



CEPT Report 54

Report from CEPT to the European Commission in response to the Mandate “To develop harmonised technical conditions in the 1452-1492 MHz frequency band for wireless broadband electronic communications services in the EU”

Report approved on 28 November 2014 by the ECC

0 EXECUTIVE SUMMARY

This CEPT Report is the response to the Mandate issued by the European Commission to develop harmonised technical conditions in the 1452-1492 MHz frequency band for its use for wireless broadband (WBB) electronic communications services in the EU.

The Report is based on the impact analysis carried out by CEPT aimed at determining the regulatory framework that will bring the highest benefits to the future harmonised use of the 1452-1492 MHz in Europe. In that respect, the conclusion of this analysis is that the most appropriate regulatory framework for the future use of the 1452-1492 MHz band is its harmonisation for wireless broadband supplemental downlink (WBB SDL), while allowing individual countries to adapt to specific national circumstances in part of the band for terrestrial broadcasting and other terrestrial applications. This regulatory framework is found to bring the highest benefits to CEPT.

The harmonisation of the 1452-1492 MHz band for WBB SDL is important to enhance the downlink capability of mobile broadband systems and represents a strategic tool to tackle the growing mobile data traffic asymmetry driven by increased mobile multimedia usage. WBB technologies such as UMTS and LTE have already evolved to be capable of using unpaired spectrum, including 1452-1492 MHz, for SDL, and such capability has already been incorporated in the international standards developed by 3GPP.

This CEPT Report provides the harmonised technical arrangements and conditions for WBB SDL-based use of the 1452-1492 MHz, namely the channelling arrangement, the common and minimal (least restrictive) technical conditions, the common technical conditions to ensure coexistence with radio services/applications in adjacent bands, including at the EU outer borders.

It is noted that in addition to the harmonised technical arrangements and common conditions, some specific measures can be applied at national level by those administrations that need to enable the use of the 1452-1492 MHz band for SDL while ensuring coexistence with uncoordinated fixed links. The co-existence with all other radio services/applications considered in adjacent bands, is ensured when appropriate, with relevant coordination procedures for coordinated fixed links (which may include additional technical/operational conditions i.e. frequency-territorial planning depending on national circumstances) and telemetry, with the common harmonised out of band limits defined in this Report. In the case where an Administration uses Terrestrial Digital Audio Broadcasting (T-DAB) in part of the band 1452-1479.5 MHz, coordination thresholds to be used under the Maastricht Agreement have been developed together with, for that Administration, nationally applicable technical conditions to ensure in-band adjacent channel coexistence.

TABLE OF CONTENTS

0 EXECUTIVE SUMMARY	2
1 INTRODUCTION.....	5
2 BACKGROUND INFORMATION	6
2.1 Evolution steps of 1452-1492 MHz use in CEPT	6
2.2 Regulatory background	6
3 RESULT OF STUDIES ON 1452-1492 MHZ.....	7
3.1 Results of the impact analysis on the future use.....	7
3.2 Harmonised channelling arrangement and technical conditions for wireless broadband usage of the 1452-1492 MHz frequency band.....	8
3.2.1 Harmonised channelling arrangement	8
3.2.2 Least Restrictive Technical Conditions	9
3.2.2.1 <i>Coexistence between WBB use within the same band.....</i>	9
3.2.2.2 <i>Coexistence between WBB and other applications/services in adjacent bands.....</i>	9
3.2.3 Coexistence between WBB and other incumbent applications/services in the band.....	11
3.2.4 Cross-border coordination, including at EU outer borders	12
4 CONCLUSIONS.....	14
ANNEX 1: CEPT MANDATE	15
ANNEX 2: TECHNICAL ANNEX	20
ANNEX 3: LIST OF REFERENCE.....	23

LIST OF ABBREVIATIONS

Abbreviation	Explanation
3GPP	3G Partnership Project
BEM	Block Edge Mask
CEPT	European Conference of Postal and Telecommunications Administrations
EC	European Commission
ECC	Electronic Communications Committee
ECN	Electronic Communications Network
ECS	Electronic Communication Services
e.i.r.p.	effective isotropically radiated power
ERC	European Radiocommunication Committee
FDD	Frequency Division Duplex
LRTC	Least Restrictive Technical Conditions
LTE	Long Term Evolution
MA	Maastricht Agreement
MFCN	Mobile / Fixed Communication Networks
MSR	Multi Standard Radio
OOBE	Out of Band Emissions
pdf	Power flux density
RSPG	Radio Spectrum Policy Group
SDL	Supplemental Downlink
SEM	Spectrum Emission Mask
T-DAB	Terrestrial Digital Audio Broadcasting
UMTS	Universal Mobile Telecommunication System
WBB	Wireless Broadband
WiMAX	Worldwide Interoperability for Microwave Access

1 INTRODUCTION

This CEPT Report is the response to the EC Mandate issued by the European Commission to develop harmonised technical conditions in the 1452-1492 MHz frequency band for its use for wireless broadband (WBB) electronic communications services (ECS) in the EU (ANNEX 1:).

The Mandate acknowledges the work carried out in CEPT [1] on the development of harmonised implementation measures for WBB use of 1452-1492 MHz as Supplemental Downlink (SDL). It notes that the RSPG recommends to the European Commission to consider adopting complementary measures, to the CEPT ones, to further promote the use of 1452-1492 MHz for SDL, while preserving the possibility for Member States to use part of this band for other terrestrial uses such as terrestrial broadcasting. The Commission further notes in the Mandate that CEPT adopted, in November 2013, a regulatory framework for SDL-based WBB use of the 1452-1492 MHz band [2], which also aims at facilitating coexistence with Digital Audio Broadcasting (DAB) applications. It subsequently considers that the 1452-1492 MHz band represents a candidate band for WBB use in the EU in the near term.

CEPT is therefore mandated to develop harmonised technical conditions for the short term use of wireless broadband electronic communications services in the 1452-1492 MHz frequency band taking into account, if necessary, sharing conditions with incumbent services for which future spectrum demand has been identified.

In particular, CEPT is mandated to develop harmonised technical arrangements and conditions for wireless broadband usage of the 1452-1492 MHz frequency band as well as related harmonised sharing and compatibility conditions, wherever necessary, with incumbent services/applications in the same or in adjacent bands, including at the EU outer borders. The arrangements and conditions must be sufficiently precise for the development of EU-wide equipment. This includes:

1. *Development of channelling arrangements and common and minimal (least restrictive) technical conditions for wireless broadband usage. These conditions should be sufficient to ensure coexistence of wireless broadband services within the same band and with others services in adjacent bands.*
2. *Development of common technical conditions to ensure wireless broadband spectrum usage on a shared basis with relevant incumbent radio services/applications in close cooperation with all concerned stakeholders. These conditions should be sufficient to ensure coexistence while mitigating interference with incumbent radio services/applications in the same band or in adjacent bands, in line with their regulatory status.*
3. *For each incumbent service/application identified as in need of protection under 2, definition of relevant protection parameters and conditions for facilitating coexistence with wireless broadband within the same band and in adjacent bands, including at the EU outer borders.*
4. *Considering requirements for cross-border coordination, including at the EU outer borders.*

The work required under this Mandate to develop the harmonised arrangements and common technical conditions for WBB SDL-based use of the 1452-1492 MHz, namely the harmonised channelling arrangement, the common and minimal (least restrictive) technical conditions and the common technical conditions to ensure coexistence with radio services/applications in adjacent bands, has already been carried out by CEPT and is available in ECC Reports 188 [2] and 202 [3].

The remaining work required under the Mandate to develop the technical conditions for adjacent channel coexistence and cross-border coordination within the band between WBB SDL and other incumbent radio-services/applications, to address specific national circumstances of incumbent use, namely terrestrial broadcasting and aeronautical telemetry, is also finalised and available in ECC Report 227 [10].

This CEPT Report provides the necessary harmonised channelling arrangement and common technical conditions to assist the European Commission in elaborating complementary measures to further promote the use of the band 1452-1492 MHz for WBB SDL in the EU as recommended by the RSPG.

2 BACKGROUND INFORMATION

2.1 EVOLUTION STEPS OF 1452-1492 MHZ USE IN CEPT

The 1452-1479.5 MHz sub-band is harmonised in CEPT for Terrestrial Audio Broadcasting systems through the Maastricht Special Arrangement (MA), since 2002. The arrangement was later revised in Constanța (MA02revCO07), in 2007 [3] to introduce additional flexibility in order to allow the deployment of terrestrial mobile multimedia systems on a national basis. In addition, the 1479.5-1492 MHz sub-band had been harmonised for Satellite Digital Audio Broadcasting (S-DAB) since 2003 through the ECC Decision (03)02 [4]. However, despite those harmonisation measures, the 1452-1492 MHz band has remained mostly unused for the past decade.

In late 2010, administrations and industry within CEPT expressed strong interest in reviewing the utilisation of the 1452-1492 MHz band in order to ensure an efficient use of those 40 MHz of prime spectrum in Europe and to provide a considerable opportunity for the development of new applications. In December 2010 the ECC launched a questionnaire to determine the candidate applications for the future use of the band and in May 2011, a new Project Team was established to determine which future use of the 1452-1492 MHz band that would be the most appropriate for CEPT, with the support of an impact analysis.

This work resulted in the adoption by CEPT of ECC Report 188 on the future harmonised use of 1452-1492 MHz in CEPT [1], in February 2013, and the subsequent adoption of ECC/DEC/(13)03 on “the harmonised use of the frequency band 1452-1492 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)” [2] in November 2013.

2.2 REGULATORY BACKGROUND

The ITU Radio Regulations allocate the band 1452-1492 MHz in Region 1 to the Fixed, Mobile (except aeronautical mobile), Broadcasting and Broadcasting Satellite Service on a co-primary basis.

Several footnotes apply to the band:

- **5.342** *Additional allocation:* in Armenia, Azerbaijan, Belarus, the Russian Federation, Uzbekistan, Kyrgyzstan and Ukraine, the band 1 429-1 535 MHz, and in Bulgaria the band 1 525-1 535 MHz, are also allocated to the aeronautical mobile service on a primary basis exclusively for the purposes of aeronautical telemetry within the national territory. As of 1 April 2007, the use of the band 1 452-1 492 MHz is subject to agreement between the administrations concerned. (WRC-12).
- **5.345** Use of the band 1 452-1 492 MHz by the broadcasting-satellite service, and by the broadcasting service, is limited to digital audio broadcasting and is subject to the provisions of Resolution **528 (WARC-92)***.

In CEPT, the Maastricht, 2002, Special Arrangement, as revised in Constanța, in 2007 (MA02revCO07) provides the technical and regulatory framework for the deployment of T-DAB and other terrestrial mobile multimedia services in the frequency band 1452-1479.5 MHz. Annex 1 to MA02revCO07 provides the Plan as agreed in 2007. The Plan can be modified in order to include new allotments using the procedures given in MA02revCO07. MA02revCO07 further provides cross-border coordination procedures between T-DAB and the Mobile Service.

The ECC/DEC/(03)02 [4], adopted in 2003, designated the frequency band 1479.5-1492 MHz for use by satellite DAB systems. This Decision was withdrawn in June 2013 by CEPT through ECC/DEC/(13)02 [5] as a result of the adoption of ECC Report 188 [1] on the future harmonised use of 1452-1492 MHz for MFCN SDL.

In November 2013, CEPT adopted ECC/DEC/(13)03 [2] which harmonises the use of the frequency band 1452-1492 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL).

* This Resolution was revised by WRC-03.

3 RESULT OF STUDIES ON 1452-1492 MHz

3.1 RESULTS OF THE IMPACT ANALYSIS ON THE FUTURE USE

The impact analysis carried out by CEPT aimed at determining which regulatory framework will bring the highest benefits. The study is detailed in ECC Report 188 [1] on the future harmonised use of 1452-1492 MHz [1].

In order to conduct this impact analysis, a number of criteria have been defined, namely:

1. compatibility with the current regulatory framework;
2. possibility to share with other applications/uses;
3. extent (maximisation) of social and economic benefits;
4. timeframe for availability of equipment on a large scale and for application deployment - status of standardisation;
5. Potential for economy of scale (need and potential for harmonisation within and outside CEPT).

The candidate applications considered for the future use of the band were:

1. Terrestrial Broadcasting;
2. Mobile Broadband;
3. Mobile Broadband Supplemental Downlink;
4. Satellite Digital Audio Broadcasting;
5. Program Making and Special Events;
6. Broadband Public Protection Disaster Relief for temporary and local use;
7. Broadband Direct Air to Ground Communication.

The spectrum requirement of each candidate application was determined and an analysis of the various candidate applications against the defined criteria was carried out. The regulatory options required for the deployment of the candidate applications have been defined. Three regulatory options were then retained for further analysis. A detailed methodology to conduct the impact analysis was developed and the impact analysis was conducted.

The conclusion of the ECC Report 188 [1] is that the most appropriate regulatory framework for the future use of the 1452-1492 MHz band in CEPT is the harmonisation of this band for MFCN SDL¹, while allowing individual countries to adapt to specific national circumstances in part of the band for terrestrial broadcasting and other terrestrial applications. This regulatory framework will bring the highest benefits for CEPT, with those benefits being maximised when SDL is deployed under this framework.

The ECC also concluded that the harmonisation of the 1452-1492 MHz band for MFCN SDL is important to enhance the downlink capability of mobile broadband systems and represents a strategic tool to tackle the asymmetric growing mobile data traffic driven by mobile multimedia usage. The ECC also noted that WBB technologies, such as UMTS and LTE, have evolved to be capable of using unpaired spectrum, like 1452-1492 MHz, for SDL. The ECC further recognised that the use of the band 1452-1492 MHz for MFCN SDL based on least restrictive technical conditions (LRTC) and on a harmonised frequency arrangement will maximise the opportunities and benefits for end users, will reduce capital expenditure for operators and cost of manufacturing equipment and will secure future investments by providing economy of scale.

¹ A MFCN SDL is a mobile broadband system, which by means of base station transmitters in the network, uses unpaired spectrum in the downlink to provide a supplemental downlink capacity to carry comprehensive text, audio, images, data, sound and video content in general, in a unicasting, multicasting or broadcasting mode to mobile devices.

The implementation of this regulatory framework resulted in the following:

- The ECC adopted ECC/DEC/(13)03 [2] which designates the band 1452-1492 MHz for Mobile/Fixed Communication Networks (MFCN) Supplemental Downlink and defines the harmonised channelling arrangement and the least restrictive technical conditions for MFCN SDL use of the 1452-1492 MHz band
- The ECC adopted ECC/DEC/(13)02 [5] which withdrew ECC/DEC/(03)02 [4], that used to harmonise the sub-band 1479.5-1492 MHz for Satellite Digital Audio Broadcasting within CEPT
- As a matter of national flexibility, an administration wishing to maintain the use of incumbent terrestrial digital sound broadcasting networks in part of the 1452-1479.5 MHz may choose to do so using the MA02revCO07 Arrangement and its possible Plan modifications.
- The MA02revCO07 Agreement was also retained for cross-border coordination bilateral agreements between terrestrial broadcasting, for countries wishing to maintain terrestrial broadcasting incumbent use in part of the band, and MFCN SDL.
- CEPT is considering proposing at the WRC-15 to introduce pfd limits to be included in Article 21 of the RR. The objective is to protect MFCN SDL use within CEPT from harmful interference from satellite use outside CEPT². The required pfd limits have been determined.
- MFCN SDL to MFCN SDL cross-border coordination in the band 1452-1492 MHz will be subject to an ECC/REC/(15)01 for bilateral agreements similar to other mobile to mobile cross-border coordination in other bands [11].

3.2 HARMONISED CHANNELLING ARRANGEMENT AND TECHNICAL CONDITIONS FOR WIRELESS BROADBAND USAGE OF THE 1452-1492 MHz FREQUENCY BAND

The harmonised arrangement and technical conditions for WBB SDL-base use of the 1452-1492 MHz band are summarised in Annex 2.

3.2.1 Harmonised channelling arrangement

The channelling arrangement for the harmonised use of 1452-1492 MHz for WBB in the EU is based on eight block size of 5 MHz each, for downlink use i.e. base station to mobile transmission and is specified in Table 1:

² In the meantime, Administrations will have the possibility to register terrestrial stations of the SDL mobile service in the MIFR in order to ensure protection of MFCN from satellite interference through the ITU coordination procedure.

Table 1: Harmonised channelling arrangement of the 1452-1492 MHz band

1452-1457	1457-1462	1462-1467	1467-1472	1472-1477	1477-1482	1482-1487	1487-1492
Downlink (base station transmit)							
40 MHz (8 blocks of 5 MHz)							

3.2.2 Least Restrictive Technical Conditions

3.2.2.1 Coexistence between WBB use within the same band

CEPT developed Least Restrictive Technical Conditions based on a Block Edge Mask (BEM) to ensure the coexistence between WBB SDL users within 1452-1492 MHz. The studied compatibility scenario corresponds to Base Station (BS) to Terminal Station (TS) interference scenario, which has been previously studied, in the context of the 2 GHz band, in CEPT Report 39 [7]. Furthermore, the Spectrum Emission Masks corresponding to the BEMs from CEPT Report 39 [7] were also shown to be sufficient to ensure coexistence in the 900 MHz band (ECC Report 82 [8] and CEPT Report 40 [9]).

It is then considered that:

- BS to TS interference is similar to intra-system interference that occurs at the channel boundaries within WBB systems. Technical standards have been derived with sufficient mitigation techniques to overcome this type of interference;
- WBB SDL Base station BEM out-of-block e.i.r.p. limits within the band 1452-1492 MHz can be derived directly by integration of the spectrum emission mask (SEM) of 3GPP Multi Standard Radio (MSR) specifications. Plans for current other ECN standards (e.g. WiMAX) indicate that alignment with this MSR SEM is feasible and it is considered that this should not impose any constraint on equipment implementation.

The technology-neutral BEM (out-of-block) for WBB SDL Base Station operating within 1452-1492 MHz, per antenna, is provided in Table 2:

Table 2: Base station BEM (out-of-block) e.i.r.p. within 1452-1492 MHz per antenna

Frequency range of out-of-block emissions	Maximum mean out-of-block e.i.r.p. [dBm]	Measurement bandwidth [MHz]
-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 MFCN SDL frequencies	9 dBm	5 MHz

3.2.2.2 Coexistence between WBB and other applications/services in adjacent bands

CEPT developed Least Restrictive Technical Conditions based on Out-of-Band Emission (OOBE) limits for WBB SDL to ensure the coexistence between WBB SDL within 1452-1492 MHz and other applications/services in adjacent bands.

The studies which have been carried out between WBB SDL and other applications/services used in adjacent bands are shown in the figure below. For the purpose of these studies, aeronautical telemetry is limited to ground stations, which are the only relevant receivers for that application.



Figure 1: Incumbent applications/services in bands adjacent to 1452-1492 MHz

The studies are detailed in ECC Report 202 [6]. They 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.

These harmonised OOBE limits for the WBB SDL Base Station operating in the band 1452-1492 MHz are provided in the Table 3:.

Table 3: OOBE limits for the WBB SDL base station operating in 1452-1492 MHz

Frequency range of out-of-band emissions	Maximum mean out-of-band 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

Furthermore, the Report [6] concludes that, in addition to these OOBE, coexistence between MFCN SDL and coordinated fixed link stations, as well as coexistence between MFCN SDL and aeronautical telemetry stations in adjacent bands, within the territory of an administration, can be managed and ensured through network and frequency planning coordination (i.e. frequency/engineering planning which may require additional technical/operational conditions being applied i.e. frequency-territorial planning, depending on national circumstances). It should be noted that the Fixed Link protection and assignment criteria are different from country to country. Examples of coordination distances which are country specific, technical criteria and conditions are available in ECC Report 202 [6].

Based on MFCN SDL deployment requirements and on compatibility with other applications/services operating in adjacent bands, administration could at national level restrict the base station in-band e.i.r.p. limit. Such limit may range up to 68 dBm / 5 MHz while higher e.i.r.p levels may also be considered in specific circumstances (e.g., when the 1452-1492 MHz SDL band is be aggregated with FDD coverage bands in lower frequencies, so as to ensure the SDL capacity all over the base station cell). For the purpose of this Report, the e.i.r.p. is the total radiated power in any direction at a single location independent of any base station configuration³.

For the specific case of coexistence with ‘uncoordinated’ fixed links, ECC Report 202 [6] also provides specific MFCN SDL in-block and out-of-band e.i.r.p. ‘Uncoordinated fixed links’ refer to fixed links operating below 1452 or above 1492 MHz in an uncoordinated manner and not having specific operation locations. It

³ See ECC Report 202 for further details.

was noted that this situation was rare and that the fixed link protection and assignment criteria are different from country to country and that some administrations may consider uncoordinated fixed links as fixed service, whereas other administrations may consider it as mobile service with different criteria. For this compatibility scenario between SDL with adjacent band uncoordinated fixed links, where the fixed link equipment, its position and its antenna alignment are completely unknown (from the SDL perspective), on the basis of Monte Carlo simulations and where there are no SDL base stations directly within the fixed link antenna main beam, ECC Report 202 [6] provides an out of band emission limit of -38.5 dBm/MHz (respectively, -26.2 dBm/MHz) for I/N protection criteria of -20 dB (resp. -6 dB) with a minimum separation distance requirement of 250 m and additional limits on the in band SDL base station maximum e.i.r.p. of 11.8 dBm (resp. 33.4 dBm) for the first and last 5 MHz channel and 20.2 dBm (resp. 34 dBm) for the rest of the band, to address uncoordinated fixed links adjacent band selectivity and blocking requirement. However, the Report notes that uncoordinated fixed links with directional antennas above rooftop at any location pointing to any direction with low interference threshold results in extremely stringent requirements for systems in adjacent bands and that under such conditions, the band 1452-1492 MHz is practically unusable for any terrestrial system and that the deployment of uncoordinated fixed links in a country is incompatible with the implementation of the Maastricht Special Arrangement for this country.

It can therefore be concluded that in addition to the harmonised out-of-band emission limits, some administrations may need to develop and implement additional technical and/or procedural measures, such as site coordination and/or more stringent out-of-band emissions, which take into account the specific national situations, to enable the use of 1452-1492 MHz for SDL while ensuring compatibility between SDL and systems in adjacent bands.

3.2.3 Coexistence between WBB and other incumbent applications/services in the band

Some CEPT administrations have identified the need to maintain, as a matter of national flexibility, the use of Terrestrial Digital Audio Broadcasting (T-DAB) in part of the band 1452-1479.5 MHz. T-DAB is therefore the only incumbent application which would require in-band adjacent channel coexistence study in the context of this Mandate.

The interference from SDL to T-DAB in adjacent channel is moderate under assumptions corresponding to rural deployment. In such a case, deployment with limited (0.5 MHz) guard band seems to be appropriate. In urban environment, the probability of interference from SDL implementing the out-of-block emission from Table 2: to T-DAB is substantial (more than 10 %) for guard band lower than 1 MHz.

The SDL critical BEM, guaranteeing that interference into T-DAB due to blocking is the dominant interference factor for any guard band is defined as follows:

Table 4: OOB limits for WBB SDL base station operating in 1452-1492 MHz z for adjacent channel coexistence with T-DAB

Frequency range of out-of-block emissions	Maximum mean out-of-block e.i.r.p. [dBm]	Measurement Bandwidth [MHz]
0 – 1.3 MHz from block edge	9.3	1
1.3-1.5 MHz from block edge	2.8	1
1.5-1.8 MHz from block edge	-6.7	1
1.8-2 MHz from block edge	-12.4	1
2-2.3 MHz from block edge	-13.7	1
2.3-5 MHz from block edge	-14.9	1
Remaining T-DAB frequencies	-14.9	1

The adoption of the SDL critical BEM defined in Table 1 of ECC Report 227 [10] and reproduced in Table 4: guarantees:

- That interference from SDL to T-DAB due to blocking is the dominant interference factor for any guard band;

- A low level of interference from SDL to T-DAB for a guard band of 1.5 MHz, even in urban deployment scenario.

It should be noted that no assessment was conducted in ECC Report 227 [10] on whether the proposed SDL critical BEM can be implemented on a cost efficient manner. Such studies would be required on a national basis in order to select a potentially different guard band between T-DAB and SDL, and accordingly the SDL BEM corresponding to that guard band.

3.2.4 Cross-border coordination, including at EU outer borders

The two relevant scenarios, in the context of this Mandate for cross-border coordination within the EU and at EU outer borders are WBB SDL / T-DAB and WBB SDL / aeronautical telemetry (operated in some non-EU countries).

▪ WBB SDL vs. T-DAB cross-border coordination

The MA02revCO07 Agreement was retained by CEPT for cross-border coordination bilateral agreements between terrestrial broadcasting (for countries wishing to maintain terrestrial broadcasting incumbent use in part of the band) and WBB SDL.

Article 5 of Ma02revCo07 applies. Indeed, Article 5.1.1 highlights that reception of stations in the mobile service, except the aeronautical mobile service, is likely to be affected by a proposed T-DAB block assignment if the appropriate limits indicated in Annex 2 are exceeded. Section 4.2.2 of Annex 2 outlines that when *'no information concerning protection ratios for other services suffering interference from T-DAB has been supplied to the Planning Meeting, the administrations concerned should develop appropriate sharing criteria by mutual agreement. When available one could use the relevant ITU-R Recommendations or ERC and ECC Decisions and Recommendations'* to determine maximum permissible interfering field strength limits. Article 5.2.1 and Section 4.2.1 of Annex 2 include similar provisions for the reverse case, namely when T-DAB allotments are likely to be affected by the mobile service.

Since the field strength limits to be applied for cross-border coordination between T-DAB and MFCN SDL have not been specified in Annex 2 of Ma02revCo07, at the time of the development of the agreement, CEPT has developed the following recommended coordination thresholds, to be used under the Maastricht Agreement coordination procedure:

- in the case of cross-border coordination of MFCN SDL interfering with T-DAB: 41 dB μ V/m⁴ measured over the bandwidth of a single T-DAB block for an antenna height of 10 m (in conformity with the Maastricht agreement).
- in the case of cross-border coordination of T-DAB interfering with MFCN SDL: 56.4 dB μ V/m measured over the bandwidth of a single SDL block (5 MHz) for an antenna height of 10 m (relaxing the threshold level from the Maastricht agreement).

▪ WBB SDL vs. aeronautical telemetry cross border coordination

While allocated on a worldwide basis to the mobile service except aeronautical mobile the 1452-1492 MHz band is additionally allocated to aeronautical mobile services exclusively for the purposes of aeronautical telemetry within the national territory of some non-EU countries. Indeed, Footnote RR No.5.342 reads:

"Additional allocation: in Armenia, Azerbaijan, Belarus, Bulgaria, the Russian Federation, Uzbekistan, Kyrgyzstan and Ukraine, the band 1 429-1 535 MHz is also allocated to the aeronautical mobile service on a primary basis exclusively for the purposes of aeronautical telemetry within the national territory. As of 1 April 2007, the use of the band 1 452-1 492 MHz is subject to agreement between the administrations concerned."

In order to provide protection of aeronautical telemetry ground receivers in Region 1 from co-frequency interference caused by IMT stations, required separation distances would generally exceed 100 kilometres.

⁴ This value is based on the assumption of the impact of a single MFCN SDL interferer.

However, when applying mitigation techniques (e.g., sector antenna disabling at IMT base stations) separation distances may be reduced to few tens of kilometres. Appropriate separation distances and potential mitigation techniques (either at IMT base stations or ground telemetry stations) will be addressed during coordination between the concerned administrations.

For the protection of IMT UE receiver, according to a scenario which takes into account measured distribution of antenna gain of airborne transmitter and Monte-Carlo simulation, the separation distance of 15 km is sufficient to protect IMT UE receiver assuming 0.5% interference probability criteria. On the other hand, some ITU studies indicated that there could be interferences to UE up to 25 km from the border.

4 CONCLUSIONS

This CEPT Report is the response to the Mandate issued by the European Commission to develop harmonised technical conditions in the 1452-1492 MHz frequency band for its use for wireless broadband (WBB) electronic communications services (ECS) in the EU.

On the basis of the extensive work carried out within CEPT on the harmonisation of 1452-1492 MHz, namely the impact analysis on the regulatory framework that will bring the highest benefits with regard to the future harmonised use of the 1452-1492 MHz and the subsequent technical studies on the harmonised technical conditions, this CEPT Report provides the harmonised technical arrangements and common technical conditions for WBB Supplemental Downlink (SDL) use of the 1452-1492 MHz in the EU. These technical arrangements and conditions consist of the harmonised channelling arrangement, the common and minimal (least restrictive) technical conditions and the common technical conditions to ensure coexistence with radio services/applications in the same or in adjacent bands, including at the EU outer borders.

As a consequence, this CEPT Report provides the necessary harmonised arrangements and common technical conditions, as gathered in ANNEX 2:, to assist the European Commission in elaborating complementary measures to further promote the use of the band 1452-1492 MHz for WBB SDL in the EU, as recommended by the RSPG.

ANNEX 1: CEPT MANDATE



EUROPEAN COMMISSION
Communications Networks Content & Technology Directorate-General
Electronic Communications Networks & Services
Spectrum

Brussels, 19 March 2014
DG CONNECT/B4

RSCOM13-67rev3

ADOPTED

RADIO SPECTRUM COMMITTEE
Working Document

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

Subject: Mandate to CEPT to perform technical studies in the 1452-1492 MHz frequency band for its use for wireless broadband electronic communications services in the EU

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MANDATE TO CEPT
TO DEVELOP HARMONISED TECHNICAL CONDITIONS IN THE 1452-1492 MHz FREQUENCY BAND FOR WIRELESS BROADBAND ELECTRONIC COMMUNICATIONS SERVICES IN THE EU

1. PURPOSE

The deliverables of this Mandate should ensure flexible and efficient spectrum use of the 1452-1492 MHz frequency band by developing harmonised technical conditions for wireless broadband (WBB) electronic communications services (ECS) and, if necessary, harmonised sharing conditions which ensure co-existence of WBB use with incumbent services for which future demand has been identified.

Noting the favourable propagation properties within the 1.5 GHz frequency range, 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). In preparing them, CEPT is requested to take into account the relevant developments at ITU level on the aforementioned frequency bands with regard to the World Radiocommunications Conference in 2015 (WRC-15).

2. BACKGROUND AND INPUTS

In its Opinion on the strategic challenges facing Europe in addressing the growing spectrum demand for wireless broadband⁶, the Radio Spectrum Policy Group (RSPG) provided the following views regarding the potential of frequency bands in the 1.5 GHz range for WBB use in EU:

1. The frequency band **1452-1492 MHz** (40 MHz in total) is identified as potentially available in the near term while the bands **1375-1400 MHz** and **1427-1452 MHz** (50 MHz in total) are considered potentially available in the medium term (> 2015).
2. The frequency bands 1350-1375 MHz and 1492-1518 MHz are not identified as potentially available for WBB use.
3. The frequency band 1400-1427 MHz, which is protected from emissions by virtue of the ITU radio regulations⁷, is not identified as potentially available for WBB use.
4. The frequency range 1518-1559 MHz (41 MHz in total) is considered already available for WBB services (e.g. IMT satellite component, mobile satellite applications).

The conclusions of the RSPG in the aforementioned Opinion are based on analysis of incumbent services and possibilities for sharing with WBB, also in the light of the ITU radio regulations. The table below gives an overview of incumbent non-WBB services in frequency bands of the 1.5 GHz frequency range based on information from the RSPG Opinion.

Frequency band	Bandwidth [MHz]	RSPG: overview of incumbent non-WBB uses in the EU	RSPG: assessment regarding WBB use in the EU
1350-1375 MHz	25	Military, fixed links, radio astronomy	No recommendation
1375-1400 MHz	25	Military, fixed links, wireless cameras, radio astronomy	Recommendation: medium term (> 2015)
1400-1427 MHz	27	EESS (passive sensors), radio astronomy	No recommendation
1427-1452 MHz	25	Military, fixed links, wireless cameras	Recommendation: medium term (> 2015)
1452-1492 MHz	40	T-DAB / S-DAB (low or no use)	Recommendation: near-term
1492-1518 MHz	26	Military, fixed links	No recommendation

Table 1: Overview of the regulatory status of frequency bands in the 1.5 GHz range

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 Document RSPG13-521 rev1

⁷ Footnote 5.340 of the ITU Radio Regulations

In particular, the RSPG recommends to the Commission to make sufficient and appropriate spectrum available for WBB in the 2013-2020 timeframe including *inter alia* analysis of the usage and the potential for WBB services of the 1452-1492 MHz band as well as the 1375-1400 MHz and 1427-1452 MHz frequency bands on a harmonised basis in accordance with the likely timeframe of their availability.

As for the 1452-1492 MHz band, and noting work in CEPT to develop harmonised implementation measures for WBB use as a supplemental downlink (SDL), the RSPG recommends to the Commission to consider adopting complementary measures to further promote the use of this band for SDL, while preserving the possibility for Member States to use part of this band for other terrestrial uses such as terrestrial broadcasting. The Commission services note that CEPT adopted in November 2013 a regulatory framework for SDL-based WBB use of the 1452-1492 MHz band⁸, which also aims at facilitating co-existence with broadcasting (DAB) applications. Therefore, the 1452-1492 MHz frequency band represents a candidate band for WBB use in the EU in the near term.

Both the CEPT and the ITU have launched sharing and compatibility studies regarding the potential allocation to the mobile service and/or identification for IMT (or WBB) of frequency bands in the 1.5 GHz range within their ongoing preparatory work on agenda item 1.1 of WRC-15. In this regard, the Commission services note that no final decision on candidate bands in relation to agenda item 1.1 has been taken yet at international level. Nevertheless, a final international agreement on the mobile service allocation and IMT identification of spectrum, which is bindingly applicable to the EU Member States, will be taken only at the WRC-15. In this regard, cross-border coordination with other services (such as aeronautical) at EU borders (e.g. with Russia) should be considered for certain frequency bands of the 1.5 GHz frequency range.

3. JUSTIFICATION

Pursuant to Article 4(2) of the Radio Spectrum Decision⁹ 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 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.

The Radio Spectrum Policy Programme 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 2020¹⁰. In particular, the RSPP sets the objective of identifying at least 1200 MHz of suitable spectrum for wireless broadband by 2015¹¹, based on the spectrum inventory. That figure includes spectrum already in use. Furthermore, the RSPP stipulates that Member States, in cooperation with the Commission, shall, where appropriate, foster shared use of spectrum¹².

In this regard, major objectives of the EU spectrum inventory¹³ set up by the RSPP are to facilitate efficient spectrum use as well as reallocation and spectrum-sharing opportunities in identified bands while taking into account future needs for spectrum.

The RSPP also stipulates that Member States, in cooperation with the Commission, continuously monitor the capacity requirements for wireless broadband services. On the basis of the results of the analysis referred to in Article 9(4) of the RSPP, the Commission shall assess and report to the European Parliament and the Council by 1 January 2015 on whether there is a need for action to harmonise additional frequency bands¹⁴. This report should be duly taken into account in the final deliverables on this Mandate.

The Commission services take the view that spectrum sharing should become a mainstream mode of spectrum use in the internal market given the increasing scarcity of spectrum resources (at least at frequencies below 6 GHz) and in order to ensure efficient spectrum use. In its Communication on promoting shared use of spectrum¹⁵, the Commission has stated that, to foster the development of wireless innovations

⁸ ECC Decision ECCDEC(13)03

⁹ 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

¹⁰ Article 6(1) RSPP

¹¹ Article 3(b) RSPP

¹² Article 4(1) RSPP

¹³ Article 9 RSPP

¹⁴ Article 6(5) RSPP

¹⁵ COM(2012) 478 final, 3 September 2012

in the EU, it is necessary to continuously improve the opportunities for harmonised spectrum access in both licence-exempt bands and licensed spectrum and to establish new tools for more shared use of radio spectrum resources in the internal market. In particular, the Commission stated that it sees the need in a common path in the EU towards enabling more sharing possibilities, based on contractual agreements between users. Furthermore, the RSPG has provided views on spectrum sharing in several deliverables such as the Opinion on collective use of spectrum and the Opinion on licensed shared access¹⁶. In view of the above, the Commission considers that the consistent implementation of the RSPG policy objectives linked to the spectrum inventory and taking utmost account of the opinion of the RSPG justify the need for technical studies in the frequency band 1452-1492 MHz.

4. TASK ORDER AND SCHEDULE

CEPT is herewith mandated to undertake work in support of the EU policy objectives presented above to develop harmonised technical conditions in the short term for wireless broadband electronic communications services in the 1452-1492 MHz frequency band taking into account, if necessary, sharing conditions with incumbent services for which future spectrum demand has been identified.

In the work carried out under the Mandate, the overall spectrum policy objectives of the EU regulatory framework in electronic communications such as effective and efficient spectrum use should be given utmost consideration. In implementing this Mandate, the CEPT shall, where relevant, take utmost account of EU law applicable and support the principles of service and technological neutrality, non-discrimination and proportionality insofar as technically possible.

CEPT is requested to collaborate actively with the European Telecommunications Standardisation Institute (ETSI) which develops harmonised standards for conformity under Directive 1999/5/EC.

In particular, CEPT is mandated to develop *harmonised technical arrangements and conditions* for wireless broadband usage of the 1452-1492 MHz frequency band as well as related *harmonised sharing and compatibility conditions*, wherever necessary, with incumbent services/applications in the same or in adjacent bands, including at the EU outer borders. The arrangements and conditions must be sufficiently precise for the development of EU-wide equipment. This includes:

1. Development of channelling arrangements and common and minimal (least restrictive) technical conditions¹⁷ for wireless broadband usage. These conditions should be sufficient to ensure coexistence of wireless broadband services within the same band and with others services in adjacent bands.
2. Development of common technical conditions to ensure wireless broadband spectrum usage *on a shared basis* with relevant incumbent radio services/applications in close cooperation with all concerned stakeholders. These conditions should be sufficient to ensure coexistence while mitigating interference with incumbent radio services/applications in the same band or in adjacent bands, in line with their regulatory status.
3. For each incumbent service/application identified as in need of protection under 2.: definition of relevant protection parameters and conditions for facilitating coexistence with wireless broadband within the same band and in adjacent bands, including at the EU outer borders.
4. Considering requirements for cross-border coordination, including at the EU outer borders.

In performing this task, CEPT should take into consideration ETSI harmonised standards, which facilitate shared spectrum use and foster economies of scale.

¹⁶ Documents RSPG08-244 and RSPG13-538 , respectively

¹⁷ Such as the definition of appropriate Block Edge Masks (BEMs)

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

Delivery date	Deliverable	Subject
July 2014 ¹⁸	Final Report from CEPT to the Commission	Description of the work undertaken and the results.
December 2014	Final Report 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.

In regard to the work done by CEPT in preparation of WRC-15, CEPT is encouraged to consider possible synergies with the work to be undertaken under this Mandate.

The Commission, with the assistance of the Radio Spectrum Committee and pursuant to the Radio Spectrum Decision, may consider applying the results of this mandate in the EU, pursuant to Article 4 of the Radio Spectrum Decision and subject to the results of the spectrum inventory and relevant guidance of the RSPG.

¹⁸ Subject to subsequent public consultation

ANNEX 2: TECHNICAL ANNEX

A2.1 CHANNELING ARRANGEMENT AND COMMON AND MINIMAL (LEAST RESTRICTIVE) TECHNICAL CONDITIONS FOR WBB SDL IN 1452-1492 MHz

The harmonised technology-neutral arrangements and common technical conditions for the use of 1452-1492 MHz for WBB SDL consist of:

- A harmonised channelling arrangement;
- A Block-Edge Mask (BEM);
- Out of Band Emission (OOBE) limits.

A2.1.1 Harmonised channelling arrangement

The channelling arrangement for the harmonised use of 1452-1492 MHz for WBB SDL in the EU is:

Table 5: Harmonised channelling arrangement of the 1452-1492 MHz band

1452-1457	1457-1462	1462-1467	1467-1472	1472-1477	1477-1482	1482-1487	1487-1492
Downlink (base station transmit)							
40 MHz (8 blocks of 5 MHz)							

A2.1.2 Block Edge Mask (BEM)

The BEM (out-of-block) e.i.r.p. limits, per antenna, for WBB SDL Base Station operating within 1452-1492 MHz are provided in the table below:

Table 6: Base station BEM (out-of-block) e.i.r.p. limits within 1452-1492 MHz per antenna

Frequency range of out-of-block emissions	Maximum mean out-of-block e.i.r.p. [dBm]	Measurement Bandwidth [MHz]
-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 MFCN SDL frequencies	9 dBm	5 MHz

A2.1.3 Out-of-Band Emission (OOBE) limits

The Out-of-Band Emissions limits of WBB SDL base station operating in 1452-1492 MHz are provided in the table below:

Table 7: OOBE limits for WBB SDL base station operating in 1452-1492 MHz

Frequency range of out-of-band emissions	Maximum mean out-of-band 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

A2.1.4 Specific case of adjacent band use by fixed links

In the case where an Administration uses fixed links in the adjacent bands (namely, in 1427-1452 MHz or in 1492-1518 MHz), this Administration may implement at national level some specific measures to ensure coexistence with WBB SDL in the 1452-1492 MHz band. 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.

A2.2 COEXISTENCE BETWEEN WBB AND INCUMBEN APPLICATIONS/SERVICES WITHIN THE BAND

A2.2.1 In-band adjacent channel coexistence between WBB SDL and T-DAB

The interference from SDL to T-DAB in adjacent channel is moderate under assumptions corresponding to rural deployment. In such a case, deployment with limited (0.5 MHz) guard band seems to be appropriate. In urban environment, the probability of interference from SDL implementing the out-of-block emission from Table 5 to T-DAB is substantial (more than 10 %) for guard band lower than 1 MHz.

The SDL critical BEM, guaranteeing that interference from SDL to T-DAB due to blocking is the dominant interference factor for any guard band is defined as follows:

Table 8: OOBE limits for WBB SDL base station operating in 1452-1492 MHz for adjacent channel coexistence with T-DAB

Frequency range of out-of-block emissions	Maximum mean out-of-block e.i.r.p. [dBm]	Measurement Bandwidth [MHz]
0 – 1.3 MHz from block edge	9.3	1
1.3-1.5 MHz from block edge	2.8	1
1.5-1.8 MHz from block edge	-6.7	1
1.8-2 MHz from block edge	-12.4	1
2-2.3 MHz from block edge	-13.7	1
2.3-5 MHz from block edge	-14.9	1
Remaining T-DAB frequencies	-14.9	1

The adoption of the SDL critical BEM defined Table 1 of ECC Report 227 [10], at national level for coexistence between SDL and T-DAB, guarantees:

- that interference from SDL to T-DAB due to blocking is the dominant interference factor for any guard band;
- low level of interference from SDL to T-DAB for a guard band of 1.5 MHz, even in urban deployment scenario.

It should be noted that no assessment was conducted in ECC Report 227 on whether the proposed SDL critical BEM can be implemented on a cost efficient manner was conducted. Such studies would be required on a national basis in order to select a guard band between T-DAB and SDL and the SDL BEM corresponding to such guard band.

A2.2.2 Cross-border coordination between WBB SDL and T-DAB

In the case where an Administration uses Terrestrial Digital Audio Broadcasting (T-DAB) in part of the band 1452-1479.5 MHz, the following recommended coordination thresholds should be used under the Maastricht Agreement coordination procedure:

- in the case of cross-border coordination of MFCN SDL interfering with T-DAB: 41 dB μ V/m¹⁹ measured over the bandwidth of a single T-DAB block for an antenna height of 10m (in conformity with Maastricht Agreement).

- in the case of cross-border coordination of T-DAB interfering with MFCN SDL: 56.4 dB μ V/m measured over the bandwidth of a single SDL block (5 MHz) for an antenna height of 10m (relaxing the threshold level from Maastricht Agreement).

A2.3 IN-BAND CROSS BORDER COORDINATION BETWEEN WBB SDL AND AERONAUTICAL TELEMETRY

Cross-border coordination between WBB SDL in EU countries and aeronautical telemetry in non-EU countries can be ensured through bilateral agreement between the administrations concerned and the application of mitigation techniques (e.g. sector antenna disabling at WBB SDL base stations).

¹⁹ This value is based on the assumption of the impact of a single MFCN SDL interferer.

ANNEX 3: LIST OF REFERENCE

- [1] ECC Report 188 on the Future Harmonised Use of 1452-1492 MHz in CEPT
- [2] ECC Decision (13)03 on the harmonised use of the frequency band 1452-1492 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)
- [3] Special Arrangement of the European Conference of Postal and Telecommunications Administrations (CEPT) relating to the use of the band 1452-1479.5 MHz for Terrestrial Digital Audio Broadcasting (T-DAB), Maastricht, 2002, Constanta, 2007
- [4] ECC Decision (03)02 on the on the designation of the frequency band 1479.5-1492 MHz for use by Satellite Digital Audio Broadcasting systems
- [5] ECC Decision (13)02 on the withdrawal of ECC Decision (03)02
- [6] ECC Report 202 on the Out-of-Band emission limits for Mobile/Fixed Communication Networks (MFCN) Supplemental Downlink (SDL) operating in the 1452-1492 MHz band
- [7] CEPT Report 39: Report from CEPT to the European Commission in response to the Mandate to develop least restrictive technical conditions for 2 GHz bands
- [8] ECC Report 82: Compatibility study for UMTS operating within the GSM 900 and GSM 1800 frequency bands
- [9] CEPT Report 40: Report from CEPT to European Commission in response to Task 2 of the Mandate to CEPT on the 900/1800 MHz bands
- [10] ECC Report 227 on Compatibility Studies for Mobile/Fixed Communication Networks (MFCN) Supplemental Downlink (SDL) operating in the 1452-1492 MHz band
- [11] ECC Recommendation (15)01 on Cross-border coordination for mobile/fixed communications networks (MFCN) in the frequency bands 1452-1492 MHz, 3400-3600 MHz and 3600-3800 MHz