



CEPT Report 65

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

“to develop harmonised technical conditions in additional frequency bands in the 1.5 GHz range for their use for terrestrial wireless broadband electronic communications services in the Union”

Report approved on 17 November 2017 by the ECC

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0 EXECUTIVE SUMMARY

The European Commission issued a mandate to the CEPT to develop harmonised technical conditions in additional frequency bands in the 1.5 GHz range for their use for terrestrial wireless broadband electronic communications in the Union.

As mentioned in this mandate, CEPT focused its analysis on downlink-only Wireless Broadband electronic communications. Supplemental downlink is downlink-only use whereby spectrum within the bands is used for unidirectional base station transmission providing electronic communications services, in combination with use of spectrum in another frequency band.

Based on the analysis done in this report, CEPT recommends that the harmonised frequency arrangement for downlink-only WBB ECS (DL WBB ECS) in the bands 1427-1452 MHz and 1492-1517 MHz (extension bands) is for downlink, based on 5 MHz blocks, and takes into account also the frequency band 1452-1492 MHz and the relevant channelling arrangement in force in Commission Implementing Decision ((EU) 2015/750) [1]. CEPT confirms that the DL WBB ECS inherently offers national flexibility to administrations to introduce those services in all parts of the extension bands, taking into account that the amount of spectrum which could be made available in these frequency bands for terrestrial WBB electronic communications services may vary across Member States subject to market demands and national needs.

The 1427-1452 MHz and 1492-1518 MHz bands are currently used by incumbent services and applications to which the band is allocated (see EFIS¹ and ECA Table). There may be a need to re-farm the extension bands before making them available for DL WBB ECS. Moreover, subject to market demands and national needs, incumbent services and applications will continue operating in some countries. In that context, the bands, or part of them, may therefore not be available for the implementation of WBB ECS.

This report has been developed based on the principle of technology neutrality, taking into account parameters of technology currently available in the band. According to the current feedback from standardisation, if 5G specifications are consistent with the proposed harmonised technical conditions contained in this Report, then it will be suitable for the implementation of 5G terrestrial wireless systems.

In addition to the channelling arrangement, this CEPT report proposes least restrictive technical conditions for WBB ECS, for the frequency bands 1427-1452 MHz and 1492-1517 MHz. This CEPT report also further assesses the impact of the introduction in Member States of DL WBB ECS either in 1427-1452 MHz and/or 1492-1517 MHz, or in parts of these bands, on the existing technical conditions from Commission Implementing Decision (EU) 2015/750. In particular, coexistence limits in force in Commission Implementing Decision (EU) 2015/750 to ensure coexistence to services and applications in the adjacent bands to 1452-1492 MHz are no longer applicable when DL WBB ECS is used in 1427-1452 MHz and/or 1492-1517 MHz.

CEPT supports the current bilateral cross border coordination process between relevant CEPT countries (including those listed in ITU RR No. 5.342) on MFCN (WBB ECS) and ATS (aeronautical telemetry system) in the 1429-1518 MHz band

Additionally, CEPT is studying proportionate measures to address potential receiver blocking issues affecting MES operating on bands adjacent to 1518 MHz (including 1525-1559 MHz) at sea ports and at airports, in order to develop an ECC Report.

These above CEPT activities will not impact the harmonised technical conditions contained in this CEPT report.

¹European Frequency Information System: www.efis.dk

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
BEM	Block Edge Mask
BS	Base Station
CEPT	European Conference of Postal and Telecommunications Administrations
DL	Downlink
EC	European Commission
ECA	European Common Allocation
ECC	Electronic Communications Committee
ECS	Electronic Communication Services
EESS	Earth Exploration Satellite Service
EFIS	European Frequency Information System
EIRP	Equivalent Isotropically Radiated Power
FDD	Frequency Division Duplex
IMT	International Mobile Telecommunications
LRTC	Least Restrictive Technical Conditions
MES	Mobile Earth Station
MFCN	Mobile/Fixed Communications Network
MSS	Mobile Satellite Service
OOB	Out of Band
SDL	Supplemental Downlink
SES	Ship Earth Station
UMTS	Universal Mobile Telecommunications System
WBB	Wireless Broadband
WRC	World Radiocommunication Conference

1 INTRODUCTION

The European Commission issued a mandate to the CEPT to develop harmonised technical conditions in additional frequency bands in the 1.5 GHz range for their use for terrestrial wireless broadband electronic communications in the Union (see Annex 1).

CEPT focused its analysis on downlink-only Wireless Broadband electronic communications. Supplemental downlink is downlink-only use whereby spectrum within the bands is used for unidirectional base station transmission providing electronic communications services, in combination with use of spectrum in another frequency band.

The report provides background information, a channelling arrangement and mentions various elements in relation with compatibility studies and technical conditions.

The report proposes in Annex 2 a harmonised frequency arrangement and least restrictive technical conditions for DL WBB ECS, for the frequency bands 1427-1452 MHz and 1492-1517 MHz.

It is noted that the 1427-1452 MHz and 1492-1518 MHz bands are used by incumbent services and applications to which the band is allocated and which will continue operating in some CEPT countries. Therefore the full bands may not be available for the implementation of WBB ECS in some countries.

2 BACKGROUND AND FREQUENCY ARRANGEMENT

2.1 BACKGROUND

This report has been developed based on the principle of technology neutrality, taking into account parameters of technology currently available in the band. According to the current feedback from standardisation, if 5G specifications are consistent with the proposed harmonised technical conditions contained in this Report, then it will be suitable for the implementation of 5G terrestrial wireless systems.

This report refers only to downlink-only WBB ECS (DL WBB ECS). CEPT took also in careful consideration of the EU harmonised technical conditions for the use of the band 1452-1492 MHz by downlink-only WBB ECS.

Based on information available and relevant to its analysis, CEPT supports 1427-1518 MHz for WBB ECS for a one direction downlink service (DL WBB ECS), used in connection with another WBB ECS band that provides the uplink capabilities.

The band 1400-1427 MHz is allocated to the EESS (passive), Radio astronomy and Space Research (passive), on a worldwide basis. In the band 1427-1452 MHz, Resolution 750 (Rev.WRC-15) [2] applies for the protection of services in the band 1400-1427 MHz. This has been taken in due consideration when developing the technical conditions.

The 1375-1400 MHz frequency band paired with 1427-1452 MHz and/or 1350-1375 MHz paired with 1492-1517 MHz is used for low capacity fixed links in several countries. Re-farming of these bands to make them available for mobile SDL is a complex process which needs time and which is managed at national level taking into account national needs and alternative bands² where such fixed links could operate in the future.

It is noted that the 1427-1452 MHz and 1492-1518 MHz bands are also used for land military systems in some CEPT countries according to ERC Report 25 (The European table of frequency allocations and applications in the frequency range 8.3 kHz to 3000 GHz (ECA Table)) [3].

The frequency band 1518-1525 MHz was allocated to the mobile satellite-service (MSS) at WRC-03 and is designated to the MSS by CEPT framework³: 1518-1525 MHz (space-to-Earth) and 1670-1675 MHz (Earth-to-space). The frequency band 1525-1559 MHz (space-to-Earth) is allocated to the MSS and is partly used by safety services (see section 3.2).

This report provides results on adjacent band compatibility between IMT operating in the frequency band 1492-1518 MHz, the MSS operating in the frequency band 1518-1525 MHz, and the band 1525-1559 MHz, and relevant LRTC to be implemented in the future EC framework applicable to DL WBB ECS in frequency bands below 1518 MHz. Other measures will be implemented by the relevant harmonised standard in order to improve the receiver blocking characteristics of MES operating above 1518 MHz according to the conclusion of the ECC Report 263.

DL WBB ECS inherently offers national flexibility to administrations to introduce services in all parts of the extension bands (i.e. 1427-1452 and 1492-1518 MHz), taking into account that the amount of spectrum which could be made available in these frequency bands for terrestrial WBB electronic communications services may vary across Member States.

2.2 HARMONISED FREQUENCY ARRANGEMENT

The harmonised frequency arrangements are based on a block size of 5 MHz, resulting in the following 10 frequency blocks in the bands 1427-1452 MHz and 1492-1518 MHz:

² As example It shall be noted that CEPT recently published harmonised technical conditions for the usage of fixed links in the 6 GHz (see relevant ECC recommendation 14(06)).

³ ECC/DEC/(04)09 [4]

Table 1: Harmonised frequency arrangement for 1427-1452 MHz

1427-1432	1432-1437	1437-1442	1442-1447	1447-1452
Downlink (base station transmit)				
25 MHz (5 blocks of 5 MHz)				

*Block conditions: see Annex 2

Table 2: Harmonised frequency arrangement for 1492-1518 MHz

1492-1497	1497-1502	1502-1507	1507-1512	1512-1517**	1517-1518
Downlink (base station transmit)					Guard band
25 MHz (5 blocks of 5 MHz)					1 MHz

**Restricted power: see Annex 2

Table 3: Combined harmonised frequency arrangement (incl. EC Decision (EU) 2015/750 for informative purpose)

1427 MHz

1518 MHz

1427	1432	1437	1442	1447	1452	1457	1462	1467	1472	1477	1482	1487	1492	1497	1502	1507	1512	1517	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1432*	1437	1442	1447	1452	1457	1462	1467	1472	1477	1482	1487	1492	1497	1502	1507	1512	1517**	1518	
Downlink (base station transmit)																			
90 MHz (18 blocks of 5 MHz)																			
																	Guard band		
																	1 MHz		

*Block conditions and **Restricted power: see ANNEX 2

Table 3 for information reveals the consistency with EC Decision (EU) 2015/750 [1].

3 COMPATIBILITY STUDIES

3.1 COMPATIBILITY BETWEEN WBB ECS IN 1427-1452 MHZ AND SERVICES OPERATING IN 1400-1427 MHZ

The band 1400-1427 MHz is allocated to EESS (passive), Radio astronomy and Space Research (passive), on a worldwide basis. In the band 1427-1452 MHz, Resolution 750 (Rev.WRC-15) applies for the protection of EESS (passive) in 1400-1427 MHz.

Resolution 750 (Rev. WRC-15) [2] sets the maximum unwanted emission power in the band 1400-1427 MHz for base stations operating in 1427-1452 MHz.

Table 4: Base station maximum unwanted emission power in the band 1400-1427 MHz for base stations operating in 1427-1452 MHz

Frequency range of out-of-band emissions	Maximum unwanted emission power ⁴	Measurement Bandwidth
1400-1427 MHz	-72 dBW	27 MHz

For the protection of radio astronomy observations in the passive band 1400-1427 MHz from IMT systems in the band 1427-1452 MHz, unwanted emission power limits in Resolution 750 (Rev. WRC-15) may not be sufficient and there is therefore a need to consider at national level relevant separation distances around radio telescopes, and other mitigation techniques such as additional filtering and/or a guard band for MFCN IMT stations, as required.

3.2 COMPATIBILITY BETWEEN DL WBB ECS IN 1492-1517 MHZ AND SERVICES OPERATING IN 1518-1525 MHZ

The CEPT conducted adjacent band compatibility studies between DL WBB ECS operating in the frequency band 1492-1518 MHz and the MSS operating in the frequency band 1518-1525 MHz. CEPT recommends that base station out-of-block emission limits e.i.r.p. for a broadband signal interferer operating below 1518 MHz shall be -30 dBm/MHz above 1520 MHz. This value is 10 dB more stringent than EU Decision 2015/750 due to a different service in the adjacent band.

CEPT does not provide recommended e.i.r.p. limits for the out-of-block emissions in the band 1518-1520 MHz, but applying a 10 dB reduction to the limits in EU Decision 2015/750 and using a reference bandwidth of 1 MHz leads to the values shown in Table 5.

Table 5: Base station out-of-block emission limits per cell⁽¹⁾ above 1518 MHz for base stations operating in 1492-1517 MHz

Frequency range of out-of-block emissions	Maximum out-of-block e.i.r.p.	Measurement Bandwidth
Between 1518 and 1520 MHz	-0.8 dBm	1 MHz
Between 1520 and 1559 MHz	-30 dBm	1 MHz

⁽¹⁾ In a multi-sector site, the value per ‘cell’ corresponds to the value for one of the sectors.

Although ECC Report 263 [5] mentioned the potential need to provide protection for MES use at sea ports and airports, it is noted that the Radio Regulations (5.353A, 5.356 and 5.357) refer to safety requirements only in the band 1530-1544 MHz for Global Maritime Distress and Safety System (GMDSS) MES, in the band 1544-1545 MHz for distress and safety communications and in the band 1545-1555 MHz for safety related communications under AMS(R)S. Therefore, the MSS frequencies covered by ECC Report 263 (1518-1525 MHz) cannot benefit from protection afforded to safety communications. However the latest

⁴ The unwanted emission power level is to be understood here as the level measured at the antenna port.

satellite terminals used for maritime and aeronautical safety-related services tune across the full frequency range 1518-1559 MHz.

Concerning maritime and aircraft MES at sea ports and airports, the compatibility studies cover the frequency range 1518-1525 MHz and do not give indications of impact on systems operating above 1525 MHz.

In ECC Report 263, the MCL analysis indicates that the required separation distances necessary to ensure protection of MES in the different environment types (land, sea and air, where the aircraft is considered to be on the ground, or a vessel is in port) range from tens of metres to some kilometres. Therefore, CEPT has launched additional work to study measures to address potential blocking of MES operating in bands adjacent to 1518 MHz (including 1525-1559 MHz) at sea ports and airports. This future study does not prevent the harmonisation of LRTC for WBB ECS as proposed in this CEPT report.

The operation of ship earth stations (SESS) in sea ports and aircraft MES at airports is necessary since even though other communication means may be available, operational procedures may require testing of the satellite communication equipment before leaving.

ECC Report 263 concludes that the in-band blocking characteristic for land mobile earth stations shall be -30 dBm above 1520 MHz. Current MESSs, land, aeronautical and maritime, do not comply with the -30dBm blocking protection requirement. Improvements in MES receiver performance, in line with the Radio Equipment Directive, to a level specified in ECC Report 263 are expected in a harmonised standard in the future. This would reduce the impact of interference due to MES blocking in the longer term, as newer MES terminals are deployed, in which case the mitigation techniques mentioned above may no longer be required or can be relaxed.

3.3 COMPATIBILITY BETWEEN WBB ECS SYSTEMS OPERATING IN ADJACENT CHANNELS IN 1427-1517 MHz

CEPT defines the BEM to allow coexistence between DL WBB ECS in the 1452-1492 MHz band. There is no fundamental difference between coexistence of WBB ECS in 1452-1492 MHz and coexistence of WBB ECS in 1427-1517 MHz. Therefore, the following BEMs are still valid and can be adopted.

Table 6: Base station BEM out-of-block e.i.r.p. limits per antenna within the band 1427-1517 MHz

Frequency range of out-of-block emissions	Maximum mean out-of-block e.i.r.p.	Measurement Bandwidth
-10 to -5 MHz from lower block edge	11 dBm	5 MHz
-5 to 0 MHz from lower block edge	16.3 dBm	5 MHz
0 to +5 MHz from upper block edge	16.3 dBm	5 MHz
+5 to +10 MHz from upper block edge	11 dBm	5 MHz
Remaining DL WBB ECS frequencies	9 dBm	5 MHz

For further details on BS operating in 1452-1492 MHz, see Section 6.

4 CO-EXISTENCE WITH INCUMBENT RADIO SERVICES AND APPLICATIONS IN THE 1427-1518 MHz BAND

The EC Mandate addresses in Task 3 the possibility of co-existence with incumbent radio services and applications in the 1427-1518 MHz frequency range. Therefore the following sections consider sharing and compatibility scenarios with the relevant radio services and applications. In this respect, it is noted that the frequency bands 1427-1452 MHz and 1492-1518 MHz are allocated to the mobile service (except aeronautical mobile service) and fixed service on a co-primary basis and identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) in ITU Region 1.

CEPT is supporting the current bilateral cross border coordination process between relevant CEPT countries (including those listed in ITU RR No. 5.342) on MFCN (WBB ECS) and ATS (aeronautical telemetry system) in the 1429-1518 MHz band.

4.1 SHARING AND COMPATIBILITY BETWEEN WBB ECS AND FIXED SERVICE

As a starting point it has to be noted that the studies in ECC Report 202 [7], provide in-block and Out-of-Band e.i.r.p. (OOBE) limits for the harmonised use of 1452-1492 MHz for WBB SDL, which ensure coexistence with applications/services in the adjacent band including Tactical Radio Relays, coordinated Fixed Links and aeronautical telemetry ground stations operating below 1452 MHz and above 1492 MHz.

It is widely accepted that co-frequency, co-coverage operation of mobile and fixed service is not feasible. In this context it needs to be highlighted that ECC Report 45 [8] as well as ERC Report 64 [9] addressed coexistence of mobile system (UMTS) with fixed service operating in the 2.5 GHz and 2.1 GHz bands, respectively. In general terms, it shows that a large separation distance (tens of kilometres) is required in order to ensure coexistence (in co-frequency operation).

Moreover, taking into account the results of CEPT Report 54 [10], in the case where an Administration uses fixed links in the bands 1427-1452 MHz and/or in 1492-1518 MHz, adjacent to WBB SDL, this Administration may implement at national level some specific measures to ensure coexistence. Those measures would need to include site coordination (which may include additional technical/operational conditions i.e. frequency-territorial planning) in the case of coordinated fixed links or more restrictive technical conditions in the case of uncoordinated fixed links. These technical conditions such as more stringent out-of-band emission limits are highly dependent of the uncoordinated fixed links considered and are as such only relevant for the concerned administration.

The ability to make the frequency bands available for DL WBB ECS varies at national level. Therefore, flexibility is needed.

4.2 INTRODUCTION OF WBB ECS IN SUB-BANDS

It is not expected that WBB ECS and incumbent services would operate within the same sub-band.

CEPT confirms that the DL WBB ECS inherently offers national flexibility to administrations to introduce WBB ECS in all parts of the extension bands. The flexibility introduced gives freedom to administration to use 1427-1452 MHz (respectively 1492-1518 MHz) either for incumbent services or for DL WBB ECS. A2.2 provides additional details on the options available to administrations.

4.3 SHARING AND COMPATIBILITY BETWEEN WBB ECS AND AERONAUTICAL MOBILE SERVICE

The frequency bands 1427-1452 MHz and 1492-1518 MHz are allocated to the mobile service (except aeronautical mobile service) and fixed service on a co-primary basis and identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) in ITU Region 1. In some CEPT countries, the band is also allocated on a co-primary basis to aeronautical mobile service exclusively for the purpose of aeronautical telemetry within the national territory according to No 5.342 of the ITU Radio Regulations [2].

The aeronautical telemetry stations of aeronautical mobile service in the countries mentioned in No 5.342 RR have equality of right to operate with WBB ECS stations.

Cross-border coordination between DL WBB ECS and aeronautical telemetry in the frequency bands 1429-1452 MHz and 1492-1518 MHz will be addressed between the CEPT administrations concerned on a bi/multi-lateral basis and CEPT has initiated some activity to provide guidance to concerned administrations.

5 MAXIMUM IN-BAND E.I.R.P. FOR BASE STATIONS OPERATING IN 1427-1452 AND 1492-1517 MHz

5.1 LEGACY SITUATION IN 1452-1492 MHz

The ECC Decision 13(03) [11] states that:

"Administrations should take into account the following aspects:

- *It is not desirable to restrict the in-band e.i.r.p. as the 1452-1492 MHz band could be aggregated with FDD coverage bands in lower frequencies and thus higher in-band e.i.r.p. for a base station allows benefiting of the SDL capacity across the base station cell.*
- *Based on deployment requirements and on compatibility studies with other services operating in adjacent bands (see ECC Report 202), an administration could at national level:*
 - *restrict base stations in-band e.i.r.p.. Such limit may range up to 68 dBm. Higher e.i.r.p. may be considered in specific circumstances;*
and/or
 - *according to the service considered: handle coordination of stations."*

5.2 MAXIMUM IN BAND E.I.R.P. FOR BS OPERATING IN 1427-1452 MHz

Resolution 750 [2] provides restrictions on the emissions in 1400-1427 MHz but does not specify any requirements on emission levels above 1427 MHz. As long as the equipment complies with the unwanted emissions in 1400-1427 MHz, there is no reason to restrict the in-band e.i.r.p. in 1427-1452 MHz.

Therefore, the maximum in-band e.i.r.p. framework defined in EC Decision (EU) 2015/750 [1] is applicable to the band 1427-1452 MHz.

5.2.1 Practical limitation on maximum in band e.i.r.p. in 1427-1432 MHz

It is not expected that base stations operating at maximum power in 1427-1432 MHz will be able to comply with the emission limits below 1427 MHz specified in Table 4. On the contrary, it is expected that only lower power base stations can be deployed in the block 1427-1432 MHz.

It is not appropriate to introduce regulatory emission limits for these bands as such limits are only related to current state-of-the-art of the technology and specific deployment models.

5.3 MAXIMUM IN BAND EIRP FOR BS OPERATING IN 1492-1517 MHz

ECC Report 263 [5] defined the compatibility framework between IMT operating in the frequency band 1492-1518 MHz and the MSS operating in the frequency band 1518-1525 MHz. Compatibility requirements identified in this framework include a maximum base station in band e.i.r.p. of 58 dBm/5MHz for base stations operating in 1512-1517 MHz. Corresponding minimum blocking requirements for MSS terminals operating above 1518 MHz were defined in ECC Report 263 taking into account, in particular, a maximum in band e.i.r.p of 58 dBm for BS operating in 1512-1517 MHz. CEPT requested ETSI to change the relevant harmonized standard(s) applicable to MES in order to improve the blocking requirement and this was proposed as a compromise with the maximum in band e.i.r.p. limit in the ECC Decision (17)06 [12] as well as in the annex 2 of this CEPT Report. Any change of this limit would undermine this compromise.

Table 7: Maximum in band e.i.r.p. per cell⁽¹⁾ for BS operating in 1512-1517 MHz

WBB ECS block	Maximum in band e.i.r.p.	Measurement bandwidth
1512-1517 MHz	58 dBm	5 MHz

⁽¹⁾ In a multi-sector site, the value per 'cell' corresponds to the value for one of the sectors.

For base stations operating below 1512 MHz (i.e. more than 6 MHz away from MSS terminals), there is no reason to restrict the WBB ECS BS maximum in band e.i.r.p.. Therefore, the maximum in-band e.i.r.p. framework defined in EC Decision (EU) 2015/750 is applicable to the band 1492-1512 MHz.

6 IMPACT ON LRTC FOR WBB ECS BS OPERATING IN 1452-1492 MHZ

6.1 CURRENT EMISSION LIMITS IN ADJACENT BAND

EC Decision (EU) 2015/750 [1] harmonises the use of the band 1452-1492 MHz for terrestrial mobile/fixed communications networks supplemental downlink (MFCN SDL).

EC Decision (EU) 2015/750 currently specifies emission limits below 1452 MHz and above 1492 MHz, based on the services that were operating in 1427-1452 MHz and 1492-1518 MHz when the Decision was adopted (See Table below). Although the initial technical studies may have considered interference per cell and not just per antenna, these limits should not be modified since already part of existing licences.

Table 8: Base station out-of-block e.i.r.p. limits out of the band 1452-1492 MHz as specified in EC Decision 2015/750

Frequency range of out-of-block emissions	Maximum mean out-of-block e.i.r.p.	Measurement Bandwidth
Below 1449 MHz	-20 dBm	1 MHz
1449-1452 MHz	14 dBm	3 MHz
1492-1495 MHz	14 dBm	3 MHz
Above 1495 MHz	-20 dBm	1 MHz

6.2 CURRENT EMISSION LIMITS NOT REQUIRED AND PROBLEMATIC WHEN WBB ECS OPERATES IN ADJACENT BAND

The limits detailed in Table 8 are not required when WBB ECS is deployed either below 1452 MHz or above 1492 MHz, since the service in the adjacent band is WBB ECS, i.e. no longer the service for which the protection limits in EC Decision (EU) 2015/750 were derived.

In addition, a base station transmitting on two carriers, for example one carrier below 1452 MHz and one carrier above 1452 MHz, could not comply with the requirements from Table 6.

Therefore, these requirements would limit deployment opportunities for no reason and are not appropriate.

6.3 NEED TO UPDATE OF THE REGULATORY FRAMEWORK APPLICABLE TO WBB ECS OPERATING IN 1452-1492 MHZ

It is recommended to revise the Commission Implementing Decision (EU) 2015/750 in order to indicate that Base Station out-of-block e.i.r.p. limits below 1452 and/or above 1492 MHz are not applicable when DL WBB ECS is deployed below 1452 and/or above 1492 MHz.

7 CONCLUSIONS

The report recommends that the harmonised frequency arrangement for DL WBB ECS in the band 1427-1452 MHz and 1492-1517 MHz is for downlink, based on 5 MHz blocks, and takes into account EC Decision (EU) 2015/750 [1] for the frequency band 1452-1492 MHz.

Compatibility of DL WBB ECS operating in 1427-1452 MHz with EESS (passive) operating in 1400-1427 MHz is addressed in Resolution 750 (Rev.WRC-15).

For radio astronomy observatories in the passive band 1400-1427 MHz from IMT systems in the band 1427-1452 MHz, compliance with unwanted emission power limits in Resolution 750 (Rev. WRC-15) may not be sufficient to ensure their protection and there is therefore a need to consider at national level relevant separation distances around radio telescopes, and other mitigation techniques such as additional filtering and/or a guard band for MFCN IMT stations not compliant with the radio astronomy protection criteria.

Compatibility of DL WBB ECS operating in 1492-1517 MHz with services operating between 1518 MHz and 1525 MHz is studied in ECC Report 263 [5]. Additionally, CEPT is studying proportionate measures to address potential receiver blocking issues affecting MES operating on bands adjacent to 1518 MHz (including 1525-1559 MHz) at sea ports and at airports, in order to develop an ECC Report.

The compatibility between DL WBB ECS is addressed in EC Decision (EU) 2015/750.

DL WBB ECS inherently offers national flexibility to administrations to introduce services in all parts of the extension bands (i.e. 1427-1452 and 1492-1518 MHz), taking into account that the amount of spectrum which could be made available in these frequency bands for terrestrial WBB electronic communications services may vary across Member States.

It is noted that the 1427-1452 MHz and 1492-1518 MHz bands are also used for land military systems in some CEPT countries according to ERC Report 25 (The European table of frequency allocations and applications in the frequency range 8.3 kHz to 3000 GHz (ECA Table)) [3].

This report was developed based on the principle of technology neutrality, taking into account parameters of technology currently available in the band. 3GPP is presently developing the Next Generation New Radio (NR) Access Technology in the context of 5G and has agreed that for bands below 6 GHz, the existing 3GPP requirements for E-UTRA should be re-used for NR as much as possible. Therefore, if 5G specifications are consistent with the frequency arrangement and LRTC developed in EC Decision (EU) 2015/750, ECC Report 202 [7] and ECC Report 263 then they will be applicable to 5G systems.

The report proposes least restrictive technical conditions for DL WBB ECS, for the frequency bands 1427-1452 MHz and 1492-1517 MHz based on a compilation of these previous results and further provide guidance on the impact of the introduction of DL WBB ECS in 1427-1452 MHz and/or 1492-1517 MHz on Commission Implementing Decision (EU) 2015/750.

CEPT is supporting the current bilateral cross border coordination process between relevant CEPT countries (including those listed in ITU RR No. 5.342) on MFCN (WBB ECS) and ATS (aeronautical telemetry system) in the 1429-1518 MHz band.

These above CEPT activities will not impact the harmonised technical conditions contained in this CEPT report.

ANNEX 1: CEPT MANDATE



EUROPEAN COMMISSION

Directorate-General for Communications Networks, Content and Technology

Electronic Communications Networks and Services
Radio Spectrum Policy

Brussels, 14 March 2017
DG CONNECT/B4

RSCOM17-03rev2

PUBLIC

RADIO SPECTRUM COMMITTEE

Working Document

Subject: Mandate to CEPT to develop harmonised technical conditions in additional frequency bands in the 1.5 GHz range for their use for terrestrial wireless broadband electronic communications services in the Union

**Opinion of the RSC
pursuant to Advisory Procedure under Article 4 of Regulation 182/2011/EU and Article 4.2 of
Radio Spectrum Decision 676/2002/EC**

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**MANDATE TO THE CEPT
TO DEVELOP HARMONISED TECHNICAL CONDITIONS IN ADDITIONAL
FREQUENCY BANDS IN THE 1.5 GHz RANGE FOR THEIR USE FOR TERRESTRIAL
WIRELESS BROADBAND ELECTRONIC COMMUNICATIONS SERVICES IN THE
UNION**

PURPOSE

This Mandate aims at enhancing spectrum capacity in the 1.5 GHz frequency range by studying the potential extension of the EU-harmonised 1452-1492MHz frequency band in adjacent bands for use by terrestrial wireless broadband (WBB) electronic communications services in the Union. Its deliverables should provide harmonised technical conditions for use of the 1427-1452 MHz and 1492-1518 MHz frequency bands for downlink-only wireless broadband (WBB) electronic communications services (ECS) including next-generation (5G) terrestrial wireless systems, which ensure flexible and efficient spectrum use. They should thus facilitate economies of scale of equipment across a wider tuning range and benefit from international harmonisation.

The deliverables of this Mandate should contribute to the EU spectrum target for wireless broadband of at least 1200 MHz laid down in the Radio Spectrum Policy Programme⁵ (RSPP).

POLICY CONTEXT AND INPUTS

The 1427-1452 MHz and 1492-1518 MHz frequency bands (hereinafter "1.5 GHz extension bands") were globally identified at the WRC-15 for International Mobile Telecommunications (IMT). In this regard, CEPT has already launched technical studies to develop a channelling arrangement and technical conditions for wireless broadband use of these bands in conjunction with the availability of the 1452-1492 MHz 'core' frequency band (hereinafter "1.5 GHz core band"). Such studies would contribute to synergies in delivering results under this Mandate within a short timeframe.

The Opinion of the Radio Spectrum Policy Group (RSPG) on "Strategic challenges facing Europe in addressing the growing spectrum demand for wireless broadband" (RSPG13-521 rev1) identifies the 1427-1452 MHz frequency band for wireless broadband use in the mid-term (> 2015) and also indicates the need to assess the 1492-1518 MHz frequency band for such use following WRC-15.

Furthermore, the related RSPG Report on "Spectrum for wireless broadband and broadcasting in the frequency range 400 MHz to 6 GHz" (RSPG13-522) examines the potential of frequency bands in the 1350-1518 MHz frequency range for wireless broadband. It concludes that the 1.5 GHz extension bands are covered by 3GPP standards facilitating the availability of wireless broadband equipment (e.g. LTE or LTE-A). It also highlights existing (fixed-service or military) and points to prospective (wireless PMSE) use in this range and the resulting potential constraints for introducing wireless broadband use.

Taking into account the RSPG opinion and the Union policy objectives on high-quality connectivity in the single market⁶, Member States could take steps such as promoting shared spectrum use or re-farming, in order to ensure availability of the 1.5 GHz extension bands for wireless broadband electronic communication services, on the path to 5G. The 1.5 GHz extension bands are currently

⁵ 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

⁶ Connectivity for a Competitive Digital Single Market - Towards a European Gigabit Society COM (206) 587 final, and 5G for Europe: An Action Plan COM (2016) 306 final.

used in the Union for *low capacity fixed links*, and in some Member States, the lower extension band is also used for *wireless camera applications whereas in some other Member States the upper extension band is used for wireless audio PMSE equipment* (wireless microphones).

Given that, on the one hand, according to the NATO Joint Civil/Military Frequency Agreement (NJFA) of 2014, the extension frequency bands (1427-1452 MHz and 1492-1518 MHz) are earmarked for land military systems and maritime military systems; and, on the other, pursuant to EU law, the use of the 1.5 GHz extension bands for military applications is subject to the sovereign decision of Member States, the amount of spectrum which could be made available in these frequency bands for terrestrial WBB electronic communications services may vary across Member States. Therefore, the need for national flexibility to introduce downlink-only terrestrial WBB electronic communications services in all parts of the extension bands should be considered.

Compatibility of wireless broadband use within the 1.5 GHz extension bands with incumbent services in the adjacent bands below 1427 MHz and above 1518 GHz should be ensured according to their regulatory status. In particular, the *protection* of earth exploration satellite, space research and radio astronomy services must be safeguarded within the 1400-1427 MHz 'passive' frequency band⁷. Furthermore, applicable technical conditions to wireless broadband use below 1518 MHz should ensure *compatibility with mobile satellite service* in the 1518-1525 MHz frequency band. In this regard, the improvement of MSS receiver parameters, including to ensure continuing consistency with the Radio Equipment Directive (RED), and mitigation techniques should be studied in cooperation with ETSI to facilitate compatibility especially for mobile earth stations in particular locations such as airports or seaports.

In its "Strategic Roadmap towards 5G for Europe: Opinion on spectrum related aspects for next-generation wireless systems (5G)" (RSPG16-032 final), the RSPG sets out spectrum priorities and recommendations for the introduction of 5G terrestrial wireless systems in Europe. In this regard, the RSPG also recognises the need to ensure that technical and regulatory conditions for all EU-harmonised frequency bands for wireless broadband electronic communications services *are fit for 5G use* – including the 1.5 GHz core band.

This Mandate represents a follow-up to the Commission mandate to the CEPT of March 2014 (RSCOM13-67rev3) to study harmonised technical conditions for wireless broadband electronic communications services in the 1.5 GHz core band. The results of the latter were incorporated in the Commission Implementing Decision (EU) 2015/750 (May 2015) on the harmonisation of the 1452-1492 MHz frequency band for terrestrial systems capable of providing downlink-only electronic communications services in the Union⁸. Therefore, it is paramount that deliverables under this Mandate ensure availability of *contiguous spectrum* for WBB in the 1427-1518 MHz frequency range *under uniform harmonised technical conditions*, including any review in the 1.5 GHz core band, in support of future 5G use. Such approach would incentivise investment, reduce equipment cost and capital expenditure through economies of scale, and render benefits for end users. To this end, the studies should focus on *downlink-only use* within the whole frequency range and also address spectrum use with other relevant services in order to provide flexibility for national implementations.

JUSTIFICATION

Pursuant to Article 4(2) of the Radio Spectrum Decision the Commission may issue mandates to the CEPT for the development of technical implementing measures with a view to ensuring harmonised

⁷ The ITU Radio Regulations provide relevant limits of unwanted emissions for the band 1400-1427 MHz as to wireless broadband use in the band 1427- 1452MHz.

⁸ http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1431416821549&uri=OJ:JOL_2015_119_R_0006

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 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 the ITU and the CEPT.

The RSPP requires Member States, in cooperation with the Commission, to take all steps necessary to ensure that sufficient wireless broadband spectrum for coverage and capacity purposes is available in order to achieve the target for all citizens to have access to broadband speeds of not less than 30 Mbps by 2020. In particular, the RSPP sets the objective of identifying at least 1200 MHz of suitable spectrum for wireless broadband by 2015⁹. Furthermore, the RSPP stipulates that Member States, in cooperation with the Commission, shall, where appropriate, foster shared use of spectrum.

Advances in international standardisation as well as rapid international developments regarding 5G trials and spectrum use until 2020 call for a swift and coordinated Union-level process on delivering sufficient and appropriate spectrum for 5G use according to anticipated deployment of 5G usage scenarios.

Therefore, the availability of harmonised technical (including any sharing) conditions for the wireless broadband use of the 1.5 GHz extension bands as far as possible including in support of 5G take-up, are conducive to the Union spectrum policy objectives linked to high-quality wireless connectivity on the path to 5G.

TASK ORDER AND SCHEDULE

CEPT is herewith mandated to develop harmonised technical conditions for spectrum use in the 1.5 GHz extension bands which are suitable for the provision of terrestrial wireless broadband electronic communications services and, in particular, support next-generation (5G) wireless systems. These conditions should include, if necessary, sharing arrangements and conditions, which take into account needs of existing or prospective incumbent uses in adjacent bands. CEPT should give utmost consideration to overarching Union-level spectrum policy objectives¹⁰ such as efficient spectrum use and take utmost account of applicable principles of Union law such as technological and service 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 Directive. In particular, CEPT should take into consideration emerging technologies and ETSI (harmonised) standards, which define 5G systems and facilitate shared spectrum use or foster economies of scale.

In particular, CEPT is tasked to:

1. Study and assess the **1427-1518 MHz** frequency range for *downlink-only* use by terrestrial wireless broadband electronic communications services; in this regard, review the harmonised technical conditions applicable to the **1452-1492 MHz** frequency band;

⁹ That figure includes spectrum already in use.

¹⁰ Enshrined in the RSPP and the Radio Spectrum Decision

2. Develop channelling arrangements as well as common and minimal (least restrictive) technical conditions for spectrum use in the **1427-1452 MHz** and **1492-1518 MHz** frequency bands for the provision of downlink-only terrestrial wireless broadband electronic communications services, which are also suitable for 5G terrestrial wireless systems; when doing so, ensure *consistency* in the whole 1427-1518 MHz frequency range with view to suitability for 5G terrestrial wireless systems;
3. In conjunction with Task 2, develop harmonised technical conditions in the **1427-1452 MHz** and **1492-1518 MHz** frequency bands to enable national flexibility, including protection conditions where necessary, in close cooperation with all concerned stakeholders.

The *technical conditions* developed under Tasks 2 and 3 should be sufficient to mitigate interference and address where possible co-existence with incumbent radio services and applications in the 1427-1518 MHz frequency range and in adjacent bands, in line with their regulatory status, including at the EU outer borders. In particular, they should safeguard the protection of radio services in the 1400-1427 MHz frequency band from harmful interference in accordance with the ITU Radio Regulations

CEPT should provide deliverables according to the following schedule:

Delivery Date	Deliverable	Subject
July 2017 ¹¹	Draft Report from the CEPT to the Commission	Description of the work undertaken and the results.
November 2017	Final Report from the 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 the Radio Spectrum Decision, may consider applying the results of this mandate in the EU, pursuant to Article 4 of the Radio Spectrum Decision and subject to the results of the spectrum inventory and relevant guidance of the RSPG.

¹¹ Subject to a public consultation

ANNEX 2: LEAST RESTRICTIVE TECHNICAL CONDITIONS FOR TERRESTRIAL WIRELESS BROADBAND ELECTRONIC COMMUNICATIONS SERVICES IN 1427-1452 AND 1492-1518 MHz

The least restrictive technical conditions (LRTC) are in the form of a block-edge mask (BEM) and out-of-block emission limits. LRTC are related to the avoidance of interference between users of spectrum. The LRTC in the 1427-1452 and 1492-1518 MHz bands are optimised for, but are not limited to DL WBB ECS.

A BEM is an emission mask that is defined, as a function of frequency, relative to the block edge of spectrum. BEMs are emission restrictions without implication on the levels of the emission restriction applicable to the spurious domain. The term block edge refers to the frequency boundary of spectrum licensed to a mobile/fixed communication network.

The BEM has been derived to allow coexistence between DL WBB ECS systems in the 1427-1452 and 1492-1518 MHz bands.

In addition, out-of-block emission limits for DL WBB ECS have been defined to address compatibility between DL WBB ECS in the 1427-1452 and 1492-1518 MHz bands and other applications in adjacent bands but in the same geographical area.

Operators of WBB ECS in the 1427-1452 and 1492-1518 MHz bands may agree, on a bilateral or multilateral basis, different technical parameters providing that they continue to comply with the technical conditions applicable for the protection of other services, applications or networks and with their cross-border obligations. Administrations should ensure that these technical parameters can be used, if agreed among all affected parties.

A2.1 TECHNICAL CONDITIONS FOR BASE STATIONS

Administrations should take into account the following aspects:

It is not desirable to restrict the in-band e.i.r.p. for base stations operating in 1427-1452 MHz and 1492-1512 MHz, as the band could be aggregated with FDD coverage bands in lower frequencies and thus higher in-band e.i.r.p. for a base station allows benefiting of the SDL capacity across the base station cell.

Based on deployment requirements and on compatibility studies with other services operating in adjacent bands, or with legacy services operating in the band, an administration could at national level:

- restrict base stations in-band e.i.r.p. in the band 1427-1452 and 1492-1512 MHz. Such limit may range up to 68 dBm. Higher e.i.r.p. may be considered in specific circumstances;
- and/or
- according to the service considered: handle coordination of stations.

It should be noted that it is not expected that base station operating in the block 1427-1432 MHz can transmit a large power while respecting the emission limits detailed in Table 10 below. On the contrary, it is expected that only lower power base stations can be deployed in the block 1427-1432 MHz. It is not appropriate to introduce regulatory emission limits for these bands, as such limits are only related to current state-of-the-art of the technology and specific deployment models.

Compatibility requirements identified in ECC Report 263 [5] and ECC Report 269 [6] require restricting the in-band e.i.r.p. for base stations operating in 1512-1517 MHz to 58 dBm in band e.i.r.p.

Table 9, Table 10, Table 11 and Table 12, below define, respectively, the maximum in block e.i.r.p. per cell for BS operating in 1512-1517 MHz, the base station BEM out-of-block e.i.r.p. limits per antenna for emissions within the band 1427-1517 MHz, the base station maximum unwanted emission power in the band 1400-1427 MHz for base stations operating in 1427-1452 MHz and the base station out-of-block emission limits per cell above 1518 MHz for base stations operating in 1492-1517 MHz. In a multi sector site "cell" refers to one of the sectors.

Table 9: Maximum in block e.i.r.p. per cell⁽¹⁾ for BS operating in 1512-1517 MHz

WBB ECS block	Maximum in block e.i.r.p.	Measurement bandwidth
1512-1517 MHz	58 dBm	5 MHz

⁽¹⁾ In a multi-sector site, the value per 'cell' corresponds to the value for one of the sectors.

Table 10: Base station BEM out-of-block e.i.r.p. limits per antenna for emissions within the band 1427-1517 MHz

Frequency range of out-of-block emissions	Maximum mean out-of-block e.i.r.p.	Measurement Bandwidth
-10 to -5 MHz from lower block edge	11 dBm	5 MHz
-5 to 0 MHz from lower block edge	16.3 dBm	5 MHz
0 to +5 MHz from upper block edge	16.3 dBm	5 MHz
+5 to +10 MHz from upper block edge	11 dBm	5 MHz
Remaining DL WBB ECS frequencies	9 dBm	5 MHz

Table 11: Base station maximum unwanted emission power in the band 1400-1427 MHz for base stations operating in 1427-1452 MHz

Frequency range	Maximum unwanted emission power ¹²	Measurement Bandwidth
1400-1427 MHz	-72 dBW	27 MHz

Table 12: Base station out-of-block emission limits per cell⁽¹⁾ above 1518 MHz for base stations operating in 1492-1517 MHz.

Frequency range of out-of-block emissions	Maximum out-of-block e.i.r.p.	Measurement Bandwidth
Between 1518 and 1520 MHz	-0.8 dBm	1 MHz
Between 1520 and 1559 MHz	-30 dBm	1 MHz

⁽¹⁾ In a multi-sector site, the value per 'cell' corresponds to the value for one of the sectors.

A2.2 CHANGES TO THE USE OF THE CURRENT OUT-OF-BAND EIRP LIMITS BELOW 1452 MHz AND ABOVE 1492 MHz

For cases where WBB ECS is deployed below 1452 MHz and/or above 1492 MHz, the existing requirements for out-of-band EIRP limits set out in Table 2 of EC Decision 2015/750 are not applicable. In such cases the relevant limits from Table 10 above are applicable. When WBB ECS is deployed in the blocks immediately below 1452 MHz, Table 10 applies and the limitations indicated in Table 2 of EC Decision 2015/750 for frequency below 1452 MHz are not applicable. When WBB ECS is deployed in the blocks immediately above

¹² The unwanted emission power level is to be understood here as the level measured at the antenna port.

1492 MHz, Table 10 applies and the limitations indicated in Table 2 of EC Decision 2015/750 for frequency above 1492 MHz are not applicable.

ANNEX 3: FLEXIBILITY FOR ADMINISTRATIONS

CEPT confirms that the DL WBB ECS inherently offers national flexibility to administrations to introduce WBB ECS in all parts of the extension bands. The flexibility introduced gives freedom to administration to use 1427-1452 MHz and/or 1492-1518 MHz either for incumbent services or for DL WBB ECS. In the case where an administration decides to use either or both bands, or parts of the bands based on a block size of 5 MHz (as specified in Table 3), for DL WBB ECS, there may be an additional need for flexibility in the timing. Given this flexibility administrations shall facilitate cross-border coordination agreements so as to enable operation of the DL WBB ECS.

An illustration of different options is provided below.

Option 1: WBB ECS in 1452-1492MHz

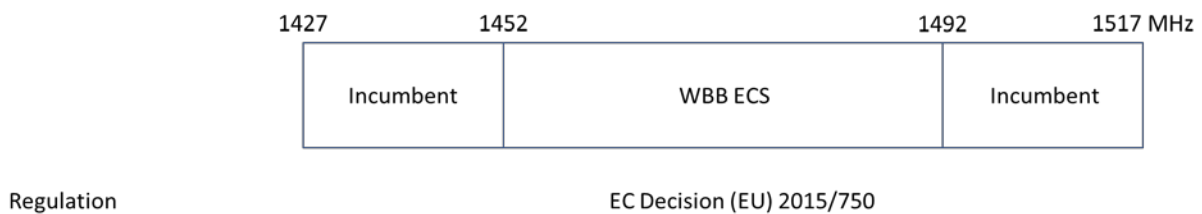


Figure 1: Option 1: DL WBB ECS in 1452-1492 MHz¹³

Option 2: WBB ECS in 1427-1492MHz

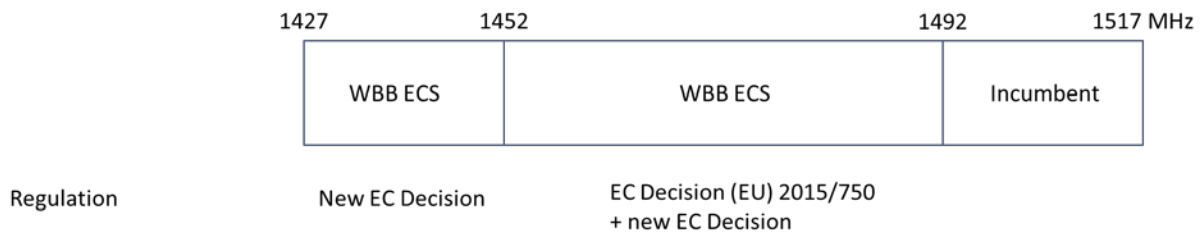


Figure 2: Option 2: DL WBB ECS in 1427-1492 MHz¹⁴

Option 3: WBB ECS in 1452-1517MHz

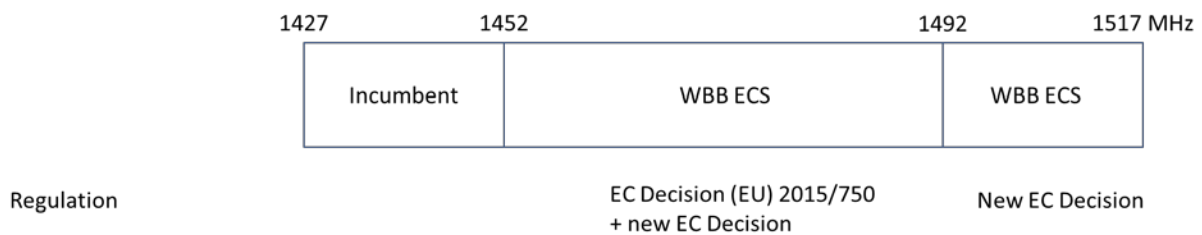


Figure 3: Option 3: DL WBB ECS in 1452-1517 MHz¹⁵

¹³ Example specification: 3GPP Band 32

¹⁴ Example specification: 3GPP Band 1427-1432 MHz and 1432-1517 MHz in 1427-1452 MHz, 3GPP Band 32 in 1452-1492 MHz

Option 4: WBB ECS in 1427-1517MHz

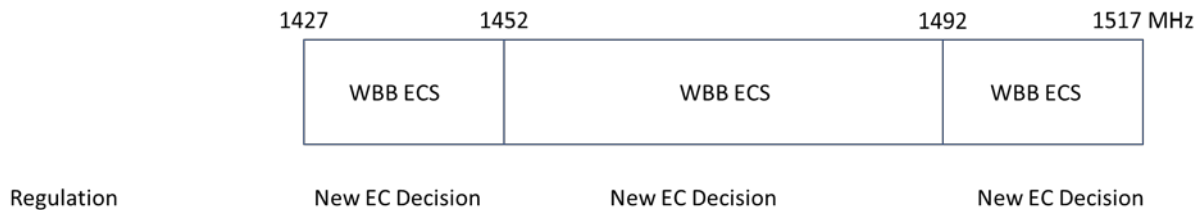


Figure 4: Option 4: DL WBB ECS in 1427-1517 MHz¹⁶

¹⁵ Example specification: 3GPP Band 32 in 1452-1492 MHz, 3GPP Band 1432-1517 in 1492-1517 MHz

¹⁶ Example specification: 3GPP Band 1427-1432 MHz and 1432-1517 MHz

ANNEX 4: LIST OF REFERENCE

- [1] EC Decision (EU) 2015/750: Commission Implementing Decision of 8 May 2015 on the harmonisation of the 1452-1492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union, May 2015
- [2] ITU Radio Regulations Edition of 2016
- [3] ERC Report 25: The European table of frequency allocations and applications in the frequency range 8.3 kHz to 3000 GHz, June 2016
- [4] ECC Decision (04)09: Designation of the bands 1518-1525 MHz and 1670-1675 MHz for the Mobile-Satellite Service, November 2004 and amended June 2009
- [5] ECC Report 263: Adjacent band compatibility studies between IMT operating in the frequency band 1492-1518 MHz and the MSS operating in the frequency band 1518-1525 MHz, March 2017
- [6] ECC Report 269: Least restrictive technical conditions for Mobile/Fixed Communications Networks in 1427-1452 MHz and 1492-1518 MHz, November 2017
- [7] ECC Report 202: Out-of-Band emission limits for Mobile/Fixed Communication Networks (MFCN) Supplemental Downlink (SDL) operating in the 1452-1492 MHz band, September 2013
- [8] ECC Report 45: Sharing and adjacent band compatibility between UMTS/IMT-2000 in the band 2500-2690 MHz and other services, February 2004
- [9] ERC Report 64: Frequency sharing between UMTS and existing fixed services, May 1999
- [10] CEPT Report 54: Harmonised technical conditions in the 1452-1492 MHz frequency band for wireless broadband electronic communications, November 2014
- [11] ECC Decision (13)03: The harmonised use of the frequency band 1452-1492 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL), November 2013 and amended July 2015
- [12] ECC Decision (17)06: The harmonised use of the frequency bands 1427-1452 MHz and 1492-1518 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL), approved 17 November 2017