



CEPT Report **58**

Report B2 from CEPT to the European Commission in response to the Mandate on 'Harmonised technical conditions for the 2300-2400 MHz ('2.3 GHz') frequency band in the EU for the provision of wireless broadband electronic communications services

Technical sharing solutions for the shared use of the 2300-2400 MHz band for WBB and PMSE

Report approved on 3 July 2015 by the ECC

0 EXECUTIVE SUMMARY

This CEPT Report is the third and final part of the response to the Mandate issued by the European Commission on harmonised technical conditions for the 2300-2400 MHz ('2.3 GHz') frequency band in the EU for the provision of wireless broadband (WBB) electronic communications services.

This CEPT Report provides the final results of the work performed under task 2 of the EC Mandate ('*Where appropriate develop common technical sharing solutions for the shared use of the 2300-2400 MHz band for WBB and incumbent services/applications*').

It is a follow-up of CEPT Report 56 [1] which identified the technological and regulatory options facilitating sharing between WBB applications and the relevant incumbent services/applications in the 2.3 GHz band. In CEPT Report 56, Licensed Shared Access (LSA) was identified as a possible option for the shared use of the band between WBB and the incumbent use. Technical conditions and details of implementation of the LSA sharing framework should be defined at the national level solely reflecting the national sharing scenarios, which depend strictly upon the type and extent of incumbent uses to be protected.

This Report focusses on the further development of solutions for the sharing framework between WBB and PMSE within 2300-2400 MHz by taking into account:

- (i) the outcome from CEPT Report 56 [1],
- (ii) that Programme Making and Special Events (PMSE) video links is the most common usage in the band 2300-2400 MHz across CEPT and
- (iii) that their technical characteristics are similar from one country to another.

This report complements the regulatory process by recommending a step-by-step procedure to provide technical and regulatory solutions for a sharing framework between WBB and PMSE. It focusses on the definition of the sharing framework in the context of LSA.

- The first step is used to determine at the national level the nature and extent of use of PMSE helping the Administration in defining the PMSE protection requirements.
- The second step is to develop technical conditions for the sharing framework, taking account of the relevant PMSE technical characteristics. The approach is the definition of protection zones related to PMSE. Additional tools are also given for additional requirements for the protection of PMSE.
- The third step defines the operational conditions for the sharing framework and the implications on the WBB network in order to fulfil the PMSE protection requirements.

The Report also identifies additional actions outside the sharing framework to be considered for the application of LSA.

Standardisation activities on LSA will facilitate the availability and interoperability of technical solutions for implementation of LSA, allowing the national implementations to be specific depending on the national conditions and incumbent usage of the band.

The practical implementation of LSA may vary on a case-by-case basis depending on the national conditions. The assessment of a feasible implementation solution for LSA may require field experimentations.

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
BS	Base Station
BWS	Broadband Wireless Systems
CEPT	European Conference of Postal and Telecommunications Administrations
ECC	Electronic Communications Committee
ETSI	European Telecommunications Standards Institute
EU	European Union
LRTC	Least Restrictive Technical Conditions
LSA	Licensed Shared Access
LTE	Long-Term Evolution
MFCN	Mobile/Fixed Communications Networks
NRA	National Regulatory Authority
PMSE	Programme Making Special Events
SAB	Services Ancillary to Broadcasting
SAP	Services Ancillary to Programme making
UAV	Unmanned Aircraft Vehicle
UE	User Equipment
WBB	Wireless Broadband

1 INTRODUCTION

This CEPT Report is the third and final part of the response to the Mandate issued by the European Commission on harmonised technical conditions for the 2300-2400 MHz ('2.3 GHz') frequency band in the EU for the provision of wireless broadband (WBB) electronic communications services. This EC Mandate (see ANNEX 1: for the full text of the EC Mandate) tasks CEPT to undertake work to develop technical harmonisation conditions for the use of the 2300-2400 MHz frequency band for the provision of WBB electronic communications services with a view to also ensuring the long term incumbent use of the band in the territory of those Member States that wish to maintain such use.

This CEPT Report provides the final results of the work performed under task 2 of the EC Mandate ('*Where appropriate develop common technical sharing solutions for the shared use of the 2300-2400 MHz band for WBB and incumbent services/applications*') and addresses specifically the task 2.3:

2.3 Depending on results for each relevant incumbent service/application under 2.2(ii) and without prejudice to national rules on data confidentiality define technical and regulatory solutions relevant for the technological and regulatory options identified under 2.2(i) that support consistent sharing frameworks defined at national level allowing for the development and efficient operation of EU-wide equipment.

This Report is a follow-up of CEPT Report 56 [1], which identified the technological and regulatory options facilitating sharing between WBB applications and the relevant incumbent services/applications in the 2.3 GHz band. In CEPT Report 56, Licensed Shared Access (LSA) was identified as a possible option for the shared use of the band between WBB and the incumbent use.

This Report focusses on the further development of solutions for the sharing framework between WBB and PMSE within 2300-2400 MHz by taking into account:

- (i) the outcome from CEPT Report 56 [1],
- (ii) that Programme Making and Special Events (PMSE) video links is the most common usage in the band 2300-2400 MHz across CEPT and
- (iii) that their technical characteristics are similar from one country to another.

2 BACKGROUND

2.1 CEPT REGULATORY FRAMEWORK FOR WBB IN THE BAND 2.3-2.4 GHz

ECC/DEC/(14)02 [2] was developed with the purpose of providing harmonised technical and regulatory conditions for mobile/fixed communications networks (MFCN), including broadband wireless systems (BWS) in the frequency band 2300-2400 MHz. It includes the least restrictive technical conditions (LRTC), taking into account the existing standardisation framework and activities at worldwide level, and an appropriate frequency arrangement.

ECC/DEC/(14)02 describes the various incumbent usages across CEPT in the band 2300-2400 MHz and also recognises that administrations, wishing to introduce MFCN in the band, and maintain the long term incumbent use of the band in their territory, should develop an appropriate sharing framework.

Licensed Shared Access (LSA), as defined by RSPG in [3] and further described in ECC Report 205 [4], is the recognised approach at the CEPT level for administrations wishing to introduce WBB while maintaining the current incumbent use, and is therefore hereby recommended as an appropriate basis for a sharing framework between the incumbent PMSE and WBB in the band 2.3-2.4 GHz.

Technical conditions and details of implementation of the LSA sharing framework should be defined at the national level solely reflecting the national sharing scenarios, which depend strictly upon the types and extent of incumbent use to be protected.

2.2 SHARING OPTIONS BETWEEN WBB AND PMSE IN THE BAND 2.3-2.4 GHz

As described in ECC Report 172 [5], incumbent PMSE applications (SAP/SAB video links) can coexist with WBB at the same time through the use of either geographic separation if co-frequency operation is expected or a combination of separation distance and frequency separation if co-located operation is anticipated.

On this basis, CEPT Report 56 [1] identifies two general sharing options, which are considered in this Report as follows:

- Option A: The first option is to allow the use of PMSE in a number of blocks or in the whole band while making available this same spectrum for WBB in accordance with the defined LSA framework;
- Option B: The other option is to preserve a number of blocks for the operation of PMSE video-links. The relevant blocks (and possibly the adjacent ones as well) will not be available for the additional user.

Therefore, this Report develops further option A described above for the implementation of a sharing framework between PMSE and WBB in the 2.3-2.4 GHz band.

Details of the implementation may be impacted by the authorisation scheme applying to the incumbent use, which varies through CEPT countries, e.g. due to limited information of the precise time and locations of the use of PMSE video in all or parts of the band.

It has to be noted that this Report focusses on PMSE (i.e. for commercial use). In some CEPT countries, the band 2300-2400 MHz is heavily used for governmental video links, for which the guidelines described in section 3 can also be applied, possibly leading to operational conditions different from PMSE.

3 IMPLEMENTATION OF A SHARING FRAMEWORK BETWEEN WBB AND PMSE WITHIN 2300-2400 MHz

As described in ECC Report 205 [4] and also reported in CEPT Report 56 [1], the implementation of LSA relies on the concept of a sharing framework that is under the responsibility of the Administration / NRA. Its development requires the involvement of all relevant stakeholders. A common understanding on the sharing conditions between the incumbent licensee(s) and the prospective WBB (LSA) licensee is required in order to assign the band or parts of it for WBB by the Administration/NRA. This may require that, when reviewing the regulatory framework for PMSE, administrations should consider appropriate conditions which facilitate the introduction of an LSA usage.

The sharing framework is a set of sharing rules or sharing conditions that will materialise the change, if any, in the spectrum rights of the incumbent(s) and define the spectrum, with corresponding technical and operational conditions, that can be made available for additional usage under LSA.

This section complements the regulatory process described in ECC Report 205 by recommending a step-by-step procedure as shown in Figure 1 to implement an appropriate sharing framework to allow for sharing and coexistence between PMSE (incumbent) and WBB. It focusses on the definition of the sharing framework in the context of LSA.

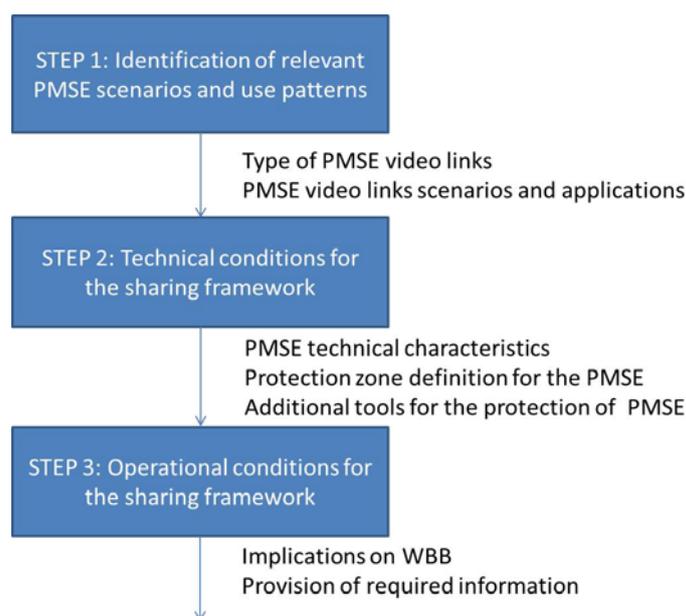


Figure 1: Step-by-step approach

The applications of PMSE and WBB are usually deployed in the same geographical area, most likely in areas with a high population density.

It should be noted that, depending upon the national cases, PMSE video links may be allowed to use the full frequency range identified or only parts of it.

The case of airborne use of PMSE may require large separation distances, reaching over national borders (see ECC REC/(14)04 [10] for guidance on cross-border coordination in the 2300-2400 MHz band).

In this Report, only interference from WBB into PMSE is considered. In the case of PMSE possibly interfering with WBB, additional constraints are not expected on PMSE deployment. Appropriate measures for handling

those parts of the WBB networks which might be affected by the incumbents' operations can be defined in the sharing framework or determined by the WBB operator.

3.1 STEP 1: IDENTIFICATION OF RELEVANT PMSE SCENARIOS AND USE PATTERNS

In the first step, the extent of the PMSE use should be determined at the national level. This will help the administration to assess the applicability of the sharing and define the PMSE protection requirements. The amount and type of PMSE usage in the band is one of the elements which will allow:

- the administration to decide nationally on the applicability of the LSA on a frequency and geographical basis;
- the administration and the prospective LSA licensee to evaluate the amount of spectrum available for sharing.

The information on the PMSE usage may be gathered by the administrations e.g. through questionnaires addressed to the relevant national stakeholders.

3.1.1 Type of PMSE video links

The categories of PMSE video links to be considered in sharing and compatibility studies are given in Table 1 (see also [6]). PMSE for the purpose of this Report is understood as PMSE video links including cordless cameras. The main type of PMSE applications used in the 2300-2400 MHz band is related to temporary video links (portable, mobile with some allowance for airborne use) and cordless cameras.

Table 1: Categories of PMSE video links in regular use

Type of link	Definition
Radio camera (line-of-sight)	Handheld or otherwise mounted camera with integrated or Clip-on transmitter, power pack and antenna for carrying broadcast-quality video together with sound signals over short-ranges line-of-sight
Radio camera (non-line-of-sight)	Handheld or otherwise mounted camera with integrated or Clip-on transmitter, power pack and antenna for carrying broadcast-quality video together with sound signals over short-ranges non-line-of-sight
Miniature camera/link	Very small transmitter and miniature camera for specialist action shots, e.g. helmet cam, UAV, etc. Can be body worn or covert mounted/installed
Portable video link	Small transmitter, for deployment over greater ranges, typically up to 2km
Mobile air-to-ground video link	Video transmission system employing radio transmitter and receivers mounted on helicopters, airships or other aircraft.(includes repeaters and relays)
Mobile vehicular video link (including ground-to-air)	Video transmission system employing radio transmitter mounted in/on motorcycles, racing motorbikes, pedal cycles, cars, racing cars or boats. One or both link terminals may be used while moving.

3.1.2 PMSE video links scenarios and applications

The PMSE scenarios together with typical applications and link types are given in Table 2. The PMSE scenarios have implications also on the WBB operational conditions. This aspect will be discussed in the step 3 described in 3.3.

Table 2: PMSE video links scenarios and applications

PMSE scenarios	Typical applications	Type of PMSE link
Frequent or permanent use, specific location	TV studio, theatre, stadium	Cordless cameras / Portable
Temporary use, specific location	Special events (e.g. Cycling races, Marathons, Formula One)	Cordless cameras / Portable / Mobile / Airborne
Temporary use anywhere, anytime, unplanned	TV news, governmental use	Cordless cameras / Portable / Airborne

3.2 STEP 2: TECHNICAL CONDITIONS FOR THE SHARING FRAMEWORK

3.2.1 Step 2.1: PMSE technical characteristics

Based on the information on PMSE gathered in step 1, administrations should identify the relevant PMSE technical characteristics to be used in the process of determining the protection criteria for the PMSE.

The PMSE technical characteristics may be defined according to the typical values given in ECC Report 219 [6] or they can be defined based on the national usage by the Administration (see Table 3).

Table 3: typical characteristics for PMSE video links

Type of Link	P_{MAI} (dBm) (Note 1)	P_{fr} (dB) (Note 2)	Receiver antenna gain @ height agl (Note 3)
			ECC Report 219 (Note 4, Note 5)
Radio Camera Line-of-Sight	-107	0	3-13dBi @ 2-60m
Radio Camera Non-Line-of-Sight	-107	0	3-13dBi @ 2-60m
Miniature Link	-107	0	3-13dBi @ 2-60m
Portable Link	-107	0	9-17dBi @ 2-60m
Air to ground Link	-107	0	17-24dBi @ 2-60m
Mobile vehicular Link (including ground-to-air)	-107	0	10-13dBi @ 2-60m 4-9dBi @ 150m-6km (airborne)

Note 1: P_{MAI} (dBm): Maximum allowable interference power at the PMSE receiver in an 8 MHz occupied bandwidth.
Note 2: P_{fr} (dB): cable and feeder loss at receiver.
Note 3: a.g.l – above ground level.
Note 4: Typical and maximum values are provided.
Note 5: Value agreed at a national level may be considered.

Regarding the PMSE protection criteria P_{MAI} , administrations may agree to choose alternative values. However, since the protection criteria of the PMSE has an effect on the availability of spectrum and therefore on the feasibility of LSA, this information is assumed to remain stable throughout the sharing arrangement.

3.2.2 Step 2.2: Protection zone definition for the PMSE

The general approach for the PMSE protection is based on the determination of protection zone.

Protection Zone is defined as a geographical area within which PMSE video link receivers will not be subject to harmful interference caused by WBB transmissions (covering both WBB BS and UEs).

However, since UEs operate under the control of a network, the protection of PMSE video links is mainly addressed by controlling the WBB BS.

A protection zone is characterised by its geographical area and the maximum field strength level (see below) defined for the protection of the PMSE video link. A protection zone is normally applicable for a defined frequency range and time period.

For the protection of unidirectional PMSE video link, there is only a need to protect the PMSE receiver.

A definition of a greater size zone by administrations for the protection of a PMSE receiver might be considered for different reasons, for example for verification measures or to include a margin to the protection.

The definition of the zone can also cover different cases:

- to have several PMSE receivers in the same zone (for example for Formula 1 races);
- to take into account the mobility of a PMSE receiver;
- to take into account the location uncertainty of the PMSE receiver.

It is up to administrations to define these zones depending upon the national situations.

In some cases, e.g. for the protection of mobile PMSE receivers, the protection zone can move over time depending upon the location of the PMSE receiver.

Within the protection zone, the electromagnetic field strength level (E_{CC} in the co-channel case or E_{AC} for the adjacent channel case) emitted by a WBB network (covering both BS and UEs) should not exceed a defined value in dB μ V/m at a defined PMSE video link receiver in a defined PMSE bandwidth (here 8 MHz) at antenna height above ground level.

In accordance with Recommendation ITU-R P.525 [7] the allowable electromagnetic field strength to be received can be calculated following the scheme below. It is to be noted that for simplification, the free space propagation loss has been assumed. It is expected that multipath propagation loss is taken into account by the WBB system, in those cases where this can be taken as possible higher interference into the PMSE receiver.

$$E_{CC} = 77.21 + P_{MAI} + 20_{\log} f_{PMSE} - G_{RX} \left[dB \frac{\mu V}{m} \right] \quad (1)$$

where:

- P_{MAI} = maximum allowable interference power in the PMSE bandwidth with $P_{MAI} = P_N + \frac{I}{N}$ [dBm] (2)
- P_N = minimum noise floor with $P_N = -174 + 10_{\log} B_{PMSE} [Hz] + F$ [dBm] (3)
- F = receiver noise figure; here: typical values available in ECC Report 219;
- B_{PMSE} = bandwidth here: 8 MHz;
- I/N = interference to noise ratio here: administrations may choose to use - 6 dB (or ECC Report 219 [6]);
- f_{PMSE} = centre frequency of the used PMSE receiver channel;
- G_{RX} = PMSE receiver antenna gain here: 0dB for isotropic antennas.

The assumption on the field strength (1) is to be considered as co-channel situation (E_{CC}), when (4) applies, while for an adjacent channel situation (E_{AC}), when (5) applies the WBB Adjacent Channel Interference Ratio is to be added to (1) leading to (6).

$$|(f_{PMSE} - f_{MFCN})| \leq \frac{(B_{PMSE} + B_{MFCN})}{2} \quad (4)$$

$$\frac{B_{PMSE} + B_{MFCN}}{2} < |(f_{PMSE} - f_{MFCN})| \leq \frac{3(B_{PMSE} + B_{MFCN})}{2} \quad (5)$$

$$E_{AC} = 77.21 + P_{MAI} + 20 \log f_{PMSE} - G_{RX} + L_{ACIR} \left[dB \frac{\mu V}{m} \right] \quad (6)$$

where:

- B_{PMSE} / B_{MFCN} = occupied bandwidths of the PMSE receiver and the WBB transmitter;
- f_{PMSE} / f_{MFCN} = centre frequencies of the PMSE receiver channel and the WBB transmitter channel;
- L_{ACIR} = Adjacent Channel Interference Ratio, ratio of the total power transmitted from a source to the total interference power affecting a victim receiver, resulting from both transmitter (L_{ACLR} = WBB Adjacent Channel Leakage Ratio, ACLR) and receiver (L_{ACS} = PMSE Adjacent Channel Selectivity, ACS) imperfections.

$$L_{ACIR} = \frac{1}{\frac{1}{L_{ACLR}} + \frac{1}{L_{ACS}}}$$

For the WBB ACLR, example value is 45dB as suggested by Table 6.6.4.4-1 ETSI TS 137 104 v12.5.0 for E-UTRA [8]. For the PMSE ACS, example value is provided in ECC Report 219 [6].

3.2.3 Step 2.3: Additional tools for the protection of PMSE

In addition to the approach described under step 2.2, administrations may want, in some cases, to introduce additional requirements for the protection of PMSE. Two possible options are described as follows:

Exclusion Zone is defined as a geographical area within which WBB operator is not allowed to have active transmissions on frequencies that interfere with the PMSE video link channel. An exclusion zone is normally applicable for a defined time period.

More stringent protection requirement: This may be stipulated by the need to create more certainty on the protection of the PMSE receivers at the given location (e.g. due to problem to provide location information of the PSME receiver) or to create a stable zone to allow use of more than one PMSE receiver in a given area. This requirement is to be added to the threshold derived from consideration on step 2.2.

The needed distance (D) and/or additional margin (L_{MARGIN}) can be calculated as follows:

$$P_{MAI} + L_{Margin} = P_{TX} - L_0 \iff D = 10^{\frac{P_{TX} - 32.4 - P_{MAI} - L_{Margin} - 20 \log f}{20}} \text{ [km]} \quad (7)$$

where:

- P_{MAI} = maximum allowable interference power [dBm]
- L_{Margin} = additional margin for PMSE protection [dB]
- P_{TX} = transmitter output power [dBm]
- L_0 [dB] = free space propagation loss with $L_0 = 32.4 + 20 \log f + 20 \log D$ (8)
- D = distance between PMSE receiver and WBB transmitter [km]
- f = frequency in MHz here: centre frequency of the used PMSE receiver channel.

3.3 STEP 3: OPERATIONAL CONDITIONS FOR THE SHARING FRAMEWORK

The WBB systems will need mechanisms to ensure that it fulfils the protection of the PMSE video links. Operational conditions for the WBB are highly dependent on the considered PMSE scenario as shown in Table 4.

Table 4: PMSE scenarios and their implications on the protection zone and WBB networks

PMSE scenarios	Typical applications	Possible Implications on the protection zone	Implications on the WBB network
Frequent or permanent use, specific location	TV studio	Permanent protection zone	Network planning according to the requirement
	Theatre, stadium	Permanent protection zone	Network planning according to the requirement
		Dynamic protection zone, protection zone and its possible dimensions known well in advance	Dynamic adjustment of radio network, pre-defined configurations possible, adequate time for network planning
Temporary use, specific location, (limited mobility possible in pre-defined area)	Special events (e.g. Cycling races, Marathons, Formula One),	Dynamic protection zone, protection zone and its possible dimensions known well in advance	Dynamic adjustment of radio network, pre-defined configurations possible, adequate time for network planning
Temporary use, anywhere, anytime, unplanned, mobility possible	TV news, governmental use	Dynamic protection zone, protection zone needed with a short notice, location may vary due to mobility	Dynamic adjustment of radio network, short response time, mobility support

3.3.1 Implications on WBB network

The operation of a PMSE video-link at a given position or on the move is to be protected from the interference arising from the BS and UE of the WBB network. In order to guarantee the protection zone around the PMSE video link receiver, the WBB operator is required to perform interference calculations and dynamically adjust its radio network at the needed position(s) in the frequency block affecting the operation of the PMSE video link accordingly.

This is done by closing down or restricting the transmission power of the BSs in the vicinity of the PMSE receiver to fulfil the protection criteria. The latter may allow WBB BSs with lower transmission power (small cells) to continue their transmission even when the macro BSs would need to be turned off. The network should operate related interfaces accepting information by the incumbent(s) on the position of the cordless camera(s). For example databases or ad-hoc information on the PMSE video link receiver positions could be considered.

The implications on the protection zone and WBB network depend on the considered PMSE application as shown in Table 4.

For PMSE applications such as special events, theatre or stadium, the PMSE usage is tied to a certain location. The need for protection zone as well as possible mobility is known by the WBB network well beforehand. This allows the WBB network adequate time for network planning as well as use of pre-defined network configurations.

In the case of applications such as TV news or governmental use, the need for protection zone may come with short notice and therefore the WBB network needs to be able to make the interference estimation and network adjustment in a fast pace. Additionally, mechanisms such as tracking may be needed to support the mobility of the PMSE video link. It has to be taken into account that in some cases, the information regarding the locations in support of tracking may be treated as confidential – see also section 4.

The need for dynamic adjustment of the WBB network is foreseen to require additional spectrum management layer on top of the existing WBB network infrastructure. The WBB network needs to calculate the interference caused to the PMSE video link in order to define appropriate areas for turning off or restricting the power of its BSs. The Administrations may set limits to the maximum time that it can take for the WBB network to make this calculation and create the appropriate protection.

Appropriate solutions implementing the above operational conditions are developed in ETSI as part of its activities on the standardisation of the LSA system requirements, architecture and interfaces. In particular, ETSI has approved TS 103 154 v 1.1.1 on the System requirements for operation of Mobile Broadband Systems in the 2 300 MHz-2 400 MHz band under Licensed Shared Access (LSA) [9].

On this basis, implementations have been developed or are under development, which fulfil the requirements set out in this Report. An example of an LSA implementation, where the WBB network is deploying fully commercial LTE equipment and the LSA System –comprising of LSA Repository and LSA Controller – is implemented on top of the existing WBB network infrastructure is given in CEPT Report 56 [1], Section 4.3 and Annex 2 of that Report.

3.3.2 Provision of required information

The information required by the WBB network for the protection of the PMSE video link can be categorised into information which can be provided only once during the sharing framework and into information that is needed when a new protection zone is required.

The values for the maximum field strength are defined in the beginning of the sharing framework. The values may vary between different PMSE video link types, service providers etc. However they should remain stable throughout the LSA sharing arrangement and may be made available in a database.

For administrations considering the dynamic protection of PMSE receivers, some information needs to be transmitted by the PMSE user upon each of its requests for a new protection zone. This kind of information includes at minimum the location and frequency of the PMSE receiver to be protected and the type of the PMSE link and may also include further information relevant for the process.

A secure means is needed so that the PMSE user provides dynamic information on a scheduled protection zone beforehand. This could be done e.g. via mobile phone or a web browser.

Automatic or on-demand tracking of the PMSE video link could be used for gathering the information in the case of immediate need for the protection zone. It would also aid in supporting the mobility of the PMSE receiver.

4 ADDITIONAL CONSIDERATIONS

Additional actions should be taken into account and performed to apply the full LSA mechanism outside of the defined sharing framework. In particular, there is a need to

- incentivise the incumbent(s) to provide access to the spectrum resource;
- reach common understanding on the use of the available resource;
- consider the protection of information/data: in order to implement a full operational sharing between the partners, both sides, the incumbent(s) and the additional user(s), need to provide information. Some of these require a certain level of confidentiality, which is to be provided by appropriate means e.g. by the implementation of a confidentiality layer in the used data bases. This could be dynamic location information and protection thresholds. Confidentiality might be required for any information to be restricted e.g. on use cases and times, traffic volumes, etc. Access to this information is to be limited to the purpose of the sharing only.

5 CONCLUSIONS

As a follow-up of CEPT Report 56 [1], this Report focusses on the further development of solutions for the sharing framework between WBB and PMSE within 2300-2400 MHz.

This Report complements the regulatory process by recommending a step-by-step procedure to provide technical and regulatory solutions for a sharing framework between WBB and PMSE. It focusses on the definition of the sharing framework in the context of LSA.

- The first step is used to determine at the national level the nature and extent of use of PMSE helping the Administration in defining the PMSE protection requirements.
- The second step is to develop technical conditions for the sharing framework, taking account of the relevant PMSE technical characteristics. The approach is the definition of protection zones related to PMSE. Additional tools are also given for additional requirements for the protection of PMSE.
- The third step defines the operational conditions for the sharing framework and the implications on the WBB network in order to fulfil the PMSE protection requirements.

The Report also identifies additional actions outside the sharing framework to be considered for the application of LSA.

Standardisation activities on LSA will facilitate the availability and interoperability of technical solutions for implementation of LSA, allowing the national implementations to be specific depending on the national conditions and incumbent usage of the band.

The practical implementation of LSA may vary on a case-by-case basis depending on the national conditions. The assessment of a feasible implementation solution for LSA may require field experimentations.

ANNEX 1: CEPT MANDATE

MANDATE TO CEPT TO DEVELOP HARMONISED TECHNICAL CONDITIONS FOR THE 2300-2400 MHz ('2.3 GHz') FREQUENCY BAND IN THE EU FOR THE PROVISION OF WIRELESS BROADBAND ELECTRONIC COMMUNICATIONS SERVICES

1 PURPOSE

This mandate aims at developing technical conditions for the introduction of wireless broadband (WBB) in the 2300-2400 MHz ('2.3 GHz') band which share with incumbent users. The technical conditions should enable the deployment of wireless broadband services while also ensuring the long term incumbent use of the band in the territory of those Member States that wish to maintain such use.

The results of this mandate should constitute a technical input to the EU-level political process of identifying 1200 MHz for WBB in accordance with the Radio Spectrum Policy Programme (RSPP)¹. The spectrum inventory established by the RSPP involves assessment of spectrum supply and demand and will examine the efficiency of spectrum use in the range 400 MHz to 6 GHz. The inventory may earmark the 2.3 GHz band for Wireless Broadband use at an early stage in view of the suitability of the band and the scope for sharing with incumbent use.

The results of this mandate should serve as a basis for any Member State that may decide to proceed with WBB and related national sharing frameworks in the 2.3 GHz band at an early stage, so as to avoid fragmentation in the internal market and contribute to consistent national sharing frameworks.

Moreover, the mandate and its technical results should also complement the policy considerations of the European Commission with regard to shared use of spectrum² and of the Radio Spectrum Policy Group (RSPG) in the context of the RSPG Opinions on Wireless Broadband³ and Licensed Shared Access⁴.

2 EU POLICY OBJECTIVES

The Digital Agenda for Europe (DAE) has set ambitious broadband targets by 2020, namely ubiquitous fast broadband coverage in the EU of at least 30 Mbps as well as subscriptions to super-fast broadband of at least 100 Mbps for 50% of the EU households. WBB is expected to play an important role in achieving these objectives.

Corresponding to the Union policy objective of allocating sufficient and appropriate spectrum in a timely manner and to best meet the increasing demand for wireless broadband, the RSPP requires the Commission and Member States to make every effort to identify at least 1200 MHz of suitable spectrum by 2015. Furthermore, the RSPP establishes a spectrum inventory inter alia to help identify frequency bands that could be suitable for reallocation and spectrum-sharing opportunities. One of its objectives is to explore new ways for sharing spectrum, to the benefit of both private and public users, while taking into account the potential positive and negative impact of allocation or reallocation of such bands and of adjacent bands on existing users.

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

¹ Decision 243/2012/EU of the European Parliament and of the Council of 14 March 2012

² Commission Communication, "Promoting the shared use of radio spectrum resources in the internal market", COM(2012) 478 final, September 2012

³ RSPG12-521(rev1) "RSPG Opinion on Strategic Challenges facing Europe in addressing the Growing Spectrum Demand for Wireless Broadband"

⁴ RSPG13-538 "RSPG Opinion on Licensed Shared Access"

shared use of spectrum⁵ the Commission has stated that, to foster the development of wireless innovations 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.

In this context the RSPG stated in its Opinion on LSA that the continued promotion of the shared use of radio spectrum is a valuable means to leverage the unique capability to re-used spectrum resources. In this regard it stated that access to previously assigned spectrum could be facilitated through licensed usage, under a Licensed Shared Access (LSA) approach.

Therefore, within the tasks of this mandate as specified in the Section "

4 **TASK ORDER AND SCHEDULE"**, the Commission requests CEPT to take into account that use of the 2.3 GHz band should contribute to several important EU policy objectives, namely:

- strengthen the Internal Market for potential mass market WBB services and equipment which will operate in the band both for legacy uses and potential new uses;
- contribute to the DAE broadband targets, which rely on a mix of technologies, including wireless broadband;
- meet spectrum demand in support of the RSPP spectrum target of 1200 MHz for wireless broadband;
- promote innovation and investment through enhanced flexibility in spectrum use;
- foster shared use of spectrum.

3 JUSTIFICATION

Pursuant to Article 4(2) of the Radio Spectrum Decision⁶ 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.

In light of the EU policy objectives mentioned in the previous section the 2.3 GHz band has been identified by and by the Radio Spectrum Policy Group (RSPG) as a possible candidate band for the use by wireless broadband (WBB) services in the EU. In this regard the RSPG recommended⁷ this frequency band to support WBB needs in the short term before 2015. Furthermore, the RSPG recommended the Commission to consider adopting complementary measures to further promote shared and flexible use of the 2.3 GHz band between wireless broadband applications and other services, based on LSA regulatory provisions, facilitating the long-term incumbent use of the band in the territory of those Member States that wish to maintain such use. Activities are already on-going in the framework of CEPT⁸ to develop harmonisation measures for Mobile/Fixed Communications Networks (MFCN) under LSA in this band.

The band appears attractive for the use by WBB services, because it provides for a rather large bandwidth of 100 MHz, is suitable for providing WBB capacity with relatively low propagation and penetration loss, and has potential for global harmonisation having been identified globally for International Mobile Telecommunications (IMT) in the World Radiocommunications Conference in 2007 (WRC-07). Consequently, it is already planned to be used for WBB in several countries, e.g. in Asia. User equipment

⁵ Commission Communication, "Promoting the shared use of radio spectrum resources in the internal market", COM(2012) 478 final, September 2012

⁶ 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

⁷ RSPG13-521(rev1) "RSPG Opinion on Strategic Challenges facing Europe in addressing the Growing Spectrum Demand for Wireless Broadband"

⁸ CEPT has set up activities in September 2012, which are aimed at developing harmonised technical conditions for WBB in the 2.3 GHz band by the first half of 2014 (CEPT ECC WGs FM 52 on the 2300-2400 MHz band and FM 53 on RRS and LSA)

and base station equipment based on the TD-LTE standard are already commercially available and the equipment market for this band is expected to significantly grow in the coming years driven by large deployments in some countries, especially in Asia.

Currently in EU Member States this band is used for strategic governmental applications such as aeronautical telemetry and closed-circuit television (CCTV, a security application) as well as Programme Making and Special Events (PMSE), specifically Services Ancillary to Broadcasting and Programme Making SAB/SAP (ERC/REC 25-10), e.g., as a core band for wireless cameras, and also at national level for various other applications.

In light of these current allocations that are expected to be maintained in some Member States, considerations have been given by Member States and stakeholders to the possibility to provide access to this band for WBB through an appropriate sharing approach such as Licensed Shared Access (LSA). Such an approach should ensure the long term incumbent use of the band in the territory of those Member States that wish to maintain such use, while providing legal certainty for the LSA licensees.

Therefore, the Commission considers that on-going international and national developments set in the context of consistent implementation of the RSPP objectives through the inventory process justify the need for technical studies to identify technical and regulatory conditions for the usage of WBB in the 2.3 GHz band.

4 TASK ORDER AND SCHEDULE

CEPT is herewith mandated to undertake work to develop technical harmonisation conditions for the use of the 2300-2400 MHz frequency band for the provision of WBB electronic communications services with a view to also ensuring the long term incumbent use of the band in the territory of those Member States that wish to maintain such use.

In the work carried out under the Mandate, the general and specific policy objectives of the RSPP, such as effective and efficient spectrum use and the support for specific Union policies shall be given utmost consideration. In implementing this mandate, 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 also 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 carry out technical studies intended to support the policy objectives presented above, in fulfilment of the following tasks:

Task 1: Develop common and minimal (least restrictive) technical conditions for wireless broadband usage of the 2300-2400 MHz frequency band.

This task includes:

- 1.1 Identify *common and minimal (least restrictive) technical conditions*⁹ for the introduction of wireless broadband use in the 2300-2400 MHz band for the provision of electronic communications services. These conditions should be sufficient to ensure coexistence between WBB services within the same band and with services in adjacent bands including use by Radio Local Area Networks (RLAN).
- 1.2 Develop *channelling arrangements* that are sufficiently precise for the development of EU-wide equipment and take into consideration the possibility of international harmonisation.

Task 2: Where appropriate develop common technical sharing solutions for the shared use of the 2300-2400 MHz band for WBB and incumbent services/applications.

This task includes:

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

- 2.1 For each of the *relevant incumbent services/applications* in the Member States including military use, PMSE, fixed links, and radio amateur services: (i) assess the *deployment assumptions and the operational footprint* and (ii) *take stock of the situation and future plans* in the Member States regarding the application of the LSA concept to enable the deployment of WBB.
- 2.2 For each incumbent service/application considered under 2.1: (i) identify *technological and regulatory options facilitating sharing* between WBB and the relevant incumbent service/application including mutual dynamic coordination mechanisms between WBB operators and incumbents; (ii) assess *the scope for harmonisation of technical sharing parameters and solutions* through standardisation and/or an implementing decision;
- 2.3 Depending on results for each relevant incumbent service/application under 2.2(ii) and without prejudice to national rules on data confidentiality define *technical and regulatory solutions* relevant for the technological and regulatory options identified under 2.2(i) that support consistent sharing frameworks defined at national level allowing for the development and efficient operation of EU-wide equipment.

The Commission may provide CEPT with further guidance on this mandate depending on future agreements at EU level (which may involve the European Parliament and the Council) concerning spectrum resources to be made available in the context of specific EU policies, as well as relevant impact assessments the Commission may undertake in this context. Also, the impact of spectrum demand assessments for different uses at national level may require to be taken into account during the work on the Mandate.

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

Delivery date	Deliverable	Subject
June 2014 ¹⁰	Final Draft Report A from CEPT to the Commission	Description of work undertaken for Task 1 and final results
November 2014	Final Report A from CEPT to the Commission, taking into account the outcome of the public consultation	Description of work undertaken for Task 1 and final results taking into account the results of the public consultation
November 2014 ¹¹	Final Draft Report B.1 from CEPT to the Commission	Description of work undertaken for Task 2, final results for task 2.2(ii) ¹²
March 2015	Final Report B.1 from CEPT to the Commission, taking into account the outcome of the public consultation	Final results for task 2.2(ii) taking into account the results of the public consultation
March 2015 ¹³	Final Draft Report B.2 from CEPT to the Commission	Description of work undertaken for Task 2 and final results
July 2015	Final Report B.2 from CEPT to the Commission, taking into account the outcome of the public consultation	Description of work undertaken for Task 2 and final results taking into account the results of the public consultation

¹⁰ Subject to subsequent public consultation

¹¹ Subject to subsequent public consultation

¹² The final results under task 2.2(ii) will clarify the scope for technical and regulatory conditions that are relevant for a harmonisation decision. If such conditions are identified, the relevant results at this stage will serve as basis for a harmonisation decision. If not, and more work is required to identify relevant conditions within 2.2(ii), these will then be set out in an addendum to Report A submitted to the RSC no later than March 2015.

¹³ Subject to subsequent public consultation

CEPT is requested to report on the progress of its work pursuant to this Mandate to all meetings of the Radio Spectrum Committee taking place during the course of the Mandate.

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

ANNEX 2: LIST OF REFERENCES

- [1] CEPT Report 56: Report B1 in response to the EC Mandate on the 2.3-2.4 GHz band - Technological and regulatory options facilitating sharing between Wireless broadband applications (WBB) and the relevant incumbent services/applications in the 2.3 GHz band
- [2] ECC Decision(14)02: Harmonised technical and regulatory conditions for the use of the band 2300-2400 MHz for Mobile/Fixed Communications Networks (MFCN)
- [3] RSPG Opinion on Licensed Shared Access, November 2013, https://circabc.europa.eu/sd/d/3958ecef-c25e-4e4f-8e3b-469d1db6bc07/RSPG13-538_RSPG-Opinion-on-LSA%20.pdf
- [4] ECC Report 205: Licensed Shared Access (LSA)
- [5] ECC Report 172: Broadband Wireless Systems Usage in 2300-2400 MHz
- [6] ECC Report 219: Characteristics of PMSE digital video links to be used in compatibility and sharing studies
- [7] Recommendation ITU-R P:525: Calculation of free-space attenuation
- [8] ETSI TS 137 104 v12.5.0: Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception (3GPP TS 37.104 version 12.5.0 Release 12)
- [9] ETSI TS 103 154 v 1.1.1: System requirements for operation of Mobile Broadband Systems in the 2 300 MHz-2 400 MHz band under Licensed Shared Access (LSA), October 2014.
- [10] ECC Recommendation (14)04 on Cross-border coordination for MFCN and between MFCN and other systems in the frequency band 2300-2400 MHz.