



CEPT Report 50

Report A from CEPT to the European Commission in response to the Mandate “On technical conditions regarding spectrum harmonisation options for wireless radio microphones and cordless video-cameras (PMSE equipment)”

Technical conditions for the use of the bands 821-832 MHz and 1785-1805 MHz for wireless radio microphones in the EU

Report approved on 8 March 2013 by the ECC

0 EXECUTIVE SUMMARY

This CEPT Report is the first part of the response to the Mandate issued by the European Commission on technical conditions regarding spectrum harmonisation options for wireless radio microphones and cordless video-cameras (PMSE equipment).

It deals with the technical conditions for the use of the bands 821-832 MHz and 1785-1805 MHz for wireless radio microphones in the EU, including the technical conditions which can contribute to facilitate the use of PMSE equipment for EU-wide operations.

The intention of this Report is not to address all spectrum requirements for PMSE, specifically wireless radio microphones, or address compensation for any loss of spectrum due to digital dividend but to provide technical conditions which may support harmonisation measures in the two bands under consideration in the Mandate.

It should be noted, that the frequency bands 821-832 MHz and 1785-1805 MHz represent duplex gaps in existing MFCN FDD systems. These gaps are required for separating up-and down link channels of these systems, to avoid interference between up-and downlink.

The Report concludes that the bands under consideration are appropriate for the development of harmonized technical and operational conditions for PMSE audio applications in Europe, but that additional studies are required to determine which wireless audio applications are appropriate, and to what extent these bands will provide additional capacity for wireless audio applications.

Technical Conditions for PMSE audio applications

This report proposes some technical conditions that would be applicable for operation of PMSE audio applications in the bands under study. These technical conditions were derived in order to ensure protection of MFCN in adjacent bands.

Table 1: BEM range recommendation for PMSE audio applications in the FDD duplex gap of the 800 MHz band

| Frequencies below 821 MHz | 821-823 MHz | 823-826 MHz | 826-832 MHz | Frequencies above 832 MHz |
|--|--|--|-----------------------------|--|
| Out-of-block baseline limits | Guard band because of adjacent band compatibility issues, i.e interference from PMSE into MFCN downlink. | In-block limits | | Out-of-block baseline limits |
| out-of-block e.i.r.p. is -43 dBm/(5 MHz) | | <ul style="list-style-type: none"> ➤ in-block e.i.r.p. of 13dBm for hand-held. ➤ in-block e.i.r.p. of 20dBm for body-worn. | in-block e.i.r.p. of 20 dBm | out-of-block e.i.r.p. is -25 dBm/(5 MHz) |

Source: CEPT Report 30 [9]

Table 2: BEM range recommendation for PMSE audio applications in the 1785-1805 MHz

| | Frequency Range | Handheld e.i.r.p. | Reasoning |
|----------------------------|-------------------|--------------------|--|
| OOB | < 1785 MHz | -17 dBm/200kHz | LTE UE spectrum emission mask |
| Restricted frequency range | 1785-1785.2 MHz | 4 dBm/200kHz | GSM blocking |
| | 1785.2-1803.6 MHz | 13 dBm/channel | |
| | 1803.6-1804.8 MHz | 10 dBm/200kHz* | slow increase of LTE UE selectivity |
| Restricted frequency range | 1804.8-1805 MHz | -14 dBm/200kHz | GSM blocking |
| OOB | > 1805 MHz | -37 dBm/200kHz | OOB calculation, in line with ERC/REC 74-01 [23] |
| | Frequency Range | Body worn e.i.r.p. | Reasoning |
| OOB | < 1785 MHz | -17 dBm/200kHz | LTE UE spectrum emission mask |
| | 1785-1804.8 MHz | 17 dBm/channel | |
| Restricted frequency range | 1804.8-1805 MHz | 0 dBm/200kHz | GSM blocking |
| OOB | > 1805 MHz | -23 dBm/200kHz | OOB calculation** |

* with a limit of 13 dBm/channel

** For the body worn case the body loss is 14 dB higher than for the handheld case, therefore the -23 dBm for body worn is equivalent to -37 dBm for handheld.

Source: ECC Report 191 [21]

Spectrum capacity for PMSE audio applications

The assessment of the potential interference from MFCN into PMSE has an impact on the extent of the operational use of the bands by PMSE audio applications. Preliminary studies have been carried out by user organisations but this issue needs further review in order to determine which PMSE applications can be operated in the band. Initial analysis suggests that, depending on the usage scenario, there may be interference from MFCN. For a qualification of the usability of the 821-832 MHz band for PMSE under the potential out-of-band interference from MFCN terminal and base stations into PMSE, this report analyses the required separation distances. Since there are no available studies concerning the impact of MFCN into digital audio PMSE in the band 1785-1805 MHz, further analysis is necessary to determine the usability of this band for PMSE. This will be subject to a supplemental CEPT report to be sent in public consultation in June 2013.

Additional consideration

Harmonisation of the bands under consideration would be an enabler for PMSE equipment flow throughout Europe and allow PMSE users to operate their equipment Europe wide. However, it should be noted that the bands cannot be used on an interference free basis in all usage scenarios, due to potential MFCN out of band interference.

TABLE OF CONTENTS

| | | |
|----------|--|-----------|
| 0 | EXECUTIVE SUMMARY | 2 |
| 1 | INTRODUCTION..... | 7 |
| 2 | PMSE – DEFINITIONS AND GENERAL OVERVIEW | 8 |
| 3 | PMSE IN THE BANDS 821-832 MHZ AND 1785-1805 MHZ | 9 |
| 3.1 | Description of PMSE applications considered in this Report | 9 |
| 3.2 | CEPT Regulatory framework and Background for PMSE systems in the bands 821-832 MHz and 1785-1805 MHz..... | 9 |
| 3.2.1 | CEPT provisions on technical parameters relevant for the 821-832 MHz band | 10 |
| 3.2.2 | CEPT provisions on technical parameters relevant for the 1785-1805 MHz band | 11 |
| 3.3 | Current usage of PMSE in the bands 821-832 MHz and 1785-1805 MHz | 11 |
| 3.3.1 | Use of the band 821-832 MHz..... | 11 |
| 3.3.2 | Use of the band 1785-1805 MHz..... | 12 |
| 3.3.3 | Potential harmonization of the bands | 12 |
| 3.4 | Technical characteristics and deployment scenarios of PMSE systems in the bands 821-832 MHz and 1785-1805 MHz..... | 13 |
| 3.4.1 | Considerations on PMSE deployment scenarios and planning practice:..... | 13 |
| 3.4.2 | Technical characteristics in the band 821-832 MHz..... | 13 |
| 3.4.3 | Technical characteristics in the band 1785-1800 MHz..... | 13 |
| 4 | TECHNICAL STUDIES ON PMSE SYSTEMS IN THE BAND 821-832 MHZ | 15 |
| 4.1 | Other systems to be considered, characteristics | 15 |
| 4.2 | Scenarios of compatibility between PMSE and other systems at the edges of the band 821-832 MHz | 16 |
| 4.3 | Results of studies | 16 |
| 4.3.1 | Impact from PMSE into MFCN: | 16 |
| 4.3.2 | Impact from MFCN into PMSE: | 17 |
| 4.3.2.1 | Interference from MFCN base stations to radio microphones..... | 17 |
| 4.3.2.2 | Interference from MFCN terminal stations to radio microphones..... | 18 |
| 4.3.2.3 | Conclusion on the theoretical studies..... | 19 |
| 4.3.3 | Additional considerations on the potential use of the band by PMSE..... | 19 |
| 4.4 | Summary for the band 821-832 MHz | 20 |
| 5 | TECHNICAL STUDIES ON PMSE SYSTEMS IN THE BAND 1785- 1805MHZ | 21 |
| 5.1 | Other systems to be considered, characteristics | 21 |
| 5.2 | Scenarios of compatibility between PMSE and other systems at the edges of the band 1785-1805 MHz | 21 |
| 5.3 | Results of studies | 22 |
| 5.3.1 | Impact from PMSE into MFCN: | 22 |
| 5.3.2 | Impact from MFCN into PMSE: | 23 |
| 5.4 | Summary for the band 1785-1805 MHz | 23 |
| 6 | CONCLUSIONS..... | 25 |
| 6.1 | General..... | 25 |
| 6.2 | Technical Conditions for PMSE audio applications..... | 25 |
| 6.3 | Spectrum capacity for PMSE audio applications | 26 |
| 6.4 | Additional considerations regarding Harmonisation..... | 26 |

**ANNEX 1: MANDATE TO CEPT ON TECHNICAL CONDITIONS REGARDING SPECTRUM
HARMONISATION OPTIONS FOR WIRELESS RADIO MICROPHONES AND CORDLESS VIDEO-
CAMERAS (PMSE EQUIPMENT) 27**

ANNEX 2: LIST OF REFERENCES 31

LIST OF ABBREVIATIONS

| Abbreviation | Explanation |
|---------------------|--|
| APWPT | The Association of Professional Wireless Production Technologies |
| BS | Base Station |
| CEPT | European Conference of Postal and Telecommunications Administrations |
| ECC | Electronic Communications Committee |
| e.i.r.p. | equivalent isotropically radiated power |
| ECN | Electronic Communication Network |
| ENG | Electronic News Gathering |
| FDD | Frequency Division Duplex |
| LTE | Long Term Evolution |
| MCL | Minimum Coupling Loss |
| MFCN | Mobile and Fixed Communication Networks |
| OB | Outside broadcasting |
| OOB | Out-of-Band |
| PMSE | Programme making and special events |
| SAB | Services Ancillary to Broadcasting |
| SAP | Services Ancillary to Programme making |
| SEM | Spectrum Emission Mask |
| SRDs | Short Range Devices |
| TDD | Time Division Duplex |
| TS | Terminal Station |
| UE | User Equipment |
| WRC | World Radiocommunication Conference |

1 INTRODUCTION

This CEPT Report is the first part of the response to the Mandate issued by the European Commission on technical conditions regarding spectrum harmonisation options for wireless radio microphones and cordless video-cameras (PMSE equipment).

It deals with the technical conditions for the use of the bands 821-832 MHz and 1785-1805 MHz for wireless radio microphones in the EU, including the technical conditions which can contribute to facilitate the PMSE equipment for EU-wide operations.

It should be noted, that the frequency bands 821-832MHz and 1785-1805 MHz represent duplex gaps in existing MFCN FDD systems. These gaps are required for separating up-and down link channels of these systems, to avoid interference between up-and downlink.

This Report responds to the following tasks set up in the Mandate (see ANNEX 1: for the full text of the EC Mandate):

(1) To identify the technical conditions for the use of the band 821-832 MHz for wireless radio microphones (which optionally include in-ear systems and control systems) in the EU. This should take into account the technical conditions specified in EC Decision 2010/267/EU [1] on the EU harmonisation of the 800 MHz band as well as any relevant outcomes of WRC-12.

(2) To identify the technical conditions resulting in a harmonisation of technical parameters in the band 1785-1805 MHz for the use of wireless radio microphones (which optionally include in-ear systems and control systems).

Through the work related to the tasks (1) and (2) above, this Report also addresses the objective for technical conditions which can contribute to facilitate the use of wireless radio microphone for EU-wide operations, including specific aspects to improve the frequency management and the overall spectrum efficiency of equipment, as outlined in the task (4) of the EC Mandate. This would facilitate placing products on the market and ease the harmonised use across Europe.

The intention of this Report is not to address all spectrum requirements for wireless radio microphones or address compensation for any loss of spectrum due to digital dividend, but to provide technical conditions which may support harmonisation measures in the two bands under consideration.

The EC mandate to CEPT on PMSE contains other tasks dealing with cordless cameras. They are addressed in another CEPT Report.

2 PMSE – DEFINITIONS AND GENERAL OVERVIEW

The term Programme Making¹ and Special Events² applications (PMSE) describes radio applications used for SAP/SAB, ENG/OB and applications used in meetings, conferences, cultural and education activities, trade fairs, local entertainment, sport, religious and other public or private events for perceived real-time presentation of audiovisual information.

The definitions of SAP/SAB and ENG/OB are set out³ as follows:

SAP: Services Ancillary to Programme making (SAP) support the activities carried out in the making of “programmes”, such as film making, advertisements, corporate videos, concerts, theatre and similar activities not initially meant for broadcasting to general public.

SAB: Services Ancillary to Broadcasting (SAB) support the activities of broadcasting industry carried out in the production of their programme material.

The definitions of SAP and SAB are not necessarily mutually exclusive. Therefore they are often used together as “SAP/SAB” to refer generally to the whole variety of services to transmit sound and video material over the radio links.

ENG: Electronic News Gathering (ENG) is the collection of video and/or sound material by means of small, often hand-held wireless cameras and/or microphones with radio links to the news room and/or to the portable tape or other recorders.

OB: Outside broadcasting (OB) is the temporary provision of programme making facilities at the location of on-going news, sport or other events, lasting from a few hours to several weeks. Mobile and/or portable radio links are required for wireless cameras or microphones at the OB location. Additionally, radio links may be required for temporary point to point connections between the OB vehicle, additional locations around it, and the studio.

The definitions of ENG and OB are not mutually exclusive and certain operations could equally well reside in either or both categories. Therefore, it has been a long practice within the CEPT to consider all types of such operations under the combined term “ENG/OB”. It is also understood that ENG/OB refers to terrestrial radiocommunication services, as opposed to SNG/OB term, which refers to similar applications but over the satellite radiocommunication channels.

The SAP/SAB applications include both ENG/OB and SNG/OB applications, but also the communication links that may be used in the production of programmes, such as talk-back or personal monitoring of sound-track, telecommand, telecontrol and similar applications.

Quality requirements of PMSE applications can vary depending on the task in hand. The bandwidth of the signal to be transmitted i.e. audio or video has a direct impact on the spectral bandwidth required.

The perceived quality of the signals is going to be dependent on their potential final use. The uses can vary from SNG links into a news programme through to a high quality HD TV production.

The reliability of service again can vary according to the task in hand. Typically within the events for large numbers of people and for broadcast applications there is frequently a need for a high degree of protection for the signals. This required protection inherently puts constraints on the amount of spectrum required to guarantee this quality of service.

With regard to this CEPT Report, only PMSE applications dealing with audio signal transmission are considered.

¹ Programme Making includes the making of a programme for broadcast, the making of a film, presentation, advertisement or audio or video recordings, and the staging or performance of an entertainment, sporting or other public event.

² A Special Event is an occurrence of limited duration, typically between one day and a few weeks, which take place on specifically defined locations. Examples include large cultural, sport, entertainment, religious and other festivals, conferences and trade fairs. In the entertainment industry, theatrical productions may run for considerably longer.

³ For further information see the ECC Report 002 [2]

3 PMSE IN THE BANDS 821-832 MHz AND 1785-1805 MHz

3.1 DESCRIPTION OF PMSE APPLICATIONS CONSIDERED IN THIS REPORT

Programme Making Special Events (PMSE) covers a wide range of equipment and applications. The bandwidth available in the two bands under consideration is only suitable for PMSE audio applications. The maximum available spectrum in these bands would not be sufficient for the wideband transmission of wireless cameras.

The most significant PMSE audio applications are radio microphones, talkback systems and/or in-ear monitors. This report addresses the applications described below, which are covered by ETSI EN 300 422 [3], EN 300 454 [4] and EN 301 357 [5]:

| | |
|------------------|--|
| Radio microphone | Handheld or body worn microphone with integrated or body worn transmitter. |
| In-ear monitor | Body-worn miniature receiver with earpieces for personal monitoring of single or dual channel sound track. |
| Talk-back | For communicating the instructions of the director instantly to all those concerned in making the programme; these include presenters, interviewers, cameramen, sound operators, lighting operators and engineers. A number of talk-back channels may be in simultaneous use to cover those different activities. Talk-back usually employs constant transmission. |
| Audio Link | For point to point communication which may be mono or stereo. |

In addition, this Report also covers advanced functions such as control channels related to cognitive and digital audio PMSE systems. Such control channels are digital channels with latency requirements that are relaxed compared to those of the audio channel(s). They may be used to perform tasks such as e.g.:

- device discovery, identification and management ,
- frequency coordination and management,
- environment discovery and interference control,
- audio link management (power management, frequency, channel coding scheme).

3.2 CEPT REGULATORY FRAMEWORK AND BACKGROUND FOR PMSE SYSTEMS IN THE BANDS 821-832 MHz AND 1785-1805 MHz

This section describes the CEPT regulatory deliverables relevant to PMSE systems in the bands 821-832 MHz and 1785-1805 MHz. It should be noted that, as shown in section 3.3, the national regulations for the implementation of PMSE are disparate, which leads to complex processes both for placing products on the market and using the equipment.

The ERC/REC 25-10 [6] has been last revised in 2003. This document recommends CEPT Administrations to assign frequencies for audio and video SAP/SAB links based on tuning ranges. This Recommendation would need to be updated to reflect the latest developments on some of the identified frequency bands.

Concerning the technical parameters applicable to the audio applications and the frequency bands under consideration in this Report, up-to-date information is available in ERC/REC 70-03 [7].

ERC/REC 70-03 [7] sets out the general position on common spectrum allocations for Short Range Devices (SRDs) for countries within the CEPT. Its annexes define the regulatory parameters as well as additional information about harmonised, standards, frequency issues and important technical parameters for various applications. In particular the Annex 10 dealing with radio microphones and the Annex 13 dealing with wireless audio applications are relevant to the issue addressed in this CEPT Report.

3.2.1 CEPT provisions on technical parameters relevant for the 821-832 MHz band

Technical parameters for radio microphones in the band 823-832 MHz are contained in the Annex 10 of ERC/REC 70-03 [7] as outlined in Table 3:.

Table 3: Technical conditions for the use of the 823-832 MHz band as contained in the Annex 10 (Radio microphones) of ERC/REC 70-03

| Frequency Band | Power | Spectrum access and mitigation requirement | Channel spacing | Notes |
|----------------|-----------------------------------|--|-----------------|---|
| e3 823-826 MHz | 20 mW e.i.r.p. 100 mW e.i.r.p. | No requirement | 200 kHz | Individual licence required. (see note 1). 100 mW restricted to body worn microphones. See technical conditions for PMSE (including radio microphones) in Annex 3 of ECC/DEC/(09)03 [8] section 3.1 |
| e4 826-832 MHz | 100 mW e.i.r.p. | No requirement | 200 kHz | Individual licence required. (see note 1). See technical conditions for PMSE Including radio microphones in Annex 3 of ECC/DEC/(09)03 [8] section 3.1 |

Note 1: it is noted that, although Recommendation 70-03 recommends that individual licence would be required in this band, many countries offer general license or license exempt usage.

In addition, ECC/DEC/(09)03 [8] specifies under its *decides* 6 :

“that administrations wishing to implement low power applications and PMSE in the centre gap of the FDD frequency arrangement given in Annex 1 or PMSE in the guard band of the TDD frequency arrangement given in Annex 2 shall adopt the common and minimal (least restrictive) technical conditions specified in Annex 3 to this Decision”

For PMSE applications, the technical conditions are provided in the section 3.1 of the Annex 3 of the ECC/DEC/(09)03 [8] under the Block Edge Mask conditions containing in-band requirements and out-of-band requirements in order to protect MFCN in the adjacent bands. These technical conditions are based on studies included in the CEPT Report 30 [9] and the in-band requirements are consistent with the e.i.r.p limits provided in ERC/REC 70-03 [7].

It should be noted that there is currently no technical condition recommended at the CEPT level for the operation for radio microphones in the 821-823 MHz sub-band. For administrations implementing the ECC Decision(09)03 [8] for MFCN with the FDD band plan, the 821-823 MHz band is considered as a guard band to help the compatibility between MFCN and potential applications operating in the duplex gap.

3.2.2 CEPT provisions on technical parameters relevant for the 1785-1805 MHz band

Within the band 1785-1805 MHz, the band 1785-1800 MHz is currently covered for radio microphones in the Annex 10 of [7] as outlined in Table 4:.

Table 4: Technical conditions for the use of the 1785-1800 MHz band as contained in the Annex 10 (Radio microphones) of ERC/REC 70-03

| Frequency Band | Power | Spectrum access and mitigation requirement | Channel spacing | Notes |
|-----------------|----------------------------------|--|-----------------|---|
| f1785-1795 MHz | 20 mW e.i.r.p. 50mW e.i.r.p. | No requirement | No spacing | Individual licence required. (Note 1) 50mW restricted to body worn microphones |
| g 1795-1800 MHz | 20 mW e.i.r.p. 50 mW e.i.r.p. | No requirement | No spacing | 50 mW restricted to body worn equipment |

Note 1: it is noted that, although Recommendation 70-03 recommends that individual licence would be required in this band, many countries offer general license or license exempt usage.

In addition, ERC/REC 70-03 [7] also contains, in its Annex 13, technical conditions applicable to wireless audio applications which cover, inter alia, the band 1795-1800 MHz.

Table 5: Technical conditions for the use of the 1785-1800 MHz band as contained in the Annex 13 (Wireless Audio applications) of ERC/REC 70-03

| Frequency Band | Power | Spectrum access and mitigation requirement | Channel spacing | Notes |
|-----------------|----------------|--|-----------------|-------|
| C 1795-1800 MHz | 20 mW e.i.r.p. | No requirement | No spacing | / |

The band 1800-1805 MHz is currently not covered by the provisions described above. However, it is envisaged as a possible extension of the 1785-1800 MHz band for radio microphones and wireless audio applications and, therefore, relevant technical conditions would have to be determined.

3.3 CURRENT USAGE OF PMSE IN THE BANDS 821-832 MHz AND 1785-1805 MHz

During the development of this Report, the ECC developed a questionnaire to CEPT administrations on the regulatory procedures used by administrations in granting access to spectrum for PMSE [10]. It covers many frequency ranges, including the 823-832 MHz and the 1785-1800 MHz bands. The analysis of the responses to the questionnaire provides an overview of the current usage of PMSE in both bands under consideration and about the related licensing regimes. For more details about the responses to the questionnaire, see [10].

3.3.1 Use of the band 821-832 MHz

The band 790-862 MHz was used by PMSE applications in the past as a service with secondary status with regard to primary users, in particular broadcasting. Many PMSE applications are still in use in the whole band as MFCN has yet to be deployed in many European countries. In countries, where MFCN plans are requiring PMSE equipment to leave the MFCN harmonised bands, PMSE user have started to re-engineer existing equipment for working below 790 MHz .

Therefore the band 823-832 MHz is already in use by PMSE equipment.

Concerning the bands 823-826 and 826-832 MHz, a vast majority (24 out of 28) of the CEPT administrations responding to the questionnaire [10] reported the availability of these bands for PMSE applications.

The predominant use is for radio microphones (and also in-ear monitors) with technical conditions based in most cases on ERC/REC 70-03 [7] and ECC/DEC/(09)03 [8] (see section 3.2.1). However, some countries apply slightly different conditions (presumably based on previous versions of ERC/REC 70-03). In some countries, the regulation is expected to be amended to be in line with the latest version of ERC/REC 70-03 [7].

The use of this band for radio microphones is generally regulated through license exempt or general license regime, but light or individual licensing may also apply in some countries.

This band is also used in a few countries for other PMSE applications such as temporary SAB, generally with higher e.r.p. and individual licensing.

The availability of the band 821-823 MHz for PMSE tends to decrease because of the on-going deployment of MFCN in the 791-821 / 832-862 MHz bands (see section 3.2.1).

3.3.2 Use of the band 1785-1805 MHz

The band 1785-1800 MHz has been available for PMSE applications for several years but is not an EU-wide harmonized band. Therefore current usage is restricted to local use only. Wireless microphone systems are commercially available and in use in some countries.

Concerning this band, a vast majority (21 out of 28) of the CEPT administrations responding to the questionnaire [10] reported the current availability of this band for PMSE applications. In addition, 3 countries intend to make the band available in the near future.

The band is used or planned to be used by radio microphones and also in-ear monitoring and wireless audio applications with technical conditions based in most cases on REC 70-03 (Annex 10 for radio microphones, Annex 13 for wireless audio applications).

The use of this band is generally regulated through license exempt or general license regime, but light or individual licensing may also apply in some countries.

The band 1800-1805 MHz is not yet identified for PMSE within CEPT on a general basis and no up-to-date evaluation has been made of its availability in CEPT countries. Depending on the results of such evaluation, it could provide a natural extension band for PMSE. Some information on the usage of this band in CEPT countries could be found in CEPT Report 08 [22].

3.3.3 Potential harmonization of the bands

The analysis related to the use of the bands under consideration outlines that there is already some degree of harmonisation of their use for audio PMSE applications and that they are consequently good candidates for further harmonisation of their use across Europe.

However, the analysis also shows that there is currently no common approach within CEPT countries on the licensing regime. PMSE may be authorized under general national regulations or individual licenses, depending on national licensing regime and on the category of PMSE. This leads to complex processes both for placing products on the market and using the equipment. This is especially the case when individual licensing regime is in place due to the variety of the national procedures.

3.4 TECHNICAL CHARACTERISTICS AND DEPLOYMENT SCENARIOS OF PMSE SYSTEMS IN THE BANDS 821-832 MHz AND 1785-1805 MHz

Both bands are duplex gap bands which are necessary due to physical and commercial reasons to decouple up- and downlink of the primary MFCN FDD application to avoid interference between both links.

Any application intended to be implemented in this duplex gap band has to take this circumstance into account by additional technical and commercial measures.

Due to the potential risk of interference and therefore performance degradation, only certain PMSE applications will be able to tolerate the potential performance degradation.

The relevant standards for PMSE applications are ETSI EN 300 422 [3], EN 300 454 [4] and EN 301 357 [5]. The relevant EMC standard is EN 301 489-9 [11].

3.4.1 Considerations on PMSE deployment scenarios and planning practice:

PMSE audio equipment designed for the use in the ranges 823-832 MHz and 1785-1805 MHz are applications that operate in ranges usually below 100 m. The vast majority of equipment is operated indoors. When properly deployed, equipment of the range 1785-1805 MHz benefits from indoor operation as reflexions from walls ceiling and floor enhance the transmission reliability.

PMSE audio devices implement a number of sharing mechanism in order to avoid interference between PMSE devices. PMSE users check spectrum availability before starting their operation. The procedure consists in turning on the receiver and listening to a frequency before switching on the corresponding transmitter. If the frequency is not in use, nothing can be heard at the receivers output and nothing can be seen at the receivers level meters. Otherwise, the competing user is detected and alternative frequency will be used. Due to the very high sensitivity of the receiver, other PMSE audio systems users are heard, identified and avoided.

Such mechanisms are only applicable to PMSE to PMSE coexistence but cannot handle interference from other types of use.

3.4.2 Technical characteristics in the band 821-832 MHz

- 823-826 MHz
 - for handheld, maximum e.i.r.p. = 20 mW (13 dBm)
 - for body worn, maximum e.i.r.p. = 100 mW (20 dBm)
 - Spectrum emission mask as in ETSI EN 300 422 [3], ETSI EN 301 357 [5]
 - Co-channel protection level in a receiver bandwidth of 200 kHz: -115 dBm
 - C/I value differs with modulation schemes; 20 dB – 25 dB
 - Antenna types: omnidirectional or directional
- 826-832 MHz
 - for handheld, maximum e.i.r.p. = 100 mW (20 dBm)
 - for body worn, maximum e.i.r.p. = 100 mW (20 dBm)
 - Spectrum emission mask as in ETSI EN 300 422 [3], ETSI EN 301 357 [5]
 - Co-channel protection level in a receiver bandwidth of 200 kHz: -115 dBm
 - C/I value differs with modulation schemes; 20 dB – 25 dB
 - Antenna types: omnidirectional or directional

3.4.3 Technical characteristics in the band 1785-1800 MHz

- for handheld, maximum e.i.r.p. = 20 mW (13 dBm)
- for body worn, maximum e.i.r.p. = 50 mW (17 dBm)
- Spectrum emission mask as in ETSI EN 300 422 [3]

- Co-channel protection level in a receiver bandwidth of 200 kHz: -115 dBm
- C/I value differs with modulation schemes; 20 dB – 25 dB
- Antenna types: omnidirectional or directional

4 TECHNICAL STUDIES ON PMSE SYSTEMS IN THE BAND 821-832 MHz

Taking into account the procedures described in CEPT Report 19 [12] for the determination of harmonised technical conditions, two main scenarios of compatibility have been identified for the determination of technical conditions for audio PMSE in the 821-832 MHz band:

- Compatibility between PMSE in the band 821-832 MHz and other systems/services in adjacent bands, i.e. in bands below 821 MHz or above 832 MHz;
- Compatibility within the band 821-832 MHz between various PMSE systems.

This section focuses on the first scenario. The intra-coexistence between various PMSE systems is considered as part of the PMSE planning (see section 3.4.1).

4.1 OTHER SYSTEMS TO BE CONSIDERED, CHARACTERISTICS

The band 821-832 MHz is the duplex gap of the FDD band plan for terrestrial systems capable of providing electronic communications services (referred as MFCN, mobile and fixed communication networks, in this Report) in the 791-821 MHz / 832-862 MHz bands. The technical conditions of the use of these bands for MFCN are contained in the EC Decision 2010/267/EU [1] and in the ECC/DEC/(09)03 [8].

The harmonised frequency arrangement is 2 x 30 MHz with a duplex gap of 11 MHz, based on a block size of 5 MHz, paired and with reverse duplex direction, and a guard band of 1 MHz starting at 790 MHz. The FDD downlink starts at 791 MHz and FDD uplink starts at 832 MHz.

| | | | | | | | | | | | | | |
|------------|----------------------------|---------|---------|---------|---------|---------|------------|----------------------------|---------|---------|---------|---------|---------|
| 790-791 | 791-796 | 796-801 | 801-806 | 806-811 | 811-816 | 816-821 | 821-832 | 832-837 | 837-842 | 842-847 | 847-852 | 852-857 | 857-862 |
| Guard band | Downlink | | | | | | Duplex gap | Uplink | | | | | |
| 1 MHz | 30 MHz (6 blocks of 5 MHz) | | | | | | 11 MHz | 30 MHz (6 blocks of 5 MHz) | | | | | |

Figure 1: FDD harmonised frequency arrangement in the band 790-862 MHz

There is a need to define assumptions for the basic MFCN system characteristics in order to conduct the necessary technical studies. The assumptions are based on the most likely systems characteristics envisaged for MFCN in the 790-862 MHz band.

Table 6: List of parameters for MFCN base station

| Parameters | Value |
|-------------------------------------|---|
| e.i.r.p | Between 59 dBm/10 MHz and 67 dBm/10 MHz |
| Antenna gain (feeder loss included) | 15 dBi |
| Antenna height | 30 m in urban environment 60m in rural environment |
| Antenna pattern | Either based on existing antenna characteristics or modelled using Recommendation ITU-R F.1336 [13] |

Source: CEPT Report 30 [9]

Table 7: List of parameters for MFCN terminal station

| Parameters | Value |
|-------------------------------------|---|
| e.i.r.p | 23 dBm |
| Antenna gain (feeder loss included) | 0 dBd (2.15 dBi) |
| Antenna height | 1.5 m a.g.l |
| Antenna pattern | Either based on existing antenna characteristics or modelled using Recommendation ITU-R F.1336 [13] |

Source: CEPT Report 30 [9]

For further assumptions on technical characteristics for MFCN, it is proposed to consider the relevant specifications applicable to the most likely technology envisaged in this band, i.e. LTE (see ETSI EN 301 908-13 [14] and EN 301 908-14 [15]).

4.2 SCENARIOS OF COMPATIBILITY BETWEEN PMSE AND OTHER SYSTEMS AT THE EDGES OF THE BAND 821-832 MHz

This section investigates the adjacent band compatibility between MFCN and PMSE audio applications in the band 821-832 MHz and provides the technical conditions under which PMSE can be deployed, namely Block Edge Masks (BEM).

The definition of the BEM is based on two scenarios:

- Interference from PMSE towards MFCN terminal stations below 821 MHz;
- Interference from PMSE towards MFCN base stations above 832 MHz.

The most critical scenario is the first one since the potential distance between PMSE and terminals can be relatively small.

In order to have a qualification of the usability of the band for PMSE, there is also a need to address the potential out-of-band interference from MFCN terminal and base stations into PMSE.

4.3 RESULTS OF STUDIES

4.3.1 Impact from PMSE into MFCN:

Detailed technical studies for this scenario are contained in CEPT Report 30 [9], in particular in its Annex 5. The main assumptions and results are summarized below.

The studies consisted in assessing the impact from 200 kHz bandwidth PMSE and radio microphones into MFCN receivers whose performance criterion relies upon desensitisation and potential blocking aspects from narrow band and wide band blocking:

- 1 dB desensitisation of victim MFCN BS;
- 3 dB desensitisation of victim MFCN TS.

Propagations losses are calculated using the Hata model.

Body losses attenuation are introduced within the link budget according to the kind of devices.

MCL analysis indicates that MFCN TS and BS will be protected if,

- a PMSE in-block e.i.r.p. of 20 dBm, out-of-block e.i.r.p. of -31 dBm/(10 MHz) below 821 MHz, out-of-block e.i.r.p. of -22dBm/(10 MHz) above 832 MHz is deployed within the FDD duplex gap with a 5 MHz guard band at 821 MHz boundary,

- a handheld PMSE in-block e.i.r.p. of 13 dBm, out-of-block e.i.r.p. of -40 dBm/(10 MHz) below 821 MHz, out-of-block e.i.r.p. of -22dBm/(10 MHz) above 832 MHz is deployed within the 823-826 MHz (i.e. 2 MHz guard band at 821 MHz boundary).

On this basis, the following technical conditions are proposed for PMSE audio application operating in the FDD duplex gap of the 800 MHz band:

Table 8: BEM range recommendation for audio PMSE in the FDD duplex gap of the 800 MHz band

| Frequencies below 821 MHz | 821-823 MHz | 823-826 MHz | 826-832 MHz | Frequencies above 832 MHz |
|--|--|---|-----------------------------|--|
| Out-of-block baseline limits | Guard band because of adjacent band compatibility issues, i.e interference from PMSE into MFCN downlink. | In-block limits | | Out-of-block baseline limits |
| out-of-block e.i.r.p. is -43 dBm/(5 MHz) | | <ul style="list-style-type: none"> ➤ in-block e.i.r.p. of 13dBm for hand-held. ➤ in-block e.i.r.p. of 20dBm for body-worn | in-block e.i.r.p. of 20 dBm | out-of-block e.i.r.p. is -25 dBm/(5 MHz) |

Source: CEPT Report 30 [9]

4.3.2 Impact from MFCN into PMSE:

This compatibility scenario has been studied in CEPT Report 30 [9] and detailed results are provided in the Annex 5, section A5.1 of [9]. Assumptions for MFCN are based on 10 MHz LTE specifications and 200 kHz radio microphones requiring signal-to-interference-plus noise (SINR) ratio of 20 dB are considered for PMSE.

This studies addresses:

- Interference from MFCN BS into PMSE;
- Interference from MFCN TS into PMSE.

4.3.2.1 Interference from MFCN base stations to radio microphones

The objective of the study reported in the Annex 5, section A5.1.1 of CEPT Report 30 [9] is to assess the impact of interference from MFCN FDD BSs to outdoor use of radio microphones across the 821 MHz frequency boundary. This involves a minimum coupling loss (MCL) analysis to evaluate the relationship between the *protection distance* and the BS in-block and out-of-block e.i.r.p. levels.

The *protection distance* is defined as the horizontal separation between an interferer BS and a victim radio microphone which would allow the radio microphone receiver to meet a minimum signal-to-interference-plus noise (SINR) ratio of 20 dB.

These studies were based on a 10 MHz duplex gap. The results can be translated for the 11 MHz duplex gap (821-832 MHz) of the harmonised FDD plan developed in the ECC/DEC/(09)03 [8]. Under these assumptions, the following figure provides the unwanted emissions from MFCN BS into the 11 MHz duplex gap.

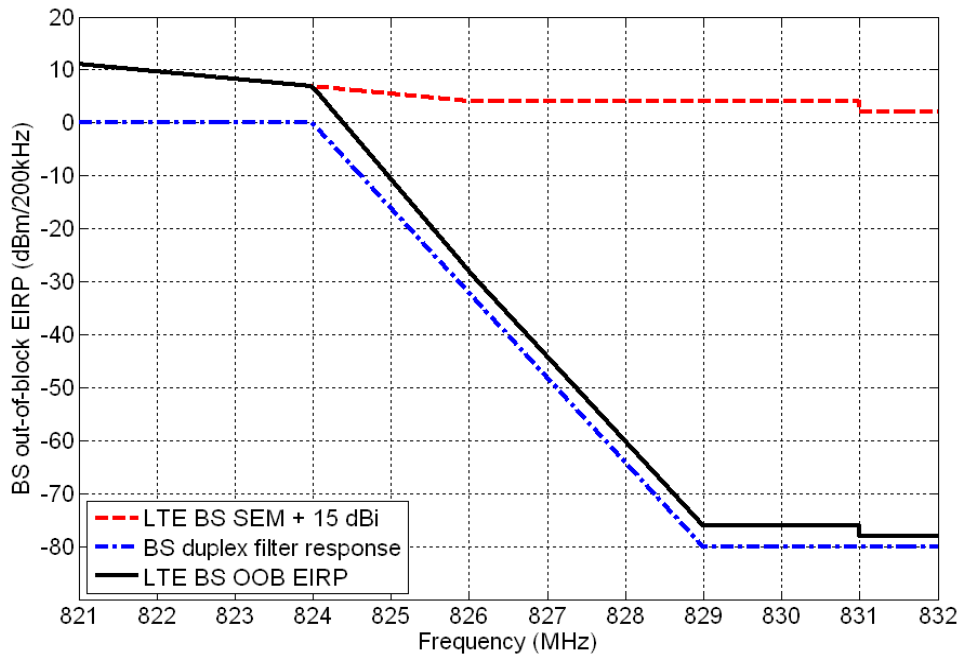


Figure 2: Interference from MFCN base stations to radio microphones

The following conclusions can be drawn from the results of this study:

- For the radio microphone operating in the lowest 200 kHz channel of the duplex gap, and given a BS out-of-block e.i.r.p. of 10 dBm/(200 kHz), the *protection distances* are typically below 200 m.
- Within the remaining 200 kHz channels of the duplex gap, and given a BS out-of-block e.i.r.p. of 10 dBm/(200 kHz), the *protection distances* are below 100 m.

The above conclusions are based on the assumption that the interferer BS radiates at an in-block e.i.r.p. of 64 dBm/(10 MHz).

It is further shown that, where the interferer BS radiates with an out-of-block e.i.r.p. which complies with the LTE BS SEM (10 MHz bandwidth), and is subject to duplex filtering, then the *protection distances* over the 821-832 MHz duplex gap are typically much smaller than 100 m.

4.3.2.2 Interference from MFCN terminal stations to radio microphones

The objective of the study reported in the Annex 5, section A5.1.2 of CEPT Report 30 [9] is to assess the impact of interference from MFCN TSs to radio microphones across the 832 MHz frequency boundary. This involves a minimum coupling loss (MCL) analysis to evaluate the relationship between the *protection distance* and the MFCN TS out-of-block e.i.r.p. level.

The *protection distance* is defined as the horizontal separation between an interferer TS and a victim radio microphone which would allow the radio microphone receiver to meet a minimum signal-to-interference-plus noise (SINR) ratio of 20 dB.

These studies were based on a 10 MHz duplex gap. The results can be translated for the 11 MHz duplex gap (821-832 MHz) of the harmonised FDD plan developed in the ECC/DEC/(09)03 [8]. Under these assumptions, the following figure provides the unwanted emissions from MFCN TS into the 11 MHz duplex gap.

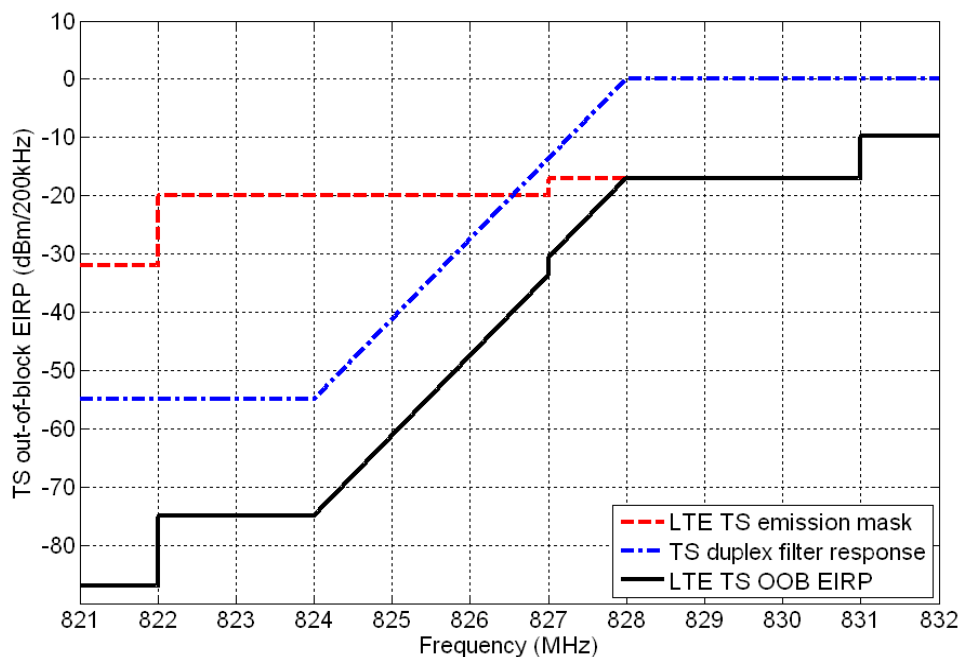


Figure 3: Interference from MFCN terminal stations to radio microphones

The following conclusions can be drawn from the results of this study:

- Within the highest 1 MHz of the FDD duplex gap, the required *protection distance* is 90-94% of the separation between the radio microphone transmitter and its receiver;
- Within the remaining portions of the FDD duplex gap, the required *protection distance* is less than 40% of the separation between the radio microphone transmitter and its receiver;

The above conclusions are based on the assumption that the interferer TS radiates at an in-block e.i.r.p. of 23 dBm/(10 MHz), and with an out-of-block e.i.r.p. which complies with the LTE (10 MHz bandwidth) TS spectrum emission mask, and is also subject to duplex filtering over the 821-832 MHz duplex gap.

The results indicate that the *protection distances* are typically smaller than the separation between the radio microphone transmitter and its receiver, even with the TS interferer radiating at peak power, and with the radio microphone operating at the upper portions of the duplex gap.

4.3.2.3 Conclusion on the theoretical studies

The results of the studies on the protection distances between MFCN and PMSE equipment required for the operation of PMSE equipment in the FDD duplex gap shown that, with the exception of the upper 1 MHz and the lower 200 kHz of the FDD duplex gap where the required protection distances may be considered prohibitive for certain applications, the operation of radio microphones in the FDD duplex gap would generally not be constrained as a result of interference from MFCN equipment.

4.3.3 Additional considerations on the potential use of the band by PMSE

Various measurement studies have been recently performed on the impact of out of band emissions of MFCN (assuming LTE technology) into PMSE audio applications operating in the band 823-832 MHz.

The test results are currently under analysis and further consideration is required before being in a position to draw any final conclusion from these tests on the usability of this band by PMSE without receiving harmful interference from adjacent band use.

However, preliminary consideration shows a large diversity in the potential impact, depending upon various factors related to the interfering signal (power, resource allocation scheme in LTE), the PMSE receiving requirements (dependent upon the type of PMSE use) and the configuration of the compatibility scenario (e.g. distance between the interferer and the PMSE receiver).

PMSE operation with high QoS requirements is likely to be more affected than the operation of certain audio PMSE applications which would require less demanding operating conditions and performance requirements.

It should be noted however that the test campaigns mentioned assess the situation for PMSE systems using currently available technologies. Future technologies may be able to be used in certain fields of applications, showing a higher immunity against the out of band energy of the MFCN working in the adjacent bands.

4.4 SUMMARY FOR THE BAND 821-832 MHz

The 821-832 MHz band is already used by PMSE at European level within the context of the secondary status of PMSE to broadcasting services that have traditionally operated in the 790-862 MHz band.

Harmonization at European level of this band would support:

- continued use of existing equipment otherwise made redundant by the introduction of MFCN services in the 800 MHz band;
- simpler operation by end user, in particular EU-wide operation (for users operating or touring in several EU countries).

This report proposes some technical conditions that would be applicable for operation of PMSE audio applications in the 823-832 MHz band. These technical conditions were derived in order to ensure protection of MFCN in adjacent bands (see Table 8:). However, the impact of MFCN to PMSE needs further review in order to understand precisely which PMSE services can be operated in the band.

The availability of the 823-832 MHz band on an EU-wide basis, under harmonized technical and operational conditions is recommended.

5 TECHNICAL STUDIES ON PMSE SYSTEMS IN THE BAND 1785- 1805MHz

Taking into account the procedures described in CEPT Report 19 [12] for the determination of harmonised technical conditions, two main scenarios of compatibility have been identified for the determination of technical conditions for audio PMSE in the 1785-1805 MHz band:

- Compatibility between PMSE in the band 1785-1805 MHz and other systems/services in adjacent bands, i.e. in bands below 1785 MHz or above 1805 MHz;
- Compatibility within the band 1785-1805 MHz between various PMSE systems operating in adjacent frequencies.

This section focuses on the first scenario. The intra-coexistence between various PMSE systems is considered as part of the PMSE planning (see section 3.4.1).

5.1 OTHER SYSTEMS TO BE CONSIDERED, CHARACTERISTICS

The band 1785-1805 MHz is the duplex gap of the FDD band plan for terrestrial systems capable of providing electronic communications services (referred as MFCN, mobile and fixed communication networks, in this Report) in the 1800 MHz band (the 1710-1785 MHz and 1805-1880 MHz frequency bands). The technical conditions for the use of these bands by MFCN are included in the European Commission Decision 2009/766/EC [16], European Commission Decision 2011/251/EU [17] and ECC/DEC/(06)13 [18].

The harmonised frequency arrangement is 2 x 75 MHz with a duplex gap of 20 MHz, paired and with standard duplex direction. The FDD uplink starts at 1710 MHz and FDD downlink starts at 1805 MHz.

| | | | | | | | | | | |
|---------------|--|--|--|-------------------|-----------------|------|--|--|--|------|
| 1710 | | | | 1785 | | 1805 | | | | 1880 |
| Uplink | | | | Duplex gap | Downlink | | | | | |
| 75 MHz | | | | 20 MHz | 75 MHz | | | | | |

Figure 4: FDD harmonised frequency arrangement in the band 1710-1880 MHz

The 1800 MHz band has been used extensively by GSM systems across Europe since 1995 (ERC/DEC/(95)03) [19]. In 2009, the band was designated and made available for other terrestrial systems capable of providing electronic communications services through European Commission Decision 2009/766/EC [16]. Since then, a number of LTE networks have been deployed in the 1800 MHz band throughout Europe. As such, for further assumptions on technical characteristics for MFCN, it is proposed to consider the relevant specifications applicable to the two most likely technologies envisaged in this band, i.e. GSM and LTE (see EN 301 511 [20], EN 301 908-13 [14] and EN 301 908-14 [15]).

5.2 SCENARIOS OF COMPATIBILITY BETWEEN PMSE AND OTHER SYSTEMS AT THE EDGES OF THE BAND 1785-1805 MHz

This section investigates the adjacent band compatibility between MFCN in the 1800 MHz band and PMSE audio applications in the band 1785-1805 MHz range.

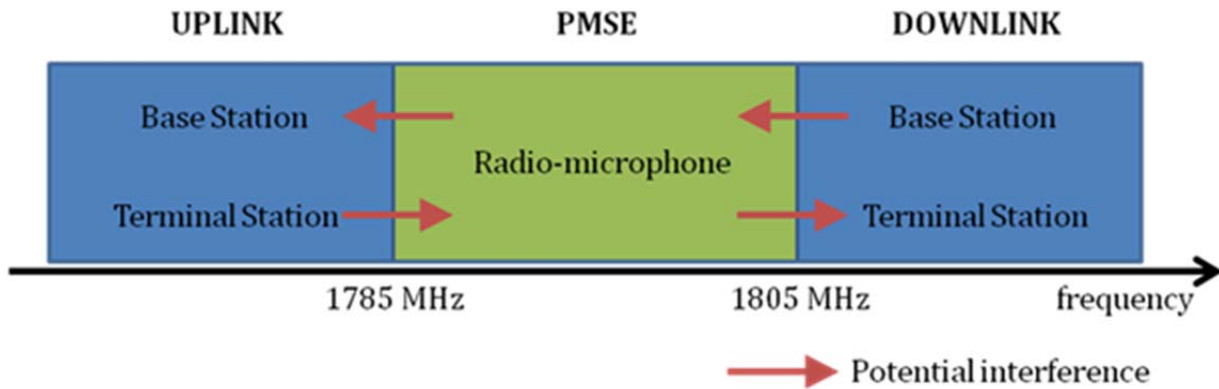


Figure 5: The FDD duplex gap and potential interference

The Report aims to provide the technical conditions under which PMSE can be deployed, namely Block Edge Masks (BEM). The definition of the BEM is based on two scenarios:

- Interference from PMSE towards MFCN base stations at 1785 MHz
- Interference from PMSE towards MFCN terminals at 1805 MHz

The report leverages results from the analyses conducted in ECC Report 191 [21]. The Report studies the deployment of audio PMSE devices in 1785-1805 MHz for a number of scenarios and simulation models including:

- Minimum Coupling Loss and Monte-Carlo analysis,
- Indoor and outdoor scenarios,
- Handheld and Body Worn audio PMSE systems.

The main common assumptions for the studies include:

- Handheld PMSE power of 13 dBm e.i.r.p.
- Body Worn PMSE power of 17dBm e.i.r.p.

A full description of the assumptions, methodologies and results can be found in the ECC Report 191 [21].

The ECC Report 191 [21] also provides preliminary studies on the impact of MFCN on audio PMSE systems.

5.3 RESULTS OF STUDIES

5.3.1 Impact from PMSE into MFCN:

The ECC Report 191 [21] confirms that the band 1800-1805 MHz is an adequate extension band to the 1785-1800 MHz for audio PMSE systems, i.e. that audio PMSE systems can operate in the band 1785-1805 MHz, under the technical conditions specified below, without creating undue interference to MFCN systems operating in the 1800 MHz band.

With regards to the precise technical conditions for audio PMSE in the band 1785-1805 MHz, the analysis conducted in [21] provides a range of results corresponding to each specific scenario/derivation method. The BEMs that would result from the studies are detailed in the Table below.

Table 9: BEM range recommendation for audio PMSE in the 1785-1805 MHz

| | Frequency Range | Handheld e.i.r.p | Reasoning |
|----------------------------|-------------------|--------------------|---|
| OOB | < 1785 MHz | -17 dBm/200kHz | LTE UE spectrum emission mask |
| Restricted frequency range | 1785-1785,2 MHz | 4 dBm/200kHz | GSM blocking |
| | 1785,2-1803,6 MHz | 13 dBm/channel | |
| | 1803,6-1804,8 MHz | 10 dBm/200kHz* | slow increase of LTE UE selectivity |
| Restricted frequency range | 1804,8-1805 MHz | -14 dBm/200kHz | GSM blocking |
| OOB | > 1805 MHz | -37 dBm/200kHz | OOB calculation, in line with ERC/REC 74-01[23] |
| | Frequency Range | Body worn e.i.r.p. | Reasoning |
| OOB | < 1785 MHz | -17 dBm/200kHz | LTE UE spectrum emission mask |
| | 1785-1804,8 MHz | 17 dBm/channel | |
| Restricted frequency range | 1804,8-1805 MHz | 0 dBm/200kHz | GSM blocking |
| OOB | > 1805 MHz | -23 dBm/200kHz | OOB calculation** |

* with a limit of 13 dBm/channel

** For the body worn case the body loss is 14 dB higher than for the handheld case, therefore the -23 dBm for body worn is equivalent to -37 dBm for handheld.

Source: ECC Report 191 [21]

5.3.2 Impact from MFCN into PMSE:

The ECC Report 191 [21] studies on the impact from MFCN into PMSE in 1785-1805 MHz lead to the conclusion that analogue audio PMSE is more sensitive to interference from MFCN than MFCN is sensitive to interference from audio PMSE. As such, it is expected that audio PMSE systems would become unable to operate on an interference-free basis before being in a situation where they would cause interference to MFCN in adjacent bands.

At this stage there are no available studies concerning the impact of MFCN into digital audio PMSE. Further studies will be performed to determine the usability of 1800 MHz band for PMSE, taking into account the impact of MFCN and the performance of current MFCN (e.g. considering the effect of the duplex filter) and PMSE equipment.

The probability of interference from MFCN into PMSE depends on the usage scenario.

5.4 SUMMARY FOR THE BAND 1785-1805 MHz

The 1785-1800 MHz band is already subject to an ECC regulation (ERC/REC 70-03) which forms the basis for the current regulation in force at national level. National regulations have been implemented in some countries due to market demand. This band is used by PMSE at a European level. The 1800-1805 MHz band is considered a valid extension to this band subject to further evaluation of usage in CEPT countries.

In general, the 1785-1805 MHz band would greatly benefit from harmonization at European level in order to facilitate both:

- availability of products, due to easier placement on the market and certainty about future band usage,

- simplified operation by end-users, in particular EU-wide operation (for users operating in several EU countries).

However it should be noted, that the availability and usability of the band for PMSE would depend on the specific operating conditions and interference scenario at a given location.

This report shows that under some technical conditions the band is applicable for operation of some PMSE audio applications (see Table 9:). These technical conditions were derived in order to ensure protection of MFCN in adjacent bands. However, the impact of MFCN to PMSE needs further review in order to understand precisely which PMSE services can be operated in the band.

The availability of the 1785-1805 MHz on an EU-wide basis, under harmonized technical and operational conditions is recommended.

6 CONCLUSIONS

6.1 GENERAL

This CEPT Report is the first part of the response to the Mandate issued by the European Commission on technical conditions regarding spectrum harmonisation options for wireless radio microphones and cordless video-cameras (PMSE equipment).

It deals with the technical conditions for the use of the bands 821-832 MHz and 1785-1805 MHz for wireless radio microphones in the EU, including the technical conditions which can contribute to facilitate the use of PMSE equipment for EU-wide operations.

The intention of this Report is not to address all spectrum requirements for PMSE, specifically wireless radio microphones, but to provide technical conditions which may support harmonisation measures in the two bands under consideration in the Mandate.

It should be noted, that the frequency bands 821-832 MHz and 1785-1805 MHz represent duplex gaps in existing MFCN FDD systems. These gaps are required for separating up-and down link channels of these systems, to avoid interference between up-and downlink.

The Report concludes that the bands under consideration are appropriate for the development of harmonized technical and operational conditions for PMSE audio applications in Europe, but that additional studies are required to determine which wireless audio applications are appropriate, and to what extent these bands will provide additional capacity for wireless audio applications.

6.2 TECHNICAL CONDITIONS FOR PMSE AUDIO APPLICATIONS

This report proposes some technical conditions that would be applicable for operation of PMSE audio applications in the bands under study. These technical conditions were derived in order to ensure protection of MFCN in adjacent bands.

Table 10: BEM range recommendation for PMSE audio applications in the FDD duplex gap of the 800 MHz band

| Frequencies below 821 MHz | 821-823 MHz | 823-826 MHz | 826-832 MHz | Frequencies above 832 MHz |
|--|--|--|-----------------------------|--|
| Out-of-block baseline limits | Guard band because of adjacent band compatibility issues, i.e interference from PMSE into MFCN downlink. | In-block limits | | Out-of-block baseline limits |
| out-of-block e.i.r.p. is -43 dBm/(5 MHz) | | <ul style="list-style-type: none"> ➤ in-block e.i.r.p. of 13dBm for hand-held. ➤ in-block e.i.r.p. of 20dBm for body-worn. | in-block e.i.r.p. of 20 dBm | out-of-block e.i.r.p. is -25 dBm/(5 MHz) |

Source: CEPT Report 30 [9]

Table 11: BEM range recommendation for PMSE audio applications in the 1785-1805 MHz

| | Frequency Range | Handheld e.i.r.p. | Reasoning |
|----------------------------|-------------------|--------------------|--|
| OOB | < 1785 MHz | -17 dBm/200kHz | LTE UE spectrum emission mask |
| Restricted frequency range | 1785-1785.2 MHz | 4 dBm/200kHz | GSM blocking |
| | 1785.2-1803.6 MHz | 13 dBm/channel | |
| | 1803.6-1804.8 MHz | 10 dBm/200kHz* | slow increase of LTE UE selectivity |
| Restricted frequency range | 1804.8-1805 MHz | -14 dBm/200kHz | GSM blocking |
| OOB | > 1805 MHz | -37 dBm/200kHz | OOB calculation, in line with ERC/REC 74-01 [23] |
| | Frequency Range | Body worn e.i.r.p. | Reasoning |
| OOB | < 1785 MHz | -17 dBm/200kHz | LTE UE spectrum emission mask |
| | 1785-1804.8 MHz | 17 dBm/channel | |
| Restricted frequency range | 1804.8-1805 MHz | 0 dBm/200kHz | GSM blocking |
| OOB | > 1805 MHz | -23 dBm/200kHz | OOB calculation** |

* with a limit of 13 dBm/channel

** For the body worn case the body loss is 14 higher than for the handheld case, therefore the -23 dBm for body worn is equivalent to -37 dBm for handheld.

Source: ECC Report 191 [21]

6.3 SPECTRUM CAPACITY FOR PMSE AUDIO APPLICATIONS

The assessment of the potential interference from MFCN into PMSE has an impact on the extent of the operational use of the bands by PMSE audio applications. Preliminary studies have been carried out by user organisations but this issue needs further review in order to determine which PMSE applications can be operated in the band. Initial analysis suggests that, depending on the usage scenario, there may be interference from MFCN. For a qualification of the usability of the 821-832 MHz band for PMSE under the potential out-of-band interference from MFCN terminal and base stations into PMSE, this report analyses the required separation distances. Since there are no available studies concerning the impact of MFCN into digital audio PMSE in the band 1785-1805 MHz, further analysis is necessary to determine the usability of this band for PMSE. This will be subject to a supplemental CEPT report to be sent in public consultation in June 2013.

6.4 ADDITIONAL CONSIDERATIONS REGARDING HARMONISATION

Harmonisation of the bands under consideration would be an enabler for PMSE equipment flow throughout Europe and allow PMSE users to operate their equipment Europe wide. However, it should be noted that the bands cannot be used on an interference free basis in all usage scenarios, due to potential MFCN out of band interference.

ANNEX 1: MANDATE TO CEPT ON TECHNICAL CONDITIONS REGARDING SPECTRUM HARMONISATION OPTIONS FOR WIRELESS RADIO MICROPHONES AND CORDLESS VIDEO-CAMERAS (PMSE EQUIPMENT)



EUROPEAN COMMISSION
Information Society and Media Directorate-General
Electronic Communications Policy
Radio Spectrum Policy

Brussels, 15 December 2011
DG INFSO/B4

FINAL

MANDATE TO CEPT ON TECHNICAL CONDITIONS REGARDING SPECTRUM HARMONISATION OPTIONS FOR WIRELESS RADIO MICROPHONES AND CORDLESS VIDEO-CAMERAS (PMSE EQUIPMENT)

1. PURPOSE

This mandate is a follow-up to the commitment made by the Commission in the Communication on the digital dividend⁴ and in the proposal for a Radio Spectrum Policy Programme.⁵ The main objective of this mandate is to identify technical conditions and options to make EU harmonised spectrum available for wireless radio microphones and cordless video-cameras. The aim is not to satisfy all the spectrum requirements⁶ of the relevant users, but rather to create a baseline for economies of scale and the functioning of the internal market.

Programme Making and Special Events (PMSE) applications fulfil an important role supporting social and cultural activities, ranging from local to EU-wide events and broadcasts, which also make a significant economic contribution. Various types of equipment are involved, such as wireless microphone applications, in-ear systems, cordless video-cameras and remote control systems, used in both professional and non professional environments.

⁴ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Transforming the digital dividend into social benefits and economic growth /*COM/2009/0586 final*/

⁵ Proposal for a Decision of the European Parliament and of the Council establishing the first radio spectrum policy programme /*COM/2010/0471 final – COD 2010/0252*/

⁶ Large events may have much higher spectrum requirements. However, these are very local and may vary over time. Consequently, they are best addressed through national case by case solutions on the base of appropriate equipment standards that specify tuning ranges for equipment.

2. JUSTIFICATION

Pursuant to Article 4 of the Radio Spectrum Decision⁷ 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; such mandates shall set the task to be performed and the timetable therefore.

Without prejudice to the final text to be adopted by the European Parliament and the Council, the draft Radio Spectrum Policy Programme states that Member States shall examine ways and, where appropriate, take technical and regulatory measures, to ensure that the freeing of the 800 MHz band does not adversely affect PMSE users. In addition it states that Member States shall, in cooperation with the Commission, seek to ensure the necessary frequency bands for PMSE, according to the Union's objectives to improve the integration of the internal market and access to culture.

CEPT Report 32⁸ concludes that:

- The historic use of PMSE of the 470-862 MHz band will need to be adapted.
- PMSE demand for spectrum is expected to continue to rise in the medium term.
- Interleaved channels/white spaces in the UHF band are the principal spectrum for wide band audio applications. Therefore, the 470 MHz to 790 MHz range should be maintained for PMSE allowing them to operate on a temporary basis in areas where broadcasting is not yet used.
- New frequency bands could be made available to PMSE in addition to 470-790 MHz.

In order to address in particular non-professional applications and a substantial amount of professional applications, and while recognising that it is not the aim to address all spectrum requirements, there is considerable justification for harmonising the band 821-832 MHz for wireless microphones.

Furthermore, the identification of detailed technical conditions for the use of band 1785-1805 MHz by wireless radio microphones is required before considering a possible harmonisation measure which includes EU-wide operations (this could include for example indoor and outdoor use and the variety of professional and non-professional situations).

In addition to the audio applications (wireless microphones) there is another important category of PMSE equipment, cordless video-cameras, which may face spectrum access issues. Currently, cordless video-cameras are often operating in the 2.3 GHz band and additional in the 2.6 GHz band. The fact that the 2.6 GHz band has been harmonised for terrestrial systems providing electronic communications services under new conditions of use and that some Member States are contemplating the use of the 2.3 GHz in the same way, makes it necessary to consider an alternative and sustainable solution for spectrum access for cordless video-cameras. Therefore, options or alternatives for spectrum use by cordless video-cameras need to be developed. It would be desirable to investigate new bands for cordless video-cameras use and sharing opportunities.

⁷ 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, OJL 108 of 24.4.2002.

⁸ 30 October 2009.

Considering the above and taking into account the fact that EU-wide operations (such as touring shows) as well as ordinary citizens using wireless microphone equipment for non-professional purposes, could both benefit from harmonisation, the Commission believes that an additional mandate is justified. The mandate should concentrate on the analysis of the 821-832 MHz and 1785-1805 MHz bands for wireless microphones and on clarifying technical options to address future needs for cordless video-cameras.

3. MAIN EU POLICY OBJECTIVES

With this mandate, the Commission issues guidance to the CEPT to continue developing technical conditions and studies serving policy objectives which contributes to an improvement of efficient use of spectrum resulting in positive economic, social and cultural benefits in the EU. These main policy objectives include:

- To ensure the availability of core spectrum for some categories of PMSE equipment, respectively wireless radio microphones and cordless video-cameras, with a view to supporting the development of media and entertainment industry (PMSE);
- To strengthen the Internal Market dimension for potential single market services and PMSE equipment, that can improve frequency management, in relation to PMSE use as well as to improve the spectrum efficiency of PMSE equipment.
- To exploit the socio-economic and cultural benefit for EU citizens and PMSE users to the fullest extent by facilitating economies of scale, lower prices and foster cross-border portability and interoperability.

4. TASK ORDER AND SCHEDULE

Through this mandate, the CEPT is requested:

- (1) To identify the technical conditions for the use of the band 821-832 MHz for wireless radio microphones (which optionally include in-ear systems and control systems) in the EU. This should take into account the technical conditions specified in EC Decision 2010/267/EU on the EU harmonisation of the 800 MHz band as well as any relevant outcomes of WRC-12.
- (2) To identify the technical conditions resulting in a harmonisation of technical parameters in the band 1785-1805 MHz for the use of wireless radio microphones (which optionally include in-ear systems and control systems).
- (3) To identify the technical conditions and the necessary frequency bands for ensuring the sustainable operation of cordless video-cameras in the EU, including spectrum sharing opportunities possible through technological developments.
- (4) To identify technical conditions which can contribute to facilitate the use of wireless radio microphone and cordless video-camera-equipment for EU-wide operations, including specific aspects to improve the frequency management and the overall spectrum efficiency of equipment,

The Commission may provide CEPT with further guidance on this mandate.

The deliverable for this mandate will be two reports A and B:

- Report A on the technical conditions for the use of the bands 821-832 MHz and 1785-1805 MHz for wireless radio microphones in the EU, including the technical conditions which can contribute to facilitate the PMSE equipment for EU-wide operations;
- Report B on the technical conditions for ensuring the sustainable operation of cordless video-cameras in the EU.

The following delivery dates are scheduled:

| Delivery date | Deliverable |
|----------------------|---|
| 3/07/12 | For RSC#40 Progress report A |
| 4/12/12 | For RSC#42 Progress report B |
| 4/12/12 | For RSC#42 Draft final report A, subject to public consultation |
| 11/03/13 | Final report A delivery |
| July 2013 | For RSC#44 Draft final report B, subject to public consultation |
| November 2013 | Final report B delivery |

In implementing this mandate, the CEPT shall, where relevant, take the utmost account of Community law applicable and support the principles of technological neutrality, non-discrimination and proportionality insofar as technically possible.

The Commission, with the assistance of the Radio Spectrum Committee 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.

ANNEX 2: LIST OF REFERENCES

- [1] EC Decision 2010/267/EU on harmonised technical conditions of use in the 790-862 MHz frequency band for terrestrial systems capable of providing electronic communications services in the European Union
- [2] ECC Report 02: SAP/SAB (Incl. ENG/OB) spectrum use and future requirements
- [3] ETSI EN 300 422 Technical characteristics and test methods for wireless microphones in the 25 MHz to 3 GHz frequency range
- [4] ETSI EN 300 454 Wide band audio links; Technical characteristics and test methods
- [5] ETSI EN 301 357 : Cordless audio devices in the range 25 MHz to 2 000 MHz
- [6] ERC Recommendation 25-10 on Frequency ranges for the use of temporary terrestrial audio and video SAP/SAB links (incl. ENG/OB)
- [7] ERC Recommendation 70-03 on Relating to the use of Short Range Devices (SRD)
- [8] ECC Decision (09)03 on harmonised conditions for Mobile/Fixed Communications Networks (MFCN) operating in the band 790-862 MHz
- [9] CEPT Report 30 on the identification of common and minimal (least restrictive) technical conditions for 790 - 862 MHz for the digital dividend in the European Union
- [10] Questionnaire to CEPT administrations on the regulatory procedures used by administrations in granting access to spectrum for PMSE ([summary](#), [full set of responses](#))
- [11] ETSI EN 301 489-9 Specific conditions for wireless microphones, similar Radio Frequency (RF) audio link equipment, cordless audio and in-ear monitoring devices
- [12] CEPT Report 19 to develop least restrictive technical conditions for frequency bands addressed in the context of WAPECS
- [13] Recommendation ITU-R F.1336: Reference radiation patterns of omnidirectional, sectoral and other antennas in point-to multipoint systems for use in sharing studies in the frequency range from 1 GHz to about 70 GHz
- [14] ETSI EN 301 908-13 : IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 13: Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE)
- [15] ETSI EN 301 908-14 . IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 14: Evolved Universal Terrestrial Radio Access (E-UTRA) Base Stations (BS)
- [16] European Commission Decision 2009/766/EC on harmonisation of the 900 MHz and 1800 MHz for terrestrial systems capable of providing pan-European ECS
- [17] European Commission Decision 2011/251/EU on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community
- [18] ECC/DEC/(06)13 on the designation of the bands 880-915 MHz, 925-960 MHz, 1710-1785 MHz and 1805-1880 MHz for terrestrial IMT-2000/UMTS systems
- [19] ERC/DEC/(95)03 on the frequency bands to be designated for the introduction of DCS 1800
- [20] ETSI EN 301 511: Global System for Mobile communications (GSM); Harmonized EN for mobile stations in the GSM 900 and GSM 1800 bands covering essential requirements under article 3.2 of the R&TTE directive
- [21] ECC Report 191: Adjacent band compatibility between MFCN and PMSE audio applications in the 1800 MHz range
- [22] CEPT Report 08 on the harmonised uses for the frequency bands 1670-1675 MHz and 1800-1805 MHz (the "TFTS bands")
- [23] ERC Recommendation 74-01 on Unwanted Emissions in the Spurious Domain