this framework for FSS earth stations and designated the band for MSS earth stations (space-to-Earth).

The band 43.5-45.5 GHz is allocated to the MSS without limitation to direction, and it is currently assumed to be used by Earth-to-space direction only.

The band 39.5-40.5 GHz is expected to be used by coordinated receiving FSS earth stations, for which the location of such stations is known. The band is also expected to be used by uncoordinated receiving earth stations, whether FSS or MSS, for which the location of the stations is not known.

When drafting this Report, both GSO and NGSO systems have been considered in dense urban and urban scenarios. In the suburban scenario, CEPT studied GSO FSS earth stations.

CEPT developed guidelines on measures to facilitate coexistence between WBB ECS in 40.5-43.5 GHz and receiving FSS earth stations in 39.5-40.5 GHz (see ECC Recommendation (22)02 [2]) including possible measures to be included in authorisation regimes.

3 WBB ECS CHARACTERISTICS

3.1 WBB ECS USAGE SCENARIOS IN 40.5-43.5 GHZ

A progressive introduction of 5G services in 40.5-43.5 GHz is foreseen in Europe.

In the 40.5-43.5 GHz band, WBB ECS is intended to support mainly hotspots in urban and suburban areas. The deployment of WBB ECS is expected to target only cells with a small range. Due to the characteristics of this frequency band, there is no expectation that it will be used for contiguous wide/nationwide coverage of WBB ECS networks areas. There may be a need for a limited number of hotspots in rural areas. WBB ECS networks at 40 GHz could be deployed indoor and outdoor. Virtually no WBB ECS deployment is expected in the 40 GHz band in rural areas and therefore this scenario has not been studied in this Report.

It has been assumed, when developing the attached harmonised technical conditions that WBB ECS base stations will operate under an authorisation regime where locations are known.

CEPT intends to assess the evolution of WBB ECS system characteristics, including network deployments, in a three-year timeline (or earlier if needed), so as to be able to provide additional confidence that such evolution will continue to ensure the adequate protection of other services, in particular space services.

In addition, the harmonised technical conditions include a general provision requiring that outdoor base station deployments shall ensure that the antenna beam is normally below the horizon and outdoor base station shall not have mechanical pointing above the horizon. This would help to prevent 5G base stations with antenna pointing directly towards the sky which, in case there are many such deployments, would significantly increase the interference potential to FSS.

During the development of this Report, it was noted that various high bit-rate WBB ECS aerial UE applications might use this band or parts of the band in the future in some countries. However, the connectivity from aerial UE to ground BS may have an impact, e.g. on separation distance from RAS stations and FSS earth stations and coexistence with adjacent band services. It should further be noted that the proposed WBB ECS framework in this Report requires a limitation on antenna pointing above the horizon reducing opportunity for aerial UE applications. Before possible aerial UE usage in the band, studies would be required. Currently no studies have been performed for aerial UE in this band or part of the band.

3.2 WBB ECS PARAMETERS USED IN SHARING STUDIES

The characteristics of WBB ECS systems used in the sharing studies are those used in the ITU preparatory work for WRC-19 agenda item 1.13, in particular in Recommendation ITU-R M.2101 "Modelling and simulation of IMT networks and systems in sharing and compatibility studies" [13].

3.3 DEFINITION OF TOTAL RADIATED POWER (TRP)

TRP is defined as the integral of the power transmitted in different directions over the entire radiation sphere as shown in the expression below.

$$TRP \stackrel{\text{def}}{=} \frac{1}{4\pi} \int_0^{2\pi} \int_0^\pi P(\theta, \varphi) \sin(\theta) d\theta d\varphi \quad (1)$$

Where:

- TRP is equal to the total conducted power input into the antenna array system less any losses in the antenna array system;
- $P(\theta, \varphi)$: power radiated by an antenna array system in direction (θ, φ) .

$$P(\theta, \varphi) = P_{Tx}g(\theta, \varphi) \quad (2)$$

Where:

- P_{Tx} : conducted power (Watts) input to the array system;
- $g(\theta, \varphi)$: array systems directional gain along (θ, φ) direction.

The maximum e.i.r.p. for an active antenna system (AAS) base station can be written in log domain as follows:

$$EIRP_{max} = TRP + G_E + 10\log_{10}N \quad (3)$$

Where:

- G_E : is the antenna element gain in dBi;
- N : is the number of beam forming elements.

3.4 UNSYNCHRONISED NETWORKS

Baseline and transitional region limits are defined in this Report assuming synchronised WBB ECS operation. For cases other than synchronised WBB ECS operations, administrations may define appropriate mitigation measures to be applied in case of unsynchronised or semi-synchronised operations, taking into account ECC Report 307 which provides a toolbox on coexistence of MFCN in 24.25-27.5 GHz in unsynchronised and semi-synchronised modes [14]. However, it should be noted that further assessments would be required in order to determine the applicability of ECC Report 307 results on WBB ECS BS in 40 GHz band due to different parameters such as the WBB ECS BS antenna array size and conducted power, carrier frequency, and WBB ECS outdoor hotspot deployment characteristics i.e. single sector.

4 COEXISTENCE ISSUES

The section reviews the various coexistence issues with Fixed links, RAS and FSS.

Co-existence studies for WBB ECS with respect to a number of other services, including RAS and FSS, were conducted for WRC-19 including for the band 40.5-43.5 GHz and both assumptions and conclusions of these studies have been reused as appropriate.

The underlying technical assumptions for these studies are detailed in various ITU-R TG 5/1 documents such as the Chairman's Report (Document 5/1-36) [15], Recommendation ITU-R M.2101 [13] and Recommendation ITU-R P.2108 [16].

It should be recognised that any deviation from these assumptions may have a large impact on the necessary coordination and exclusion zone sizes to be implemented at national level in order to protect other services as RAS and FSS. The separation distances resulting from this WRC-19 work were generally provided by generic studies assuming flat terrain modelling. Separation distances for individual RAS and/or FSS earth stations should be calculated using site-specific terrain and clutter information, where available, which it is anticipated would reduce the necessary separation distances for some RAS and/or FSS earth station sites.

In addition it should be noted that if a significant fraction of WBB ECS base stations in urban/suburban areas were installed above roof tops, the clutter loss for these would be reduced, which could potentially increase the necessary separation distances.

It should further be noted that WBB ECS BS for hotspot deployment use single sector active antenna systems (AAS) and hence, the interference potential is dependent on the choice made for the location of the WBB ECS BS to cover its service area and the resulting pointing direction, appropriate selection of which may contribute to reduce interference issues.

CEPT developed the analysis hereafter in order to appropriately protect the radio astronomy service in the 42.5-43.5 GHz and receiving earth stations in 40.5-42.5 GHz and satellite receivers in 42.5-43.5 GHz.

There is also a need to maintain the possibility for existing and future FSS earth stations to operate in the band 40.5-43.5 GHz. CEPT developed guidelines to support the introduction of WBB ECS while ensuring, in a proportionate way, the use of FSS receiving earth stations in the frequency band 40.5-42.5 GHz and the use of FSS transmitting earth stations in the frequency band 42.5-43.5 GHz and the possibility for future deployment of these earth stations. CEPT decided to update the ECC framework (ECC Decision (02)04 [11]) to reflect FSS use of the 40.5-43.5 GHz band.

In addition, CEPT developed measures to facilitate coexistence between WBB ECS in 40.5-43.5 GHz and receiving FSS earth stations in 39.5-40.5 GHz (see ECC Recommendation (22)02 [2]) including possible measures to be included in authorisation regimes.

4.1 FIXED LINKS

Studies for WRC-19 which evaluated the possible coexistence between WBB ECS and FS in the mm-Wave bands show that coexistence is generally possible, but that coordination between both services is needed, if they should be deployed in the same area in the same frequency range. The coordination could be done on a case-by-case basis at national level.

Any migration issues are to be managed at national level and are subject to national decision. Co-channel deployment of WBB ECS with fixed links remains possible depending on national situations. There is no need to define a common date for management of a migration to an alternative band or to clear the 40.5-43.5 GHz band from fixed services. Due to the nature of fixed service bi- or multilateral cross-border coordination may be necessary.

4.2 RADIO ASTRONOMY SERVICE

RAS sharing with WBB ECS is feasible when the location of WBB ECS base stations is known. For WBB ECS base stations at these frequencies high transmit directivity can be achieved with active antenna systems (AAS) and various site engineering techniques may reduce the risk of interference in the direction of an observatory. WBB ECS use of the 42.5-43.5 GHz band will involve sharing with the RAS on a co-primary basis and RAS operations may also be affected by the unwanted emissions from WBB ECS use of the adjacent band at 40.5 - 42.5 GHz. For RAS, the interference issue is from WBB ECS networks into RAS equipment operating on RAS sites.

For the protection of radio astronomy, generic compatibility studies between RAS and WBB ECS systems considering both in-band and adjacent band co-existence issues for various WBB ECS deployment scenarios have been studied for WRC-19; this work concluded that for the frequency band 40.5-43.5 GHz, exclusion zones around RAS stations are required to protect this service from WBB ECS emissions. These could be managed on a case-by-case basis at national level and the size of the zone would be dependent on the local environment, such as antenna heights, clutter, and expected WBB ECS deployment densities.

Where the locations of the planned WBB ECS base stations are not known in advance of installation, the protection of RAS can be achieved through the calculation of a geographical separation distance and the determination of exclusion zones around RAS stations, which are defined at national level. Protection of RAS is achieved by ensuring that the WBB ECS BS are located outside of this exclusion zone. A mechanism such as a regulatory requirement to respect exclusion zones defined and applied on a national basis (taking into account terrain, clutter, etc.) would be needed in order to ensure protection of the RAS site. No technical mechanism to prevent interference has been identified for the WBB ECS equipment during the drafting of the Report, other than locating new base stations outside of a pre-determined exclusion zone.

4.2.1 Shared band (radio astronomy service and WBB ECS in 42.5-43.5 GHz)

A generic in-band sharing study between the RAS in the band 42.5-43.5 GHz and WBB ECS systems in the same band shows that separation distances around RAS stations are required to protect this service from WBB ECS operations, with radii of up to 56 km.

4.2.2 Adjacent band (radio astronomy service in 42.5-43.5 GHz and WBB ECS in 40.5-42.5 GHz)

Separation distances around RAS stations in 42.5-43.5 GHz may be required to avoid interference from WBB ECS unwanted emissions. Within ITU-R TG 5/1, a compatibility study was performed between the RAS in the band 42.5-43.5 GHz and WBB ECS in the band 40.5-42.5 GHz indicating that separation distances ranging from 7 km to 44 km are required around RAS stations when considering both the WBB ECS OOB and spurious emissions.

Exclusion zones around RAS sites should be determined on a site-by-site basis at national level taking into account the OOB limits established in Table 2 and Table 3 of the ECC Decision (22)06 [17] which correspond to the limits defined in ETSI TS 138 104 V17.6.0 (Table 9.7.4.3.3-2) [18], which refers to emission levels above 42.5 GHz for WBB ECS operating in 40.5-42.5 GHz as follows:

- either the OOB level in 42.5 -43.5 GHz;
- or limits of transitional region;
- or baseline requirements of WBB ECS.

CEPT noted the WBB ECS BS OOB emission limits applicable in the frequency range 37-52.6 GHz are defined by standardisation. Any relaxation of the limits from the ETSI harmonised standard compared to the assumptions used in the studies supporting this CEPT analysis may lead to an increased risk of interference.

4.3 FIXED SATELLITE SERVICE AND MOBILE SATELLITE SERVICE

Within 40.5-43.5 GHz, two sub-bands are relevant for space and satellite services:

- 40.5-42.5 GHz allocated to FSS (space-to-Earth);
- 42.5-43.5 GHz allocated to FSS (Earth-to-space).

CEPT developed ECC Recommendation (22)01 delivering “Guidelines to support the introduction of MFCN in 40.5-43.5 GHz while ensuring, in a proportionate way, the use of FSS receiving earth stations in the frequency band 40.5-42.5 GHz and the use of FSS transmitting earth stations in the frequency band 42.5-43.5 GHz and the possibility for future deployment of these earth stations” [1].

Section 4.3.3 addresses FSS/MSS below 40.5 GHz. CEPT is currently updating ECC Decision (02)04 [11] to reflect FSS use of the 40.5-43.5 GHz band.

4.3.1 Fixed-Satellite Service in the band 40.5-42.5 GHz

With respect to the protection of the receiving FSS earth station based on the results of the WRC-19 studies, coexistence issues can be managed at national level (see ANNEX 3).

It is noted that the protection of these satellite services is generally based on an authorisation regime where the location of WBB ECS base stations is known. Where this is not the case, additional provisions are needed. CEPT has developed guidelines to help Member States to manage this issue at national level (see ANNEX 3). Administrations may need to establish limits on the e.i.r.p./TRP of WBB ECS stations (base stations and user terminals) as a basis to determine the required coordination distances without impacting the LRTC developed in this Report. The ECC Recommendation mentioned above will assist administrations on this issue.

WRC-19 sharing studies between IMT and FSS (space-to-Earth) in this band provided results in terms of separation distances between an IMT network and an FSS earth station, and probabilities that an IMT network may have the potential to cause interference to an FSS earth station at different separation distances. Separation distances calculated in these studies are between 210 meters, up to a maximum of around 2 kilometres, with low probabilities that the levels of aggregate emissions from WBB ECS network may potentially cause interference to an FSS earth station.

Separation distances for individual earth stations need to be calculated using site-specific terrain and clutter information. It is considered that the protection of FSS (space-to-Earth) in this band is a national issue to be addressed on a case-by-case basis since the use of the band by FSS is limited to coordinated earth stations.

4.3.2 Fixed-Satellite Service in the band 42.5-43.5 GHz

This section refers to WBB ECS coexistence issues with receiving space stations and transmitting earth stations.

4.3.2.1 Protection of the FSS satellite receivers in 42.5-43.5 GHz

With respect to the protection of the FSS satellite receivers in 42.5-43.5 GHz, based on the deployment scenarios and characteristics provided for the WRC-19 studies, most sharing studies between IMT and FSS (Earth-to-space) in the 42.5-43.5 GHz band show that there is a sufficient protection margin between the level of emissions that would be expected from WBB ECS networks and the level that could potentially cause interference (aggregated) to FSS space stations.

The results of WRC-19 studies are summarised as follows:

- FSS GSO: sharing studies using the agreed parameters have shown that GSO FSS would be protected with a positive margin. A study showed I/N values ranging from -43.46 dB I/N to -26.5 dB I/N. When compared with the -10.5 dB I/N (exceeded up to 20% or I/N average) protection criterion, all studies show a positive margin. Sensitivity analysis in line with the agreed methodology on how to vary the parameters found that a positive margin compared to the protection criterion is maintained;
- FSS non-GSO: sharing studies using the agreed parameters have shown that non-GSO FSS would be protected with a positive margin. Studies have shown I/N values ranging from -34.8 dB I/N to -38.2 dB I/N for both fixed orbit positions and dynamic cases. One study showed a worst case I/N value of -21.3 dB I/N. However, several other simulations under similar assumptions have resulted in an I/N below -30 dB instead of -21.3 dB. When compared with the -10.5 dB I/N (20% or I/N average) protection criterion, all studies show a positive margin.

CEPT proposes to implement a similar approach as for the protection of FSS satellite receivers at 26 GHz:

- Assessment, on a regular basis, of the deployment of WBB ECS system including characteristics of network deployments. Administrations are invited to monitor and report annually to ECO on deployment of 40.5-43.5 GHz WBB ECS in their country. The framework will be reviewed in a three year period or earlier in order to provide additional confidence that such evolution will continue to ensure the adequate protection of other services, in particular space services;
- Under authorisation regimes where there are no means to monitor the evolution of WBB ECS density and its deployment characteristics, an in-band limit for the TRP for WBB ECS equipment could be defined. This could compensate for the uncertainty related to the deployment density and to the effective implementation of the antenna pointing restriction, as well as the impossibility for reviewing precisely the effective deployment characteristics and their impact on the interference level to satellites;
- General antenna provision: In addition, the harmonised technical conditions include a general provision requiring that outdoor base station deployments shall ensure that the antenna beam is normally below the horizon and outdoor base stations shall not have mechanical pointing above the horizon. This would help in preventing WBB ECS base stations with antenna pointing directly towards the sky which, in case there are many such deployments, would significantly increase the interference potential to FSS.

An authorisation regime where the locations of WBB ECS base stations are planned and well known would assist in the protection of these satellite services.

4.3.2.2 Protection of WBB ECS from FSS transmitting earth station emissions

Based on results of the WRC-19 sharing studies, coexistence issues in terms of protection of WBB ECS from FSS earth station emissions can be managed at national level, with the LRTC developed in this Report.

Regarding interference from FSS ESs into WBB ECS, studies showed separation distances between WBB ECS base stations and FSS earth stations are from 160 m to 4 km. Where FSS earth stations and WBB ECS stations are in the same geographical area sharing could be dealt with on a case-by-case basis.

For the case where the location of WBB ECS base stations is not known in the authorisation framework, it could be an option to rely on the provision that such WBB ECS equipment operates on a non-protection basis, but this may result in cases of insufficient protection of WBB ECS from emission of FSS earth stations. Other options are described in the ECC Recommendation (22)01 [1].

4.3.3 Fixed-Satellite Service/MSS below 40.5 GHz

In the case of coordinated earth stations operated below 40.5 GHz it can be assumed, based on previous studies¹ and as a worst case, that compatibility could be feasible with limited separation distance. In this case the same measures as those considered for in-band sharing between WBB ECS networks, with the assumption that location of the base station is known, and coordinated earth stations could be used for adjacent band scenarios (e.g. calculation of appropriate separation distances based on site-specific terrain and or clutter information).

Both when the locations of the earth stations and/or the WBB ECS stations are known or not known, studies show that there is a low probability of interference and additional measures may be considered by administrations, as necessary, to ensure the protection of the receiving earth stations below 40.5 GHz.

ECC Recommendation (22)02 on “Measures to facilitate compatibility between MFCN operating in 40.5-43.5 GHz and FSS earth stations receiving in 39.5-40.5 GHz and to prevent and/or resolve interference issues” [2] provides guidelines for both scenarios where locations are known and where not known.

The studies concluded that no additional harmonised technical measures are needed to WBB ECS or FSS to enable compatibility at the 40.5 GHz boundary.

In this regard no additional BEM was developed. However, the protection of adjacent services are based on the assumption that the WBB ECS out-of-band limit in the FSS earth station channel of operation is -

¹ The results of the WRC-19 sharing studies between co-frequency FSS and IMT systems in the band 40.5-42.5 GHz

13 dBm/MHz (4 dBm/(50 MHz)) as a compromise if all the possible configurations of the WBB ECS and FSS ES channels of operation are considered. It is noted that this assumption does not amend the ETSI standard requirements.

Although not forming part of the BEM, the assumption for the out-of-band limits in order to protect the adjacent services used in the studies are provided hereafter:

- The TRP of -5 dBm/MHz ($0 \leq \Delta f < 20$ MHz), -13 dBm/MHz ($20 \text{ MHz} \leq \Delta f < 400$ MHz) and spurious limits ($\Delta f > 400$ MHz), valid below 40.5 GHz and above 43.5 GHz², which are taken from Table 9.7.4.3.3-2 in ETSI TS 138 104 V17.6.0 [18].

From the spectrum mask, it was agreed to use -13 dBm/MHz (4dBm/50 MHz) for the main part of the studies.

This assumption is fulfilled by the WBB ECS BS when complying to ETSI TS 138 104 (the limits of Table 9.7.4.3.3-2) for a contiguous bandwidth of 200 MHz or below.

If the limits from the ETSI Harmonised standard were relaxed compared to the assumptions used in the studies this may lead to an increased risk of interference.

In addition, CEPT included in its framework (ECC Decision (22)06 [17]) on WBB ECS a clause to require a review after three years, or earlier if needed. CEPT invited administrations to monitor and report annually to ECO on deployment of 40.5-43.5 GHz WBB ECS in their country. It is also required to rapidly report to ECO on cases of interference to FSS caused by WBB ECS above 40.5 GHz and the measures that have been taken to resolve them. The relevant information collected in that context could benefit in the review of the EC framework as appropriate.

CEPT developed ECC Recommendation (22)02 on “Measures to facilitate compatibility between MFCN operating in 40.5-43.5 GHz and FSS earth stations receiving in 39.5-40.5 GHz and to prevent and/or resolve interference issues” [2]. This addresses receiving FSS/MSS earth stations, which are designated for the use in the frequency band 39.5-40.5 GHz, for GSO and non-GSO satellite systems, through ERC Decision (00)02 [12].

In addition, for terminal stations, adjacent services are expected to be protected by requirements of the ETSI TS 138.101-2 v.17.6.0 (Table 6.5.2.1-1) [20].

² For information, WBB ECS BS OBUE limits applicable in the frequency range 37-52.6 GHz in accordance with [18]:

Frequency offset from 40.5-43.5 GHz band	Maximum Total Radiated Power (TRP)	Measurement Bandwidth
$0 \text{ MHz} \leq f \leq 0.1 \cdot BW_{\text{contiguous}}$	12 dBm	50 MHz
$0.1 \cdot BW_{\text{contiguous}} \leq f \leq \Delta f_B$	4 dBm	50 MHz
$\Delta f_B \leq f \leq \Delta f_{\text{max}}$	2 dBm	50 MHz
<ul style="list-style-type: none"> - NOTE 1: For non-contiguous spectrum operation within any operating band the limit within sub block gaps is calculated as a cumulative sum of contributions from adjacent sub-blocks on each side of the sub-block gap - NOTE 2: $\Delta f_B = 2 \cdot BW_{\text{contiguous}}$ when $BW_{\text{contiguous}} \leq 500$ MHz, otherwise $\Delta f_B = BW_{\text{contiguous}} + 500$ MHz - NOTE 3: $BW_{\text{contiguous}}$ corresponds to the WBB ECS BS transmission bandwidth - NOTE 4: Δf_{max} corresponds to the maximum offset of the operating band unwanted emissions mask from the operating band edge. For the 40.5-43.5 GHz band $\Delta f_{\text{max}} = 1500$ MHz 		

5 WBB ECS (5G) AUTHORISATION REGIME

It is noted that definition of the authorisation regime is a national matter. The harmonised least restrictive technical conditions have been developed with the assumption that the locations of BSs are known. Depending on the authorisation regime applied in this band and in order to ensure appropriate co-existence of or compatibility between terrestrial systems capable of providing wireless broadband electronic communications services with other services in the band and in adjacent bands, there is a need for administrations to assess if it is necessary to impose additional measures while still respecting the least restrictive harmonised technical conditions included in the ANNEX 2.

In cases where the locations of WBB ECS base stations are not known in advance of installation, additional measures were identified where applicable to be considered by administrations on a national basis in ANNEX 3 while still respecting the least restrictive harmonised technical conditions. It should be noted that implementation of sharing conditions implies the need for information on relative location of/or distance between interferer and victim, or on the location of one of these when planning the location of the other. This approach is fully consistent with the one adopted by ECC concerning authorisation regimes regarding 26 GHz in response to a letter to the European Commission clarifying the situation (see Minutes ECC(19)081, Annex 09 [19]). The contents of this letter have also been seen as relevant to 40.5-43.5 GHz in the context of the authorisation regime and when developing the response to this EC Mandate taking into account relevant authorisation modes.

6 CONCLUSIONS

This Report addresses Tasks 1, 2 and 4, concerning 40.5-43.5 GHz, of the EC Mandate to CEPT to develop least restrictive harmonised technical conditions suitable for next-generation (5G) terrestrial wireless systems for priority frequency bands above 24 GHz (EC Mandate - see ANNEX 1). Taking into account the technical conditions identified this Report addresses sharing and compatibility conditions to ensure protection of other users of spectrum in the 40.5-43.5 GHz frequency band (e.g. FS, RAS and FSS) and in adjacent bands (FSS and FS).

The harmonised technical conditions proposed for Wireless Broadband Electronic Communications Services (WBB ECS) systems in the 42 GHz band (see ANNEX 2) have been developed based on the main assumptions of synchronised operation and knowledge of location of the WBB ECS base stations. Depending on the authorisation regime applied in this band and in order to ensure appropriate co-existence of terrestrial systems capable of providing WBB ECS with other services in the band and in adjacent bands, there is a need for administrations to assess if it is necessary to impose additional measures (see ANNEX 3) while still respecting the least restrictive harmonised technical conditions in ANNEX 2. For an authorisation regime where the location of base stations are not known in advance of installation, implementation of sharing conditions implies the need for information on relative location of/or distance between interferer and victim, or on the location of one of these when planning the location of the other station.

When developing the BEM, CEPT took into consideration elements of 3GPP/ETSI standardisation and made the assumption of a hotspot deployment approach. In the case where location of base stations are not known in advance of installation further measures may need to be considered. To assist administrations in sharing and co-existence with other services, CEPT developed guidelines in two separate ECC Recommendations.

CEPT developed guidelines to support the introduction of 5G WBB ECS while ensuring, in a proportionate way, the use of FSS receiving earth stations in the frequency band 40.5-42.5 GHz and the use of FSS transmitting earth stations in the frequency band 42.5-43.5 GHz and the possibility for future deployment of these earth stations (see ECC Recommendation (22)01 [1]). In addition, CEPT developed guidelines on measures to facilitate compatibility between WBB ECS in 40.5-43.5 GHz and receiving FSS earth stations in 39.5-40.5 GHz to prevent and/or resolve interference issues (see ECC Recommendation (22)02 [2]).

A review of the current and planned use of the 40.5-43.5 GHz frequency band taking into account the radio applications according to ERC Report 25 (ECA Table) [3] was done and the results of an ECC Questionnaire from 2016 were evaluated. No additional questionnaire was needed as the incumbent services to be protected in preparation for WRC-19 stayed the same i.e.: fixed service (FS), radio astronomy (RAS) and fixed-satellite service (FSS). Depending on the national situation and according to the assumption for usage of this band in this Report, a need was identified to maintain appropriate provisions in WBB ECS authorisation in 40.5-43.5 GHz for protection of fixed links and RAS in 42.5-43.5 GHz (see in section 2.2, the list identified RAS sites). It should be noted that in some countries there are no fixed links or RAS sites. Moreover, there is also a need to ensure, in a proportionate way, the use and the possibility for future deployment of FSS receiving earth stations in the frequency band 40.5-42.5 GHz and FSS transmitting earth stations in the frequency band 42.5-43.5 GHz, while protecting WBB ECS in 42.5-43.5 GHz.

Based on the results of the review of the current and planned use of the 40.5-43.5 GHz frequency band, the frequency arrangements and common and minimal (least restrictive) technical conditions were developed, including sharing conditions for the band which are suitable for terrestrial wireless systems, including 5G, in compliance with the principles of technology and service neutrality.

The technical conditions identified in this Report address sharing and compatibility conditions to ensure protection of other users of spectrum in the 40.5-43.5 GHz frequency band (e.g. FS, RAS and FSS) and in adjacent bands (e.g. FSS and FS) [4]. It is noted that sharing with active services above 40 GHz may be easier than systems operating at lower frequencies for several reasons [5]: high transmitting directivity can be easily achieved with antennas of practical size; the line-of-sight and atmospheric attenuation is higher at these frequencies, diffraction is weaker (leading to stronger shielding by obstacles); the scattering of signals by the troposphere decreases with increasing frequency.

The FSS framework in the 40.5-43.5 GHz band is referenced in the revision of ECC Decision (02)04 [11].

For the protection of FSS satellite receivers in 42.5-43.5 GHz, CEPT proposes to implement a similar approach as for the protection of FSS satellite receivers at 26 GHz (CEPT Report 68 [6], ECC Decision 18(06) [7] and the 26 GHz EC Decisions (EU) 2020/590 amending Decision (EU) 2019/784 [8]) including the need to monitor the evolution of WBB ECS. Under authorisation regimes where there are no means to monitor the evolution of WBB ECS density and its deployment characteristics, an in-band limit for the TRP for WBB ECS equipment could be defined at national level.

In consequence, CEPT intends to assess on regular basis the deployment of WBB ECS system including characteristics network deployments. Administrations are invited to monitor and report annually to ECO on deployment of 40.5-43.5 GHz WBB ECS in their country and encouraged to rapidly report to ECO on cases of interference to FSS caused by WBB ECS above 40.5 GHz and the measures they have taken to resolve them.

For the protection of radio astronomy, generic compatibility studies between RAS and WBB ECS systems concluded that for the frequency band 40.5-43.5 GHz, exclusion zones around RAS stations are required. These could be managed on a case-by-case basis at national level.

During the development of this Report, it was noted that various high bit-rate WBB ECS aerial UE applications might use this band or in parts of the band in the future in some countries. No studies have been performed.

In response to Task 4, CEPT supports the current bilateral cross-border coordination process between relevant CEPT countries and intends to develop relevant ECC Recommendation for this frequency band.

ANNEX 1: CEPT MANDATE

EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR COMMUNICATIONS NETWORKS, CONTENT AND
TECHNOLOGY

The Director-General

Brussels
CNECT.B.4

MANDATE TO CEPT

TO DEVELOP LEAST RESTRICTIVE HARMONISED TECHNICAL CONDITIONS SUITABLE FOR NEXT-GENERATION (5G) TERRESTRIAL WIRELESS SYSTEMS FOR PRIORITY FREQUENCY BANDS ABOVE 24 GHz

1. PURPOSE

This Mandate is a follow-up to the Commission mandates regarding the development of harmonised technical conditions suitable for the provision of next-generation (5G) electronic communications services in ‘pioneer’ bands (RSCOM16-40rev3) as well as in EU-harmonised bands (RSCOM18-19rev1). It should deliver least restrictive harmonised technical conditions in the context of technology and service neutrality, including relevant sharing conditions, which allow use of the priority frequency band 40.5-43.5 GHz for terrestrial wireless systems capable of providing wireless broadband electronic communications services. Furthermore, it should assess the need to update the EU-harmonised technical conditions for the same type of use of the priority frequency band 66-71 GHz. The technical conditions for both bands should take into account 5G usage scenarios related to very high-capacity networks and meet the overarching objective of ensuring efficient spectrum use.

2. POLICY CONTEXT AND INPUTS

The ITU-R vision for the next-generation mobile telecommunications¹ outlines three major 5G usage scenarios – enhanced mobile broadband (eMBB), massive machine type communications (mMTC), and ultra-reliable and low latency communications (URLLC). Millimetre-wave bands are particularly suitable for the provision of high-speed and low-latency services while ensuring high network capacity.

In its 5G Action Plan², the Commission advanced action on the EU-level identification and harmonisation of 5G spectrum regarding pioneer frequency bands as well as **additional** frequency bands, based on the opinion of the Radio Spectrum Policy Group (RSPG). In its Opinions on a

¹ In the ITU context of "International Mobile Telecommunications for 2020 (IMT2020)", s. ITU Recommendation: https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I!!PDF-E.pdf

² See: <https://ec.europa.eu/digital-single-market/en/5g-europe-action-plan>

"Strategic Roadmap towards 5G in Europe"³, the RSPG identified the 40.5-43.5 GHz and 66-71 GHz frequency bands as priority bands for the rollout of 5G terrestrial wireless systems in the Union. The RSPG considered the band 40.5-43.5 GHz as a viable option for 5G in the longer term, taking into account the support from mobile industry and the need to take into account the general balance between the mobile and satellite sectors to access the 40-50 GHz frequency range. The RSPG takes the view that shift of non-5G use from other bands to the 40.5-43.5 GHz band should be avoided as far as possible in order to facilitate its availability for 5G in the future.

Furthermore, the RSPG emphasized that there is no reported use of the 66-71 GHz frequency band. Its proximity to the 57-66 GHz band, already designated and used for multiple-gigabit wireless systems (WiGig), indicates that 5G equipment could potentially be available in the 66-71 GHz frequency band relatively early by benefiting from the ecosystem being developed in the adjacent band, in particular under general authorisation, which remains an important enabler of innovative 5G services and applications. The 66-71 GHz band has better propagation characteristics than the adjacent 57-66 GHz band as it falls outside the so-called oxygen absorption peak, and therefore can be a viable alternative to lower mm-wave bands ensuring comparable cell radiuses in the range of 50-200 metres.

The 66-71 GHz frequency band is currently harmonised in the Union by virtue of the Commission Decision on short range devices⁴ for use with wideband data transmission devices. Any amendment to the EU-harmonised technical conditions applicable to this band, in order to accommodate 5G use, should be implemented unambiguously within a single legal instrument.

The World Radiocommunication Conference in 2019 (WRC-19) amended the ITU-R Radio Regulations by providing a global mobile allocation and IMT (including 5G) identification of both, the 37-43.5 GHz frequency band, or portions thereof (i.e. including the case of using only the 40.5-43.5 GHz band), and the 66-71 GHz frequency band. Therefore, use of the 37-43.5 GHz frequency range would vary across the globe within the concept of a common tuning range. The deployment of 5G services worldwide would benefit from a degree of coherence of the applicable harmonised technical conditions throughout this frequency range on a global scale. For the 40.5-43.5 GHz frequency band, the amended Radio Regulations stipulate measures to ensure co-existence between 5G services and fixed satellite services (space-to-earth) as well as radio astronomy services within the band. The amended Radio Regulations also provide for coexistence of 5G systems and wireless access systems such as multiple-gigabit wireless systems within the 66-71 GHz frequency band. Furthermore, co-existence with certain satellite services should be considered for the latter band.

3. JUSTIFICATION

Pursuant to Article 4(2) of the Radio Spectrum Decision⁵ the Commission may 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 1 of the Radio Spectrum Decision, activities under the Decision must facilitate policy making with regard to the strategic planning and harmonisation of radio spectrum use as well as ensure the

³ Documents RSPG16-032 final (9 November 2016) and RSPG18-005 final (30 January 2018)

⁴ Commission Decision 2006/771/EC as last amended by Commission Decision (EU) 2019/1345.

⁵ Decision 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, OJ L 108 of 24.4.2002

effective implementation of radio spectrum policy in the EU while serving the aim of coordination of policy approaches. Furthermore, they shall take due account of the work of international organisations related to spectrum management such as ITU.

The Commission Communication on the Gigabit Society⁶ sets out even more ambitious Gigabit connectivity targets for households, socio-economic drivers, urban areas and major transport paths, taking account progressing 5G network rollout. The European Electronic Communications Code⁷ refers to the importance of studying the 40.5-43.5 GHz and 66-71 GHz frequency bands for high-capacity 5G networks.

Advances in international standardisation and regulations within 3GPP and ITU, as well as ongoing international deployment of 5G, call for a continued coordination at the EU level in order to deliver sufficient and appropriate 5G spectrum in the Union according to anticipated deployment of 5G usage scenarios.

4. TASK ORDER AND SCHEDULE

CEPT is herewith mandated to develop harmonised least restrictive technical conditions for the 40.5-43.5 GHz frequency band and to revise, only if necessary, the harmonised technical conditions in the 66-71 GHz frequency band, with a view to their suitability for *next-generation (5G) terrestrial wireless systems*, in line with the policy priorities set out in this Mandate and taking into account relevant needs for shared spectrum use with incumbent uses. CEPT should give utmost consideration to the overall EU spectrum policy objectives such as effective and efficient spectrum use and take utmost account of applicable principles established in EU law such as those relating to service and technological neutrality, non-discrimination and proportionality insofar as technically possible.

CEPT is requested to collaborate actively with the European Telecommunications Standardisation Institute (ETSI), which develops harmonised standards for conformity under the Radio Equipment Directive⁸. In addition, CEPT should take into consideration emerging technologies and ETSI standards, which define 5G systems, facilitate shared spectrum use and foster economies of scale.

More specifically, CEPT is mandated to perform the following tasks with a view to developing harmonised least restrictive technical conditions for spectrum use:

1. Review the current and planned use of the 40.5-43.5 GHz frequency band and identify relevant scenarios for shared spectrum use between those uses and next-generation (5G) wireless broadband electronic communications services, in order to ensure co-existence and further development of all relevant services within the band.
2. Based on the results under Task 1, develop frequency arrangements and common and minimal (least restrictive) technical conditions⁹, including sharing conditions, for the aforementioned frequency band, which are suitable for terrestrial wireless systems, including 5G, in compliance with the principles of technology and service neutrality. In this regard, consider the need to ensure coherence of the harmonised frequency arrangements within the 40.5-43.5

⁶ COM(2016)587 final

⁷ Directive (EU) 2018/1972.

⁸ Directive 2014/53/EU.

⁹ Such as the definition of appropriate Block Edge Masks (BEMs).

GHz frequency band with the envisaged use of the 37-40.5 GHz frequency range in other world regions.

3. Review and revise, only if necessary, the EU-harmonised technical conditions for use of the 66-71 GHz frequency band⁴ with a view to use of this band for next-generation (5G) wireless broadband electronic communications services, taking into account relevant scenarios for shared spectrum use and the further development of all relevant services within the band. In this regard, ensure coherence of results and reporting to the Commission, taking into account the ongoing work on the permanent mandate to CEPT on short-range devices¹⁰, in accordance with the latest Commission guidance¹¹.

The conditions under Tasks 2 and 3 should take into account relevant authorisation modes and be sufficient to mitigate interference and to ensure co-existence with incumbent radio services/applications in the same band or in adjacent bands, in line with their regulatory status, including at the EU outer borders.

4. Assess the need for and develop, if necessary, guidance for cross-border coordination.

Overall, the CEPT should provide deliverables under this Mandate according to the following schedule:

Delivery date	Deliverable	Subject
March 2021	Draft Report(s) from CEPT to the Commission ¹² .	Description of the work undertaken and the results.
July 2021	Final Report(s) from CEPT to the Commission, taking into account the outcome of the public consultation.	Description of the work undertaken and the results.

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 the Mandate.

The Commission, with the assistance of the Radio Spectrum Committee and pursuant to Article 4 of the Radio Spectrum Decision, may consider applying the results of this mandate in the Union taking into account any relevant guidance of the RSPG.

¹⁰ Document RSCOM 06-27 Rev (5 July 2006)

¹¹ Document RSCOM19-9rev2

¹² Subject to subsequent public consultation

ANNEX 2: CHANNELLING ARRANGEMENT AND LEAST RESTRICTIVE TECHNICAL CONDITIONS

A2.1 HARMONISED FREQUENCY ARRANGMENT FOR THE BAND 40.5-43.5 GHZ

- The frequency arrangement is a TDD arrangement with a block size of 200 MHz;
- This block size could be adjusted to narrower blocks (multiples of 50 MHz) adjacent to other users, to allow full use of spectrum, if required.

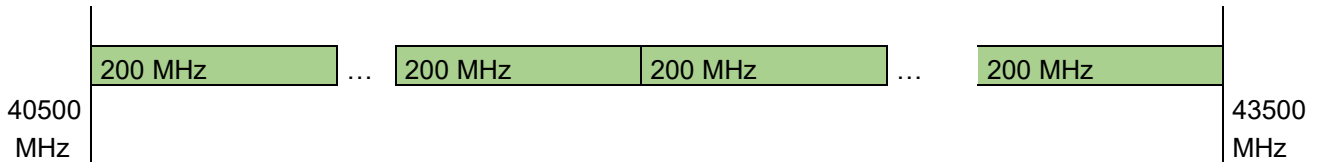


Figure 1: Example of possible frequency arrangements for WBB ECS in the 40.5-43.5 GHz band

A2.2 LEAST RESTRICTIVE TECHNICAL CONDITIONS

The technical conditions presented in this annex have been developed assuming an authorisation regime where the base station locations of transmitters and receivers are known. These conditions include provisions related to the coexistence between WBB ECS systems in the form of a block edge mask (BEM), i.e. related to spectrum licensing and the avoidance of interference between users of spectrum. Additional considerations may be needed on a national basis for an authorisation regime where the location of base stations is not known to ensure that the harmonised technical conditions in this Decision are met (see ANNEX 3).

A BEM is an emission mask that is defined, as a function of frequency, relative to the edge of a block of spectrum that is licensed to an operator. It consists of components which specify the permitted emission levels in adjacent blocks (transitional region 0-50 MHz below or above operator block) and non-adjacent blocks in the band.

The technical conditions derived below for the frequency range 40.5-43.5 GHz are optimised for, but not limited to, fixed/mobile communications networks (two-way). The BEM for BSs have been developed to ensure coexistence with other WBB ECS blocks, as well as other services and applications in adjacent bands. Additional measures may be required at national level to achieve coexistence with other services and applications.

A2.2.1 Base station technical conditions

The WBB ECS Base Station (BS) BEM consists of a baseline level, designed to protect the spectrum of other WBB ECS operators using the band 40.5-43.5 GHz and transitional levels for coexistence between WBB ECS networks in adjacent blocks. Adjacent services are expected to be protected by requirements of the ETSI TS 138 104 V17.6.0 (Table 9.7.4.3.3-2) [18].

Table 2 contains the different elements of the BS BEM and Table 3 and Table 4 contain the power limits for the different BEM elements.

To obtain a BS BEM for a specific block, the BEM elements that are defined in Table 2, are used as follows:

- Transitional regions are determined, and corresponding power limits are used;
- For remaining spectrum assigned to WBB ECS, baseline power limits are used.

Operators of mobile/fixed communications networks (WBB ECS) in the 40.5 -43.5 GHz band may agree, on a bilateral or multilateral basis, less stringent technical parameters provided that they continue to comply with the technical and regulatory conditions applicable for the protection of other services, applications or networks and with their cross-border obligations. Administrations should ensure that these less stringent technical parameters can be used, if agreed among all concerned parties.

Table 2: WBB ECS BS BEM elements

BEM element	Definition
Baseline	Applies in spectrum used for WBB ECS, except from the operator block in question and corresponding transitional regions.
Transitional region	These are the regions adjacent to an operator block.

For Table 3 and Table 4 synchronised operation is assumed.

Table 3: WBB ECS BS transitional region requirements for coexistence between WBB ECS networks operating in adjacent blocks (assuming synchronised operation, see note 1) in the 40.5-43.5 GHz

Frequency range	Maximum Total Radiated Power (TRP)	Measurement Bandwidth
0-50 MHz below or above operator block	12 dBm	50 MHz
Note 1: Administrations may define appropriate mitigation measures to be applied in case of unsynchronised or semi-synchronised operations – see ECC Report 307 [14]		

Table 4: WBB ECS BS baseline requirements for coexistence with WBB ECS networks in other blocks in the band (assuming synchronised operation, see note 1)

Frequency range	Protected frequency range	Maximum Total Radiated Power (TRP)	Measurement bandwidth
In-band baseline	40.5-43.5 GHz	4 dBm	50 MHz
Note 1: Administrations may define appropriate mitigation measures to be applied in case of unsynchronised or semi-synchronised operations – see ECC Report 307 [14]			

Table 5: Conditions applying to the pointing of the main beam of 5G AAS outdoor base stations in 42.5-43.5 GHz

Requirement on pointing of the main beam of 5G AAS outdoor base stations
When deploying outdoor base stations, it shall be ensured that each antenna is normally transmitting only with main beam pointing below the horizon and in addition the antenna shall have mechanical pointing below the horizon except when the base station is only receiving.

This requirement in Table 5 refers to the elevation of the main beam of 5G AAS outdoor base stations to ensure coexistence with space station receivers.

ANNEX 3: ADDITIONAL MEASURES TO BE CONSIDERED ON A NATIONAL BASIS WHEN THE LOCATION OF WBB ECS BASE STATIONS ARE NOT KNOWN

Depending on the authorisation regime applied in this band, there is a need for administrations to assess if it is necessary to impose additional measures while still respecting the harmonised technical conditions included in ANNEX 2.

The harmonised technical conditions for WBB ECS with assumption that location of base station is known are set out in ANNEX 2. Additional considerations are provided in this Annex for an authorisation regime where the location of base stations are not known in advance of installation to ensure compatibility with other services. It should be noted that implementation of sharing conditions implies the need for information on relative location of/ or distance between the interferer and victim, or on the location of one of these in order to apply the sharing conditions, such as separation distances/zones, when planning the location of the other station.

A3.1 FIXED SERVICE AT 40.5-43.5 GHZ

National coordination might be needed to manage the incumbent FS while introducing WBB ECS systems in the 40.5-43.5 GHz band depending upon the authorisation regime. Various approaches or a combination thereof could be considered to manage co-channel or adjacent channel coexistence between WBB ECS and FS at 40 GHz, e.g. separation in distance, separation in frequency, separation in angle, depending upon line-of-sight and local clutter attenuation.

Such national coordination between fixed services and WBB ECS is only manageable:

- where the location of WBB ECS BS is known;
- or where coordination of exclusion zones around existing FS are available and required to be respected by the authorisation regime for WBB ECS.

It is expected that there is only a low risk of interference to the fixed service from indoor WBB ECSs. However, the impact to fixed links may need to be analysed on a national basis.

A3.2 RADIO ASTRONOMY SITES

Protection of RAS can be achieved through the calculation of a geographical separation distance, and the determination of exclusion zones around RAS stations, which are defined at national level.

A mechanism such as a regulatory requirement to respect exclusion zones defined and applied on national basis (taking into account terrain, clutter, etc.) would be needed in order to ensure protection of the RAS site. No technical mechanism to prevent interference has been identified for the WBB ECS equipment during the drafting of the Report, other than locating new base stations outside of a pre-determined exclusion zone.

A3.3 EARTH STATIONS (FSS) IN THE BAND 40.5-42.5 GHZ AND 42.5-43.5 GHZ

Coexistence can be achieved through the calculation of a geographical separation distance, and the determination of coordination zones that can be applied around the stations of these other services, where further consideration may be needed if WBB ECS base stations were inside these zones.

A3.3.1 Receiving earth Stations (FSS) in the band 40.5-42.5 GHz

Appropriate measures for ensuring the coexistence with FSS earth stations are needed. The following options could be considered:

- Sharing solutions might be possible, such as the use of databases¹³ and/or associated regulatory requirements to ensure that the coordination zones are respected, so that WBB ECS base stations are not deployed within the coordination zones of FSS earth stations, otherwise other mitigations may need to be applied. It is noted that technical solutions to support implementation of geolocation are emerging for e.g.

¹³ E.g. a record of locations or geolocation database allowing Dynamic Spectrum Access.

dynamic spectrum access. However, no studies or proposals have been submitted in support of this mode to access to spectrum;

- Assuming there are relatively few FSS ESs, geographical and/or pointing restrictions could be applied to the WBB ECS licence conditions. In case that WBB ECSs are to be deployed within the coordination zones, a site-specific feasibility calculation/clearance should be performed and for this the location of the WBB ECS is required.

ECC Recommendation (22)01 provides guidelines to support the introduction of MFCN in 40.5-43.5 GHz while ensuring, in a proportionate way, the use of FSS receiving earth stations in the frequency band 40.5-42.5 GHz, and the possibility for future deployment of these earth stations, for GSO and non-GSO satellite systems. [1]

A3.3.2 Transmitting earth stations (FSS) in the band 42.5-43.5 GHz

The potential interference from FSS transmitting earth stations to WBB ECS in the band 42.5-43.5 GHz should be taken into account.

It is expected that there is a low risk of interference from transmitting FSS earth stations to indoor WBB ECS base stations.

Appropriate measures for ensuring the coexistence with FSS earth stations are needed. The following options could be considered:

- Sharing solutions might be possible, such as the use of a database to guide the installation of WBB ECS base stations to be outside any pre-defined coordination zones of FSS earth stations, and/or to apply mitigations if to be deployed within the coordination zone;
- In the case of deployment of additional FSS earth stations, sharing may be possible by national mechanisms to define additional pre-defined coordination zones, or by requiring an individual site specific feasibility demonstration to show no possibility of interference for additional FSS earth stations outside a pre-defined coordination zone.

ECC Recommendation (22)01 provides guidelines to support the introduction of MFCN in 40.5-43.5 GHz while ensuring, in a proportionate way, the use of FSS transmitting earth stations in the frequency band 42.5-43.5 GHz, and the possibility for future deployment of these earth stations, for GSO and non-GSO satellite systems [1].

A3.4 SATELLITE RECEIVERS (FSS) IN THE BAND 42.5-43.5 GHZ

Where there is no means to monitor the evolution of WBB ECS density and its deployment characteristics, an in-band limit for the TRP for WBB ECS equipment could be defined.

This could compensate for the uncertainty related to the deployment density and to the effective implementation of the antenna pointing restriction, as well as the impossibility for reviewing precisely the effective deployment characteristics and their impact on the interference level to satellites.

A3.5 RECEIVING EARTH STATIONS (FSS/MSS) IN THE BAND 39.5-40.5 GHZ

CEPT developed ECC Recommendation (22)02 which provides “Measures to facilitate compatibility between MFCN operating in 40.5-43.5 GHz and FSS earth stations receiving in 39.5-40.5 GHz and to prevent and/or resolve interference issues” [2]. Various approaches or a combination thereof could be considered to manage adjacent channel coexistence between WBB ECS and FSS at 40 GHz, e.g. separation in distance, separation in frequency, separation in angle, depending upon line of sight and local clutter attenuation.

ANNEX 4: LIST OF REFERENCES

- [1] [ECC Recommendation \(22\)01](#): “Guidelines to support the introduction of MFCN in 40.5-43.5 GHz while ensuring, in a proportionate way, the use of FSS receiving earth stations in the frequency band 40.5-42.5 GHz and the use of FSS transmitting earth stations in the frequency band 42.5-43.5 GHz and the possibility for future deployment of these earth stations”
- [2] [ECC Recommendation \(22\)02](#): “Guidelines on measures to facilitate compatibility between MFCN operating in 40.5-43.5 GHz and FSS earth stations receiving in 39.5-40.5 GHz and to prevent and/or resolve interference issues”
- [3] [ERC Report 025](#): “The European Table of Frequency Allocations and Applications in the frequency range 8.3 kHz to 3000 GHz (ECA Table)”, approved June 1994 and latest amended October 2021
- [4] ITU-R Document [5-1/287 \(Annex 5\)](#), “[Annex 5 to Task Group 5/1 Chairman’s Report: Sharing and Compatibility Studies of IMT Systems in the 37-43.5 GHz Frequency Range](#)”, October 2018
- [5] ITU-R, [Handbook on Radio Astronomy](#), 2013
- [6] [CEPT Report 68](#): “Report B from CEPT to the European Commission in response to the Mandate “to develop harmonised technical conditions for spectrum use in support of the introduction of next-generation (5G) terrestrial wireless systems in the Union”
Harmonised technical conditions for the 24.25-27.5 GHz (‘26 GHz’) frequency band”, approved July 2018
- [7] [ECC Decision 18\(06\)](#): “ECC Decision of 6 July 2018 on the harmonised technical conditions for Mobile/Fixed Communications Networks (MFCN) in the band 24.25-27.5 GHz”, latest amended on 20 November 2020
- [8] EC Decisions (EU) 2020/590 of 24 April 2020 amending Decision (EU) 2019/784 as regards an update of relevant technical conditions applicable to the 24,25-27,5 GHz frequency band
- [9] 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)
- [10] [ECC Report 173](#): “Fixed Service in Europe Current use and future trends post 2016”, approved March 2012 and amended 27 April 2018
- [11] [ECC Decision \(02\)04](#): “ECC Decision of 15 March 2002 on the use of the band 40.5 – 42.5 GHz by terrestrial (fixed service/ broadcasting service) systems and uncoordinated Earth stations in the fixed satellite service and broadcasting-satellite service (space to Earth)”, approved March 2002
- [12] [ERC Decision \(00\)02](#): “ERC Decision of 27 March 2000 on use of the band 37.5-39.5 GHz by the fixed service and by earth stations of the fixed-satellite service (space-to-Earth) and use of the band 39.5-40.5 GHz by earth stations of the fixed-satellite service and the mobile-satellite service (space-to-Earth)”, amended March 2022
- [13] Recommendation ITU-R M.2101-0 “Modelling and simulation of IMT networks and systems in sharing and compatibility studies”
- [14] [ECC Report 307](#): “Toolbox for the most appropriate synchronisation regulatory framework including coexistence of MFCN in 24.25-27.5 GHz in unsynchronised and semi-synchronised mode”, approved March 2020
- [15] ITU-R Document 5/1-36: “Liaison statement to Task Group 5/1 - Spectrum needs and characteristics for the terrestrial component of IMT in the frequency range between 24.25 GHz and 86 GHz”
- [16] Recommendation ITU-R P.2108: “Prediction of clutter loss”
- [17] [ECC Decision \(22\)06](#): “Harmonised technical conditions for Mobile/Fixed Communications Networks (MFCN) in the band 40.5-43.5 GHz”
- [18] ETSI TS 138 104 V17.6.0: “NR: Base Station (BS) radio transmission and reception”
- [19] ECC(19)081 Annex 09: “Additional input regarding harmonised technical conditions for the 26 GHz band”, ECC#51, July 2019
- [20] ETSI TS 138 101-2 V17.6.0: “User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone”