



CEPT Report 015

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

**identify the conditions relating to the provision of
harmonised radio frequency bands in the European Union
for Broadband Wireless Access applications**

Final Report on 30 March 2007 by the:



Electronic Communications Committee (ECC)
within the European Conference of Postal and Telecommunications Administrations (CEPT)



0 EXECUTIVE SUMMARY

The CEPT has completed the work in response to the EC Mandate on BWA and concluded that the current demand for the flexible and technology neutral BWA deployment should be met in the frequency bands 3400-3600 MHz, 3600-3800 MHz and 5725-5875 MHz.

The CEPT has established the necessary regulatory framework for the BWA deployment in the above bands through the following deliverables:

- For the bands 3 400-3 600 MHz and 3 600-3 800 MHz:
 - ECC Report 33 (February 2006);
 - ECC Report 100 (February 2007);
 - ECC Recommendation (04)05 (February 2006);
 - ECC Decision (07)02 (30 March 2007).

- For the band 5725-5875 MHz:
 - ECC Report 68 (June 2005);
 - ECC Report 101 (February 2007);
 - ECC Recommendation (06)04 (December 2006).

It is believed that this regulatory framework provides clear and stable regulatory regime for deploying BWA in the bands 3400-3600 MHz and 3600-3800 MHz on technology neutral principle and allowing flexible usage modes (i.e. fixed, nomadic and mobile modes) with the minimal technical limitations.

For administrations making the frequency band 5 725 – 5 875 MHz, or parts of it, available for Broadband Wireless Access systems, the deployment of BWA in this band should be made on a technology neutral basis with minimal constraints, but limited to fixed/nomadic usage mode for the time being.

For the detailed CEPT responses to the particular work items of EC Mandate please see the detailed summary and conclusions in section 4.



Table of Contents

0 EXECUTIVE SUMMARY	2
1 INTRODUCTION.....	5
2 BACKGROUND.....	6
3 RESPONSE TO EC MANDATE	6
3.1 SCHEDULE AND PRIORITISE ACTIVITIES	6
3.2 ESTABLISH THE CURRENT DEGREE OF HARMONISATION OF BWA BANDS IN EUROPE AND PROVIDE INFORMATION ON THE GLOBAL SITUATION.....	6
3.3 DETERMINE THE FREQUENCY RANGE(S) TO FOCUS UPON INITIALLY FOR BWA APPLICATIONS, AND JUSTIFY THIS SELECTION ON THE BASIS OF CLEAR CRITERIA	14
3.4 STUDY THE POSSIBLE USE OF ADDITIONAL FREQUENCY RANGES IN THE FUTURE	15
3.5 UNDERTAKE REQUIRED TECHNICAL COMPATIBILITY STUDIES AND CONSIDER THE RESULTS OF MEASUREMENT CAMPAIGNS BETWEEN BWA APPLICATIONS AND POTENTIALLY AFFECTED RADIO SERVICES FOR THE FREQUENCY RANGES UNDER CONSIDERATION, BASED ON EXPECTED INTERFERENCE SCENARIOS	15
3.6 ADOPT A FLEXIBLE USE APPROACH TO THE DETERMINED BANDS, WITH ANY SPECIFIC RESTRICTIONS ON THE USAGE MODE(S) (I.E. FIXED, NOMADIC, MOBILE, OR A COMBINATION OF THEM) TO BE APPLIED IN SPECIFIC BANDS BEING APPROPRIATELY JUSTIFIED.....	17
3.7 CONSIDER OPTIMAL CHANNEL PLANS FOR SUCH BANDS, WHILST AVOIDING UNDUE DISCRIMINATION TOWARDS ANY SPECIFIC TECHNOLOGY	19
3.8 GIVE DUE CONSIDERATION TO TECHNOLOGY NEUTRALITY AND TO EXPECTED LICENSING REGIMES ASSOCIATED TO PARTICULAR BANDS	20
3.9 COLLECT AND PRESENT ANY READILY AVAILABLE AND RELEVANT INFORMATION ON MARKET DEMAND FOR SPECIFIC FREQUENCY BANDS, AND ON COSTS AND BENEFITS OF ALTERNATIVE REGULATORY SCENARIOS	21
3.10 PROPOSE A WORK PLAN FOR FURTHER FUTURE ACTIVITIES ON BWA.....	24
4 SUMMARY AND CONCLUSIONS.....	25
ANNEX 1: MANDATE TO CEPT TO IDENTIFY THE CONDITIONS RELATING TO THE PROVISION OF HARMONISED RADIO FREQUENCY BANDS IN THE EUROPEAN UNION FOR BWA APPLICATIONS	31
ANNEX 2: TERMS OF REFERENCE OF THE JPT BWA	35
ANNEX 3: ECC/DEC/(07)02 ON BWA IN 3400-3800 MHZ.....	36
ANNEX 4: ECC/REC/(06)04 ON BFWA IN 5725-5875 MHZ	43
ANNEX 5: EXTRACT OF ERC REPORT 25 FOR THE BAND 3400-5925 MHZ (MAY 2007).....	51



List of Abbreviations

Abbreviation	Explanation
ATPC	Automatic Transmit Power Control
BEM	Block Edge Mask
BFWA	Broadband Fixed Wireless Access
BWA	Broadband Wireless Access
CEPT	European Conference of Postal and Telecommunications Administrations
CS	Central Station
DFS	Dynamic Frequency Selection
EC	European Commission
ECC	Electronic Communications Committee (of CEPT)
e.i.r.p.	Equivalent isotropically radiated power
EN	European Standard
ERO	European Radiocommunications Office (CEPT/ECC)
ES	Earth station
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission (USA)
FDD	Frequency Division Duplex
FH	Frequency Hopping
FS	Fixed Service
FSS	Fixed-satellite service
FWA	Fixed Wireless Access
HiperMAN	High Performance Radio Metropolitan Access Networks
IEEE	Institute of Electrical and Electronics Engineers, Inc.
ISM	Industrial, scientific and medical
ISP	Internet Service Provider
ITS	Intelligent Transport Systems
ITU	International Telecommunication Union
JPT BWA	Joint Project Team on Broadband Wireless Access
LAN	Local Area Network
LNB	Low Noise Block Converter
MAN	Metropolitan Area Network
MWA	Mobile Wireless Access
MWS	Multimedia Wireless Systems
NWA	Nomadic Wireless Access
OFDMA	Orthogonal Frequency Division Multiple Access
P-MP	Point-to-Multipoint
PP	Point-to-Point
RSCOM	Radio Spectrum Committee (European Commission)
RTTT	Road Transport and Traffic Telematics
SAP/SAB	Services Ancillary to Programming / Services Ancillary to Broadcasting
SME	Small and medium enterprise
SRDs	Short Range Devices
TDD	Time Division Duplex
TPC	Transmitter Power Control
TS	Terminal Station
UNII	Unlicensed National Information Infrastructure (US)
WAPECS	Wireless Access Policy for Electronic Communications Services
WGSE	CEPT/ECC Working Group Spectrum Engineering
WiFi ¹	Wireless Fidelity (Wi-Fi Alliance)
WiMAX ²	Worldwide Interoperability for Microwave Access (WiMAX Forum TM)

¹ <http://www.wifialliance.com/>

² “WiMAX ForumTM” and “WiMAX Forum CERTIFIEDTM” are trademarks of the WiMAX ForumTM,
<http://www.wimaxforum.org/home/>



1 INTRODUCTION

This report has been developed by the European Conference of Postal and Telecommunications Administrations (CEPT) in response to a European Commission (EC) Mandate (see Annex 1) given to CEPT by the Radio Spectrum Committee (RSCOM) to identify the conditions relating to the provision of harmonised radio frequency bands in the European Union for Broadband Wireless Access applications. In particular CEPT is mandated to:

1. adequately schedule and prioritise activities under this Mandate to reflect activities already undertaken in this area and to conclude the work in a timely manner;
2. establish the current degree of harmonisation of BWA bands in Europe and provide information on the global situation;
3. determine the frequency range(s) to focus upon initially for BWA applications³, and justify this selection on the basis of clear criteria;
study the possible use of additional frequency ranges in the future;
4. undertake required technical compatibility studies and consider the results of measurement campaigns between BWA applications and potentially affected radio services for the frequency ranges under consideration, based on expected interference scenarios;
5. adopt a flexible use approach to the determined bands, with any specific restrictions on the usage mode(s) (i.e. fixed, nomadic, mobile, or a combination of them) to be applied in specific bands being appropriately justified⁴;
6. consider optimal channel plans for such bands, whilst avoiding undue discrimination towards any specific technology;
7. give due consideration to technology neutrality and to expected licensing regimes associated to particular bands;
8. collect and present any readily available and relevant information on market demand for specific frequency bands, and on costs and benefits of alternative regulatory scenarios;
9. propose a work plan for further future activities on BWA⁵.

The order and schedule set out by RSCOM included a request for an Interim Report which was completed and sent from ECC in July 2006. The Interim Report gave an outline of the work completed to that date by CEPT on this topic.

The Final CEPT Report has been restructured and contains updated information. The CEPT responses to the above mentioned 9 items of the Mandate are given in sections 3.1 to 3.10 of this Report.

The JPTBWA was established in 2005 following the March 2005 meeting of ECC (#10) and the JPT held its first meeting in May of 2005. Two main drivers led to the establishment of the Joint Project Team:

1) Completion of the technical compatibility work undertaken in ECC project team SE PT 38. That group was addressing the sharing of Fixed Wireless Access systems in the band 5725 – 5875 MHz with other services and produced a report (Report 68 “Compatibility studies In the Band 5725 – 5875MHz between Fixed Wireless Access (FWA) systems and other systems”), in June 2005. As the group were only mandated (by CEPT) to address the technical compatibility aspects, the next step would be to focus on the regulatory environment for FWA in the band.

2) CEPT was receiving enquires from both administrations and industry as to the regulatory situation across Europe for certain broadband wireless technologies. This was noted by input to the March 2005 ECC meeting from the subordinate group; Working Group Frequency Management (WGFM). That document referenced technologies referred to as “WiMAX”.

³ Notably by focussing primarily on the 3.4-3.8 GHz frequency range, but not on the 2.5 – 2.69 GHz band, which has already been addressed by EC IMT-2000 Mandates 4 and 5. Additionally, work on the 5.8 GHz frequency range ought to be undertaken as far as possible, including regarding any compatibility issues of BWA with existing applications (such as military radar and RTTT).

⁴ Allocation to services in accordance with article 5 of the Radio Regulations of the ITU will need to be verified.

⁵ This work, to be suitably framed by one or more additional EC Mandates, may include the finalisation of the work begun under this Mandate on the harmonisation of the 5.8 GHz band for licence-free BWA applications, in particular concerning the verification of due compatibility with other applications, as well as an extension of the 3.4 -3.8 GHz frequency range subject to market demand, for instance up to 4.2 GHz.



Therefore ECC agreed that a Project Team be established to address both areas noted. A copy of the final Terms of Reference, for the Project Team, is attached as Annex 2.

2 BACKGROUND

The Joint Project Team on Broadband Wireless Access (JPTBWA) was handed the task to study the advantages and disadvantages of the development of regulatory frameworks for *Broadband Wireless Access* in the band 3 400–3 800 MHz and *Broadband Fixed Wireless Access* in the band 5 725–5 875 MHz, taking account of already existing ECC deliverables (ECC Report 68, ECC Recommendation (04)05, ECC Report 33 and ECC Report 100) and the needs of existing services. Originally the ECC requested that the deliverable for this study be an analysis of the possible actions, e.g. an ECC Decision or ECC Recommendation. Following this initial analysis by autumn 2005 it was decided that the creation of a Decision for the band 3400-3800 MHz and a Recommendation for the band 5725-5875 MHz would be the best way forward.

In that time the project team was also given the further task of answering a mandate from the European Commission attached as Annex 1. The EC requested an interim report by July 2006 (see document RSCOM 06-74) and set out a number of issues to be addressed by the response. The details at the particular issues as set out in the mandate from CEPT point of view are shown in section 3. Section 4 provides a summary and the conclusions.

3 RESPONSE TO EC MANDATE

In order to respond to the mandate CEPT felt that it was necessary to take the order and schedule set out by RSCOM and address each heading as follows:

3.1 Schedule and prioritise activities

The activities within CEPT on BWA have led to the establishment of the JPT BWA that developed a regulatory frameworks for *Broadband Wireless Access* in the band 3 400–3 800 MHz and *Broadband Fixed Wireless Access* in the band 5 725–5 875 MHz. This JPT BWA has also been identified as the relevant group within CEPT to develop the response to the EC Mandate on BWA.

3.2 Establish the current degree of harmonisation of BWA bands in Europe and provide information on the global situation

To gather information on the current status of FWA/BWA deployment in these bands, a desk research has been carried out to establish the situation on the global level. It was further complemented by the detailed analysis of situation across Europe, based on the responses from national administrations to the ERO questionnaire, carried out during May-June 2005, and later updated in August 2006. The following 23 administrations have responded to this questionnaire and included in the statistics below (*denotes countries which updated information in 2006): Austria*, Cyprus*, Czech Republic, Estonia, Finland, France*, Germany*, Greece*, Hungary*, Ireland*, Latvia, Lithuania*, Norway*, Poland, Portugal*, Russian Federation, Slovak Republic, Slovenia*, Spain, Sweden*, Switzerland*, The Netherlands, and United Kingdom*.

The findings of these studies are reported in the following sub-sections.



3.2.1 Frequency band 3400-3800 MHz

3.2.1.1 Current CEPT/ECC Regulations

At the time of writing this report, the following CEPT documents were in force, addressing the use of the 3.4-3.8 GHz band:

1. **European** Table of Frequency Allocations and Utilisations (**ECA**) in **ERC Report 25** (version of 2004), which at the time of initiation of CEPT work on this Mandate established the following major uses of these band:
 - a. The band 3400-3500 MHz to be used for:
 - i. FWA;
 - ii. Amateur applications within sub-band 3400-3410 MHz;
 - iii. Radars, with upper limit for airborne radars being 3410 MHz;
 - iv. Mobile applications (EU17A) - for co-ordinated occasional SAP/SAB (ENG/OB) use;
 - b. The band 3500-3600 MHz to be used for:
 - i. FWA;
 - ii. Mobile applications (EU17A) - for co-ordinated occasional SAP/SAB (ENG/OB) use;
 - c. The band 3600-3800 MHz, as a part of the whole 3600-4200 MHz lot, to be used for:
 - i. FSS;
 - ii. FWA, limited to band 3600-3800 MHz;
 - iii. Medium/high capacity fixed links.

This means that the band 3400-3600 MHz was almost exclusively designated for FWA, except Amateurs/Radars below 3410 MHz and occasional SAP/SAB (ENG/OB) use across the band.

By contrast, the band 3600-3800 MHz was designated for FWA on a shared basis with P-P fixed links, FSS as well as the same occasional SAP/SAB (ENG/OB) uses.

As a result of CEPT work on this mandate, JPT BWA has developed a proposal for revision of ECA in this frequency range.

The major changes are:

- Conversion of "FWA" into "BWA" which provides flexible usage modes;
 - Addition of an European mobile allocation (primary) within 3600-3800 MHz;
 - Deletion of reference to footnote EU17A within 3400-3500 MHz and 3500-3600 MHz.
2. **ERC Recommendation 14-03** (Podebrady, 1997) on Harmonised radio frequency channel arrangements for low and medium capacity systems in the band 3400 MHz to 3600 MHz, which establishes the basic channelling arrangement for fixed and SAP/SAB (ENG/OB) links, based on a flexible 0.25 MHz slots concept;
 3. **ERC Recommendation 13-04** (Tallin, 1998) on Preferred frequency bands for fixed wireless access in the frequency range between 3 and 29.5 GHz, which identifies, inter alia, the band 3400-3600 MHz as a preferred band for FWA applications in CEPT;
 4. **ERC Recommendation 12-08** (Saariselkä, 1998) on Harmonised radio frequency channel arrangements and block allocations for low, medium and high capacity systems in the band 3600 MHz to 4200 MHz, which in its Annex B provides an option of channelling arrangements whereas "traditional" FS links would be deployed in the band 3800-4200 MHz and the remaining sub-band 3600-3800 MHz could be utilised for P-MP or P-P systems with channelling based on a flexible 0.25 MHz slot raster in a manner similar to that in the neighbouring band 3400-3600 MHz (ERC REC 14-03 refers).
 5. **ECC Recommendation (04)05** (Vilamoura, 2006) on Guidelines for accommodation and assignment of Multipoint Fixed Wireless Systems in frequency bands 3.4-3.6 GHz and 3.6-3.8 GHz, which provides guidelines for block assignments of frequencies in order to achieve a technology neutral approach, enabling TDD as well as FDD systems and various access methods; this also includes a recommended CS BEM (central station Block Edge Mask) to avoid interference between adjacent blocks.



3.2.1.2 Use of frequency band 3400-3800 MHz around the world

Licences in most territories identify the band for fixed wireless access, see Table 1 below.

Territory	Frequency Range	Licensing Regime	Specific Requirements	Regulatory Framework / Comments
Canada	3400-3650 MHz in 2x25 MHz blocks per licence	Specific licences awarded on a geographic basis.	RSS - 192	See SRSP 303.4 Fixed or nomadic services allowed.
Australia	3425-3442.5 MHz paired with 3475 -3492.5 MHz or 3442.5-3475 MHz paired with 3542.5-3575 MHz	Spectrum licensed in urban areas, individual equipment licences in areas not covered above.		Band 3575-3710 MHz currently held (June 2005) pending enquiries into BWA spectrum requirements.
New Zealand	2x63 MHz in 3400-3600 MHz assigned mid 2002. A further 2x14 MHz currently undergoing assignment.	Specific licences awarded on a national basis.	Identify standards from a number of regions.	
China	3400-3430 MHz paired with 3500-3530 MHz			
US	3650-3700 MHz	Light licence proposed (Registration).	Contention protocol required. ⁶	Part 90 subpart Z. Both fixed and mobile operation included.

Table 1: Summary of global activities within 3400-3800 MHz

Deployments providing user access have chiefly been based around proprietary P-MP technology. Roll out has been slow and in many countries and earlier licensing rounds have not resulted in widespread deployment of systems to the extent that in some cases licences have been returned. The recent standardisation developments in IEEE and ETSI have renewed the interest in this frequency range to the extent that new licensing processes and procedures are under consideration in a number of countries. Recent consultations on this matter have been seen in Europe from France, Germany, Belgium and Switzerland (not an exhaustive list). Outside Europe, recent consultations in Hong Kong, Mexico, Singapore have addressed this band too.

3.2.1.3 Detailed European analysis

3.2.1.3.1 The sub-band 3400-3600 MHz

Availability of the band

All of responding countries indicated that they already allow or consider allowing FWA/BWA in this band.

Type of frequency assignments

21 of 23 responding countries indicated that they currently assign spectrum in blocks in this frequency band. Only two countries indicated that they still assign FWA frequencies individually for each station.

Regarding the type of licensing process, it appears that most countries use comparative evaluation (“beauty contest”), but at least two countries indicated that they intend using auctions for awarding BWA licences.

⁶ The FCC decision on contention protocol is under reconsideration, the WiMAX Forum™ along with many other interested users of this spectrum have petitioned the FCC to eliminate this requirement.



Number of licences

Number of licences and their type (national, regional/local) differs greatly between countries. The typical pattern however is to have one or two blocks licensed on a national basis plus one-two blocks licensed on a regional basis.

Size of assigned spectrum

The size of assigned blocks and their composition also varies among countries, with spectrum size per licensee typically being in the range of 14 to 56 MHz. While pure mathematical averaging does not seem to be appropriate here, it would appear that the 28-40 MHz (i.e. 2x14 to 2x20 MHz) may be considered as a rough estimate of average assigned spectrum per licensee.

Technology neutrality

Regarding the technology neutrality, only one country refers to specific technology standard, namely the IEEE 802.16 or the generic ETSI standard for P-MP equipment EN 301 753. In all other cases, the responding countries either do not have any technology obligations at all, or just set basic spectrum access requirements in the form of prescribed duplex separation and channel raster, which seems to be in accordance with the available CEPT Recommendations on the subject.

POR and IRL offered interesting observation, that while the administration do not set any a priori technology requirements, the licensee strictly speaking is bound by the choice of technology that was described in the tender application for the licence. Such legal interpretation might happen in other countries as well, where “beauty contests” are used in licensing process, but probably should not be qualified as technology restrictions, due to the fact that this is not administrative, but self-imposed restriction.

Service obligations

There are still a few countries (7 out of 23), which indicated that they have service restrictions in FWA/BWA licences, but in most cases these include not only access services, but also infrastructure provisioning, thus covering two most typical types of service envisaged for BWA applications. So by 2006 there was only one country which restricted services in the band to “access only”, and that one indicated that it was in the process of alleviating this requirement from licences. And the remaining, larger part of responding countries indicates that they had no service restrictions associated with FWA/BWA licences at all.

Registration of stations

In more than half of all cases (14 out of 23), the countries apply a mixed regime whereas registration of Central Stations (CS) is required and registration of Terminal Stations (TS) is not required.

Further 5 countries do not require registration for either CS or TS (note that one administration does not require to register with them the positions of TS, but operators are required to keep information on one or more user addresses in their files).

Only 2 countries indicated that they will require registration of both CS and TS in association with block frequency assignment.

Nomadic use

Probably as a result of the fact, that typically countries do not require registration of TSs, more than half of respondents (18 of 23) indicated that the nomadic use of the TSs would be allowed de facto (for 10 of 13 positive countries, which indicate that nomadic use is not specifically mentioned in their licences/legislation), or de jure (in remaining countries, which stated that they have specific provisions defining and allowing nomadic use).

Only 5 of 23 administrations indicated that they do not consider nomadic use being allowed by their current FWA/BWA licensing arrangements. Of these, one further country indicated that TSs may operate from more than one pre-registered with operator address, which makes limited nomadic use possible (i.e. from home, office, summer house, etc.).

Regarding the definition of nomadic use, several countries mentioned that they accept the definition given in Recommendation ITU-R F.1399.

Extent of use

It is difficult to gauge the exact extent of current deployment of FWA/BWA stations in the band 3400-3600 MHz, especially since most administrations apply relaxed registration regime for terminals. However the several numbers mentioned by administrations give an impression that the extent of deployment is still remaining rather limited, with only 8 countries indicating the number of CSs in excess of 100. POL seems to have the widest deployment of FWA in this band, with 3000 CSs and 100,000 TSs deployed.



International co-ordination

Most countries indicated that they apply the mechanism of bilateral or multilateral coordination agreements with neighbouring countries, e.g. based on the principles outlined in HCM Agreement-2005. Few countries indicated that they address coordination on the case-by-case basis when appropriate, e.g. when coordination trigger level is exceeded at the border.

Conclusions on the results of the questionnaire on FWA in the band 3400-3600 MHz

Results of the questionnaire clearly identify the band 3400-3600 MHz as the widest available option for sustainable BWA deployment in CEPT countries. Already now the existing national licensing arrangements have typical features that create favourable environment for unrestricted development of BWA market: spectrum assigned in blocks of sufficient size; no registration of user terminals; very basic spectrum access requirements (channelling, duplex); very seldom restrictions on technology; restrictions on services in very few countries.

When comparing updated responses in 2006 with the original information from 2005, it becomes clear that the trend is clearly towards more liberal conditions for BWA in this band (2 countries removed requirement for registration of TSs, 3 countries changed their position to positive on allowing nomadic use in the band). Not a single country indicated narrowing of requirements.

3.2.1.3.2 The sub-band 3600-3800 MHz

Availability of the band

At the moment only a limited number of countries (8 of 23) decided to allow FWA/BWA in this band (one country from 2008). However further 8 countries have indicated that they are considering opening of this band for FWA. This brings the total number of interested countries to 16 of 23, which means quite significant interest in using this band.

Type of frequency assignments

Block assignment widely used.

Number of licences

Probably related to the comparatively recent attention to this band, the number of licences in this band is low (in countries that have authorised the band). Typically the number of licences is 1-3, with two exceptions being LVA having 7 licences and Sweden having 582 regional licences.

Size of assigned spectrum

Tends to be similar to that in 3400-3600 MHz band, with some countries (LVA) assigning more spectrum in this band.

Technology neutrality, Service obligations, Registration of stations, Nomadic use and International co-ordination

In most cases, situation with these issues in the band 3600-3800 MHz is the same as for the band 3400-3600 MHz, with very few national variations (e.g. in UK).

Extent of use

Only two countries reported significant deployment numbers for this band.

Conclusions on the results of the questionnaire on FWA in the band 3600-3800 MHz

Results of the questionnaire identify the band 3600-3800 MHz as a natural and closest alternative/extension for BWA use after the band 3400-3600 MHz. Clear majority of European countries indicated that they already use it or consider possibilities of using it for BWA.

Besides the same general regulatory issues as in the band 3400-3600 MHz, in addition, the release of the band 3600-3800 MHz for BWA would seem largely conditional on the sharing conditions with other services using this band, such as FSS Earth Stations and legacy PP FS links in this band.



3.2.2 Frequency band 5725-5875 MHz

3.2.2.1 Current CEPT/ECC Regulations

The following major utilisations are addressed within the European Table of Frequency Allocations and Utilisations (ECA) in ERC Report 25 (January 2004):

- i. Amateur applications (5725-5830 MHz);
- ii. Defence systems (5725-5850 MHz);
- iii. ISM applications (5725-5875 MHz);
- iv. Non-Specific SRDs (5725-5875 MHz);
- v. RTTT (5795-5805 MHz and 5805-5815 MHz on a national basis);
- vi. Weather radars (5725-5850 MHz);
- vii. Amateur Satellite (s-E) (5830-5850 MHz);
- viii. FSS (5850-5875 MHz).

As a result of CEPT work on this mandate, JPT BWA has developed a proposal for revision of ECA in this frequency range to add "BFWA" as a major utilisation for the band 5725-5875 MHz.

3.2.2.2 Use of frequency band 5725-5875 MHz around the world

In many parts of the world access to this band has been allowed for wireless access devices on a licence-exempt basis. Many countries have followed the example of the US which allocated the band to UNII devices and this activity underpins the WiMAX Forum™ interest in certifying equipment for the band. The following Table 2 provides a snapshot of some allocations around the world.

Territory	Freq Range (MHz)	Licensing Regime	Specific Requirements	Regulatory Framework / Comments
USA	5725-5850	Unlicensed ⁷	Part 15.247: e.i.r.p. up to 36 dBm for MP and no e.i.r.p. limit on PP applications. Part 15.407: e.i.r.p. up to 36 dBm allowed for MP applications and up to 53 dBm for PP applications. No TPC or DFS requirement.	Code of Federal Regulations Title 47: Part 15 Subpart C Part 15 Sub-Part E (only 5725-5825 MHz UNII band)
Canada	5725-5825	Unlicensed ⁷	As for the USA under Part 15.407	Low Power Licence Exempt: RSS-210 refers.
Kenya	5725-5800	Licensed but neither coordinated nor protected	e.i.r.p. up to 36 dBm	None specifically identified
Korea	5725-5825	Licence Exempt	e.i.r.p. up to 30 dBm	
Taiwan	5725-5850		Max peak output power 1W. No TPC or DFS Technical rules identical to FCC Part 15	LP0002, 8 th Aug 2003
Australia	5725-5850	Unlicensed ⁷ (Class Licence)	e.i.r.p. up to 36 dBm	Low Interference Potential Devices
New Zealand	5725-5875	Licence Exempt	e.i.r.p. up to 36 dBm	General Use Radio Licence. As FCC Part 15, sub-parts C and E.
Brazil	5725-5850	Unlicensed ⁷	Max Tx Power is 1 W but where PP deployment is used then no reduction of power for antennas of > 6 dBi	National
Saudi Arabia	5725-5875	Licence Exempt	Standards under development	Under development

⁷ The term "unlicensed" is equivalent to the European term "licence-exempt"



Ireland	5725-5875	Licence Exempt	e.i.r.p. up to 33 dBm	Identified as Wideband Data Transmission devices as "National Short Range Devices"
UK	5725-5850	"Light" licensing requiring station location registration.	e.i.r.p. up to 33 dBm, TPC and DFS required (5795-5815 MHz currently notched out; an increase in the max e.i.r.p. to 36 dBm is implemented in UK regulations in February 07).	
Norway (in consultation phase)	5725 -5850	Licence exempt	5795-5815 MHz notched out, DFS required. <u>For P-MP:</u> e.i.r.p. up to 36 dBm, e.i.r.p. density up to 200 mW/MHz, TPC required, both limits -3 dB without TPC. <u>For PP:</u> Tx power up to 1 W, e.i.r.p. up to 200 W, e.i.r.p. density up to 10 W/MHz. The power flux density at the border between Norway and neighbouring states shall not exceed - 122.5 dBW/m ² measured with a reference bandwidth of 1 MHz, unless otherwise determined in a co-ordination agreement.	

Table 2: Examples around the globe where the 5.8 GHz band is open for wireless access

In the US, the 5.8 GHz band has been open for some time and some typical application areas are indicated below (these have been driven to some extent by the availability of the IEEE802.11a standard but proprietary solutions are deployed too):

- In the U.S., there are over 8,000 registered Wireless ISPs providing broadband services to underserved areas (rural, remote), suburban areas where there are DSL gaps, and urban centres where it can be difficult - especially in older buildings - to quickly set up DSL or E1-level service lines.
- Building to building connectivity - private networks for Schools, Public Safety Orgs, and Municipalities.
- Backhaul for rural cellular and regional telephone operators.
- Backhauling wireless hotspots – a FCC Broadband Task Force Report states that estimates suggest around 150,000 has been operational in the US since the end of 2005.
- Temporary high speed access for multiple applications incl. Sporting Events, Public Safety, Broadcasting.
- Many companies in the U.S. have set up private BWA networks. Industries where such networks are prevalent include transportation, education, government, construction, agriculture, oil and gas.

Licensed exempt BWA is viewed as providing a way for "organic" or grassroots BWA deployment in areas where major carriers are uninterested or unresponsive.

The US FCC published a report in February 2005 detailing the outcome of their Wireless Broadband Task Force. Many of the application areas mentioned above can be seen in this report. It also provides detail about the US view on existing and potential opportunities for wireless broadband access including both licensed and licence-exempt applications and deployments. This report can be downloaded at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-257247A1.pdf

In Ireland the 5.8 GHz band is being used for the deployment of both private and public access networks by a range of service providers. Commercial ISP, local government/authorities, private LAN/MANs and community are among the networks being deployed. On the public access side widespread use is made of the band for the provision of broadband



data services to, in general, residential and SME customers. In addition the band is seeing significant use for the provision of rural broadband access (beyond the reach of DSL) under the Government's 'Group Broadband Scheme'.

In the UK, the band is being used as infrastructure for community WiFi networks and WiFi hotspots with currently around 5000 stations deployed through around 150 licences with the administration. This has occurred in almost 2 years since the band was opened at the beginning of 2004. At the request of industry registration database may be made available to licensees to enable self co-ordination in the future.

3.2.2.3 Detailed European analysis

Availability of the band

Currently only 4 responding countries have already allowed BFWA in this band. However, further 7 administrations indicated that they consider allowing BFWA in this band, several mentioning that they wait for CEPT guidance on the matter.

Other countries typically quote sharing concerns as the main obstacle to making this band available for BFWA.

Type of frequency assignments

Of 4 countries that already allow BFWA in this band:

- Ireland and Norway apply licence-exempt regime, with power limits defined for MP and PP application types;
- UK allows BFWA in sub-bands 5725-5795 MHz and 5815-5850 MHz and applies light-licensing regime, with registration of both CSs and TSs and certain conditions (power limits, DFS, notching in the gap) applied, see details in UK response.
- While Russian Federation applies individual (link-by-link) licensing.

The mainstream of licensing approach in this band appears being split between licence-exempt or light-licensing regime, as becomes visible also from provisional indications of considered licensing regime by those administrations that only consider allowing BFWA, however preference seems to gravitate towards the licence-exempt use.

Number of licences, Size of assigned spectrum, Technology neutrality, Service obligations, Registration of stations, Nomadic use and International co-ordination

Due to very initial stages and low number of countries already using this band, the replies to the remaining questions in this part of questionnaire are very limited to non-existent, rendering any summary useless.

Several replies on nomadic usage seem to follow the same pattern as for the 3400-3600 MHz band.

Extent of use

Only two countries reported usage numbers:

- UK: ca 350 CSs (P-MP), 4500 TSs, 420 PP stations;
- Russian Federation: 100+ CSs, 2000+ TSs.

Conclusions on the results of the questionnaire on FWA in the band 5725-5875 MHz

Results of the questionnaire clearly show that the situation with the 5725-5875 MHz band has not yet passed over the stage of initial considerations in vast majority of CEPT countries. Although certain interest for using this band by BFWA may be sensed clearly, administrations were delayed with their decision on opening this band for BFWA until the harmonised CEPT approach is developed and, in particular, until resolution of questions on sharing with other services in this band: notably FH radars, RTTT, FSS and FS.

Therefore it becomes clear that only now, after CEPT guidance for using this band for BFWA was established in the form of ECC/REC(06)04, some serious opportunities of wider usage of this band for BFWA might start developing.



3.3 Determine the frequency range(s) to focus upon initially for BWA applications, and justify this selection on the basis of clear criteria

Based on the analysis of current situation, the ECC has identified two frequency bands as the primary BWA deployment opportunities in Europe: 3400-3800 MHz and 5725-5875 MHz band. Detailed considerations for these bands are given further in this section.

3.3.1 Frequency band 3400-3800 MHz

It has been considered, whether some additional measures may be taken into account by CEPT to further clarify the existing provisions with regard to the band 3 400-3 800 MHz, which were so far limited to FWA type of point-to-multipoint applications. This has been done by upgrading the status of designation of this band for generic BWA by means of an ECC Decision. Such a new Decision gives higher visibility to the BWA designation and provides more confidence for the administrations in making this band available.

When considering comparative status of BWA in the bands 3400-3600 MHz vs. 3600-3800 MHz, it appeared, that since the publication of ECC/REC(04)05, the regulatory provisions for the sub-band 3600-3800 MHz has become similar to that of 3400-3600 MHz apart from the "preferred" status given to the FWA in the band 3400-3600 MHz by ERC/REC 13-04. This however also means, that the two issues mentioned for the sub-band 3400-3600 MHz, namely the clear provision for nomadic/mobile use and the possible upgrade of BWA designation by means of an ECC Decision, have the same, if not higher visibility to this sub-band as well. Therefore the developed ECC Decision addresses both bands, 3400-3600 MHz and 3600-3800 MHz, with equal provisions and equal designation status for BWA. However, it should be noted that the current use by other services of the frequency allocations in the 3400-3600 MHz and 3600-3800 MHz bands are still very different, which may lead to different sharing conditions in the two frequency bands. As an example it should be noted that there is a number of FSS earth stations deployed in Europe, especially in frequencies above 3700 MHz.

The ECC Decision (07)02 (on "*The Availability of Frequency Bands between 3400-3800 MHz for the Harmonised implementation of Broadband Wireless Access systems (BWA)*") that establishes conditions for BWA use in the 3.4-3.6 and 3.6-3.8 GHz bands and, inter alia, clarifies the nomadic/mobile usage modes for BWA, has been approved 30 March 2007.

3.3.2 Frequency band 5725 – 5875 MHz

CEPT has noted that there is clear demand from industry for this "lightly licensed/Licence Exempt" opportunity and evidence that the band has been successfully made available on this basis in some countries. However, some CEPT administrations expressed concerns on the possible sharing between BFWA systems and existing systems/services in the 5.8 GHz band.

Therefore the CEPT developed a suitable regulatory framework to capitalise on the developments within the industry and to expedite the conclusions from ECC Report 68 into measures needed to ensure that equipment and deployments meet the requirements to facilitate equitable spectrum sharing in this band while safeguarding the use of this band for the other existing systems/services. The regulation should provide clear regulatory certainty for both suppliers, users of broadband applications and other spectrum sharing services, whilst at the same time providing flexibility and freedom to innovate as required by the demands for growing broadband applications.

As a result, the new ECC Recommendation (06)04 was finally adopted in November 2006, establishing provisions for use of the band 5725-5875 MHz by Broadband Fixed Wireless Access. For administrations wishing to implement BFWA in this band, the Recommendation suggests using some simplified authorisation procedures (i.e. licence-exempt or light-licensing regime) as well as provides suitable technical basis for regulation: power limitations and TPC requirements, mitigation techniques to be applied (DFS) as well as e.i.r.p. density limits in vertical plane for protection of FSS receivers.

It should be noted that in parallel during this period, ETSI developed a candidate harmonised standard (EN302 502) for this band. There has been good cooperation and common participation between ETSI members and the JPT BWA during this period.



The ECC Recommendation (06)04 (“*Use of the band 5725-5875 MHz for Broadband Fixed Wireless Access (BFWA)*”) had been developed and was adopted in November 2006 (see Annex 4), which establishes conditions for BFWA deployment in this band and, in particular, clarifies the provisions necessary for protection of other services operated in this frequency band.

3.4 Study the possible use of additional frequency ranges in the future

The work of the ECC (JPT BWA) has been focused around the two bands directly referenced within the agreed Terms of Reference for the group and the European Commission Mandate on Broadband Wireless Access (BWA). Currently ECC is addressing an additional Mandate around WAPECS systems (RSCOM06-09, Brussels, 2 March 2006) and these systems would encompass the scope of all BWA usage modes.

There may be a need for frequency bands (e.g. below 800 MHz) for BWA to achieve better coverage, especially in rural areas, and to improve the building penetration (indoor reception). However these bands would have to be found primarily inside the broadcasting bands and therefore a solution of this issue would depend on the studies with regard to the so called digital dividend.

The WiMAX Forum is developing procedures to certify interoperable BWA equipment. As a first step, specific “certification profiles” are defined based upon the market and industry demand as well as the regulatory framework to attempt to rationalise the number of equipment variants. Naturally these address a number of frequency ranges that reflect BWA spectrum availability around the world. The 3400-3600 MHz and 5725-5850 MHz ranges already feature as bands for certification activities and the extended range up to 3800 MHz is expected to follow soon. In addition the ranges 2300-2400 MHz, 2496-2690 MHz, 4935-4990 MHz have been identified for development within the certification profile set. Up to date information concerning the WiMAX BWA profiles can be found in the regulatory portal on the WiMAX Forum web site (<http://www.wimaxforum.org/home/>)⁸.

CEPT has considered these developments from WiMAX Forum and concluded that the bands 2300-2400 MHz and 4935-4990 MHz are not considered suitable for harmonised BWA use in Europe for the time being due to other uses of these bands. The 2500-2690 MHz band is currently addressed by CEPT as a part of WAPECS considerations.

The ECC work addressing the WAPECS Mandate and the Mandate on Digital Dividend has recently commenced. The outcome of this work will have an essential impact on the potential availability of alternative bands for BWA as well as other types of wireless access systems. **Hence no further activities on this item under BWA mandate were deemed necessary awaiting of the results of WAPECS and Digital Dividend work.**

Although current BWA technology developments limit the practical usage modes, such as mobile and nomadic use, to the bands below 6 GHz as discussed above, there may be a need to assess, in the longer term, bands above 6 GHz as well, e.g. for fixed residential access. **However any such future demand could be met from the existing CEPT allocations to P-MP/FWA/MWS systems, such as the 26 GHz, 28 GHz and 40.5-43.5 GHz (for MWS) bands.**

3.5 Undertake required technical compatibility studies and consider the results of measurement campaigns between BWA applications and potentially affected radio services for the frequency ranges under consideration, based on expected interference scenarios

3.5.1 Frequency band 3400-3800 MHz

The most important issues have been considered relevant to this band:

- The intra-service sharing, i.e. coexistence rules for two BWA systems/cells of different operators. This study for NWA and FWA cases had been originally developed in SE PT 19 in the form of revision of ECC Report 33, and the subsequent adoption of new ECC Recommendation (04)05, which provided guidance on deployment of FWA/NWA systems in the 3400-3800 MHz. Afterwards, the SE19 also studied the case of introducing MWA in this band and results of all these studies were reflected in the ECC Decision (07)02 for BWA in 3.5 GHz. The subsequent studies of mobile usage mode (MWA) were based on certain assumptions that included un-coordinated deployment as well as possible concentration of users (with active user density representative of BWA scenarios) in indoor environment. These studies indicated that a guard band of around one channel might be needed between

⁸ Access to the WiMAX Forum Regulatory Portal is available for regulators, government officials, and representatives of government agencies who are engaged in spectrum related regulatory affairs. Registration is required.



MWA TS-TS, which is understood to be implicitly provided by CS Block Edge Mask requirements.

- The inter-service sharing of BWA vs other systems and/or services in the 3.4 – 3.8 GHz band. The other systems and/or services considered in this study were SAP/SAB (also known as ENG/OB), Fixed Point-to-Point links, Fixed Satellite Service (Space-to-Earth) and Radiolocation Service (primary allocation below 3.4 GHz and secondary allocation above 3.4 GHz). This study was finalised in September 2006 with the development of ECC Report 100 ("*Compatibility studies in the band 3 400-3 800 MHz between Broadband Wireless Access Systems (BWA) and other services*"), referenced from the ECC Decision. This Report provides guidance for Administrations on co-ordination between BWA and other systems / services in the band, the details of the coordination depending upon the other systems/services characteristics and the BWA characteristics and usage mode. The most critical compatibility problems identified in this band are the following:

- Sharing with Point-to-Point fixed links : the analysis of both directions of interference (BWA interfering into PP and vice-versa) has shown that BWA and PP systems can co-exist with a certain frequency separation, depending on the BWA and PP characteristics and with the required co-ordination between the BWA Central Station (CS) and the PP systems.
- Sharing with ENG/OB : the study provides the values of the frequency separation which are required to enable the co-existence between BWA and ENG/OB systems in a set of scenarios, described in the ECC Report 100.
- Sharing with FSS (s-E) : the study of the impact from BWA into FSS Earth Station (ES) was based on the determination of a *mitigation zone or area*⁹ which is defined here as a geographical area delimited by the distance on a given azimuth and elevation from an ES (that shares the same frequency band with terrestrial BWA stations) within which there is a potential for the level of permissible interference to be exceeded and therefore co-ordination is necessary to ensure successful operation between BWA stations and that ES

BWA Terminal Stations (TS) have generally less impact than the CS. In addition, it has been demonstrated that the co-ordination of the BWA CS will generally be sufficient to ensure the co-existence with BWA TS. Studies show that when both BWA systems and FSS are deployed in a ubiquitous manner (with no individual licensing of ES), the sharing is not feasible in the same geographical area since no minimum separation distance can be guaranteed.

In the case of BWA operating in adjacent frequency bands, there is a need for mitigation distance to avoid the LNBS of the ES receivers being driven into non-linear operation, or even being saturated.

Interference from FSS spacecraft transmitting with Article 21 limits into BWA may exceed the required interference criterion by few dB in few cases; however the probability of such cases is expected to be low.

- Sharing with radiolocation : the impact from radar systems operating below 3400 MHz on BWA operating in the band 3400-3800 MHz has been assessed. It is clear that the principal way for assuring co-existence of radars vs. FWA is the co-ordination on a case-by-case basis.

In addition, the report also provides a non-exhaustive list of ways to manage interference and facilitate the co-existence between BWA and other systems/services.

- In conclusion, the two bands 3400-3600 MHz vs. 3600-3800 MHz will have different sharing considerations due to the different services, other than BWA, utilising these bands.
In relation to the introduction of a primary mobile allocation in the band 3600-3800 MHz it was recalled that co-ordination between mobile and existing FSS Earth stations is necessary. In addition other countries indicated mobile service could only be secondary in their national table.
- The new applications using Ultra Wide Band technology (UWB). Since the start of work on the present BWA mandate, ECC has received reports on UWB from Task Group 3 (TG3). These reports have been the basis for Decisions and an ECC Report which have relevance to FWA. The 13th ECC (Oulu) adopted Decision ECC/DEC/(06)04, 'on the harmonised conditions for devices using Ultra-Wideband (UWB) technology in bands

⁹ Existing provisions of the Radio Regulations relating to international coordination are unaffected by this definition, which is intended for national coordination purposes.



below 10.6 GHz'. The 15th ECC (Nicosia) adopted Decision ECC/DEC/(06)12, 'on the harmonised conditions for devices using Ultra-Wideband (UWB) technology with Low Duty Cycle (LDC) in the frequency band 3.4 – 4.8 GHz'. The 15th ECC also adopted Report 94, 'on technical requirements for UWB LDC devices to ensure protection of FWA systems'. The time frame for TG3 has been extended to allow further consideration of contentious issues concerning the possible mutual interference of UWB and FWA devices. The continuing work which should be delivered to ECC at the March 2007 meeting includes (1) the finalisation of a draft Report on Detect and Avoid Mitigation Techniques, (2) a Complementary Report on FWA in the band 3.4 to 3.8GHz, and (3) a campaign of simulation and testing of interference between UWB and FWA devices.

3.5.2 Frequency band 5725-5875 MHz

The technical compatibility study for introduction of BFWA (based on ETSI HiperMAN radio interface specifications) in this band were carried out in SE PT38 and resulted in adoption of ECC Report 68. This report identified the following most critical compatibility problems:

- Sharing with radiolocation service (static and Frequency Hopping modes), which led to establishment of DFS (Dynamic Frequency Selection) requirements for the BFWA systems in ECC/REC(06)04 and ETSI EN 302 502. This work required significant theoretical as well as experimental studies, the latter being carried both in the laboratory as well as real-life deployment scenarios. Practical studies are still ongoing on the efficiency of DFS, in particular with respect to frequency hopping radars;
- RTTT in the band 5795-5815 MHz – the ECC Report 68 concluded that interference could be possible in certain cases, therefore an additional annex was included in ECC/REC(06)04, describing the means for avoiding interference between RTTT and BFWA systems;
- FSS (Earth-to-Space) systems – the ECC Report 68 established certain e.i.r.p. limits for BFWA transmitters in elevation plane, which were incorporated as a separate annex in ECC/REC(06)04.

Due to the nature of the Fixed Service use of the 5.8 GHz band for point to point links, detailed compatibility studies have not been conducted. It is expected that if those countries which have existing fixed service point-to-point links were to introduce BFWA in the same frequency range, it would be necessary to co-ordinate between the systems. Compatibility with other considered systems/services in the 5.8 GHz band (SRDs, Amateur and Amateur Satellite (s-E)) was found to be feasible, not requiring additional regulatory provisions for BFWA operation. It should also be noted that some countries (notably UK and Norway) which have regulations for BFWA usage in these bands have an additional requirement that does not allow operation of BFWA services within the RTTT bands between 5795 – 5815 MHz.

It should also be noted that the frequency band above 5855 MHz is envisaged for ITS applications. Sharing between ITS and BFWA applications has been studied in the ECC Report 101 ("*Compatibility studies in the band 5855-5925 MHz between Intelligent Transport Systems (ITS) and other systems*"), that proposes mitigation techniques to be applied to ITS to facilitate the coexistence.

3.6 Adopt a flexible use approach to the determined bands, with any specific restrictions on the usage mode(s) (i.e. fixed, nomadic, mobile, or a combination of them) to be applied in specific bands being appropriately justified

The reference to "flexible usage mode" means regulatory provisions (e.g. licence conditions), which would allow BWA licence holder to deploy various types of Terminal Stations (TS): fixed (Fixed Wireless Access - FWA), nomadic (Nomadic Wireless Access - NWA) or mobile (Mobile Wireless Access - MWA).

The detailed definitions of FWA, NWA and MWA are given in Recommendation ITU-R F.1399.

A typical example of FWA TS could be stationary roof-top user equipment. An example of NWA TS could be a desk-top portable user equipment or laptop PC equipped with the internal BWA access card. An example of MWA TS could be a handheld user terminal.



3.6.1 Frequency band 3400-3800 MHz

The departing point for the compatibility studies was the current regulatory regime for the bands 3.4-3.6 GHz and 3.6-3.8 GHz as described in ECC/REC(04)05. This solution was initially designed for FWA and NWA scenarios and its main features are as follows:

- Contiguous assignment of blocks without prescribing any technology or channelisation inside licensed blocks (i.e. no distinction between TDD or FDD);
- The interference between adjacent blocks should be avoided through application of Block Edge Mask (BEM) for Central Stations (CS);
- This leads to the fact that a combination of some internal guard bands and filtering at the block edges will have to be provided by the operator, in order to comply with the BEM requirements.

It is important to note that this solution did not consider the case of interference between Terminal Station-to-Terminal Station (TS-TS), due to assumption of low probability of TS-TS interference because of using directional antennas for FWA scenario or TS being located indoors for NWA scenario. Therefore no provisions for TS (i.e. no BEM for TS) were established in ECC/REC(04)05.

However, when analyzing flexible usage modes, in particular introduction of mobile use, it was found out that the MWA TS-TS interference scenario was the most critical one. Two studies¹⁰ were received (Doc. SE19(06)63 and Doc. SE19(06)70), based on assumptions that included un-coordinated deployment and the possible concentration of users (with active user density representative of BWA scenarios, i.e. relatively low compared to dense cellular mobile networks) in an indoor environment, indicated that a guard band of around one channel might be needed between MWA TS-TS. Further considerations¹⁰ on this issue were offered in Doc. SE19(06)66 and Doc. SE19(06)73.

Evaluation of possible mitigation factors (such as co-ordinated deployment in terms of frequency co-ordination or network synchronisation of TDD systems, etc) would alleviate the potential of interference further.

The above finding for MWA TS-TS case is consistent with the earlier results for other interference cases, which also indicated a required guard band of approximately one channel, as consequence of applying the CS Block Edge Mask in ECC/REC(04)05. In such manner it was always understood that the stringent BEM slope would imply a “self-imposed” inner guard-band, also referred to as “virtual guard band”. Therefore, since ECC/REC(04)05 does not contain any provisions for a TS transmission block edge mask, the same “virtual guard band” should be somehow observed for TSs.

In summary, it is requested to consider including the following requirements for flexible BWA usage in the frequency range 3400-3800 MHz, in addition to the basic FWA/NWA requirements set up in ECC/REC(04)05.

Requirements for mobile (handheld) terminal stations (TS):

- *Maximum radiated power density of 25 dBm/MHz;*
- *Minimum ATPC range of 15 dB;*
- *When blocks are assigned contiguously (without external guard bands) care should be taken not to allow a TS transmit centre frequency closer than one channel width from the block edge unless co-ordination between operators is undertaken. Co-ordination may include the application of other specific interference mitigation measures. However it is understood that such a “virtual guard channel” is implicit, under normal circumstances, through application of the CS BEM as recommended in ECC/REC(04)05.*

These technical considerations are included in ECC Decision (07)02.

¹⁰ The documents mentioned in this section can be found on the web site of the European Radiocommunications Office (<http://www.ero.dk>), in the folder for SE PT 19 meeting documents (choose "SE19" under "Select Group", then choose "MWA study at 3500 MHz" under "Select Year").



3.6.2 *Frequency band 5725-5875 MHz*

The introduction of flexible BWA use in the band 5725-5875 MHz was not considered as the industry participants indicated that they believed that with present technology they did not consider full mobility to be practical given the generally poorer physical conditions for realisation of Non-Line-Of-Sight applications. It was also considered that introduction of services for full mobility would be difficult to achieve given the elaborate protection requirements that may be needed to give protection to the other (sensitive) services using this band. Previous studies carried out that are highlighted in ECC Report 68 only considered sharing issues related to introducing BFWA deployments in this band. It was concluded that if desired further technical analysis would need to be carried out to determine the feasibility of introducing more flexible usage modes.

3.7 **Consider optimal channel plans for such bands, whilst avoiding undue discrimination towards any specific technology**

3.7.1 *Frequency band 3400-3800 MHz*

The initial basic channel plans for this band were established long ago by ERC/REC 14-03 (3400-3600 MHz) and ERC/REC 12-08 (3600-3800 MHz).

Further, more elaborate technical guidance for deployment of FWA and NWA applications in this band was established in ECC/REC(04)05. The approach taken in this recommendation starts from very basic channel granularity of 0.25 MHz slots and allows accumulation of any number of such basic slots to form the actual blocks licensed to operators. Furthermore, the Recommendation (04)05 suggest some additional guidance regarding the overall size and proportioning of the blocks to allow the level playing fields for competing BWA operators. It is foreseen, that within the allocated blocks, the operators would be given flexibility to decide on the suitable internal channelling. Also provisions for flexible FDD/TDD deployment are established in the Recommendation.

Therefore it is a view of ECC that the channelling arrangements and overall provisions for construction of licensed blocks, as established by ECC/Recommendation (04)05, are sufficient for all types of BWA deployment and therefore no further action is necessary.

3.7.1.1 *Flexibility in BWA licensing processes*

Contributions to the technical studies in SE PT 19 have highlighted the improved spectrum utilisation efficiency that might be possible when specific assignments for FDD or TDD techniques are made. FDD operation necessarily requires paired blocks separated by an appropriate duplex distance. Assignments for TDD are most efficient when made as a single unpaired block. Grouping TDD and FDD applications together within any band will reduce the number of guard bands and other mitigation measures required between operators maximising the fully operational spectrum available.

Segmenting any band ahead of a licensing process cannot be optimised without precise information about the expected deployments, which are outside the scope of the licensing process, and could limit the opportunities for specific technologies to be applied efficiently. However it might be possible to put in place award procedures that offer quantities of spectrum in a first phase followed by a second phase of band planning carried out after the award, by the license winners in collaboration with the Administration concerned. In this way, the final band plan could be optimised to accommodate the licence winners' technology choices in the most efficient way.

In addition to this licensing flexibility and considering the developments towards usage mode flexibility, there is a desire for band plan harmonisation across Europe.

3.7.2 *Frequency band 5725-5875 MHz*

Given the general preference for licence-exempt operation of BFWA in the 5.8 GHz band and the vision for this band that provides an opportunity for novel BFWA applications, it was felt that any guidance with regards to the channelling beyond the provisions of relevant ETSI standards (EN 302 502) would be unnecessary.

Therefore ECC did not identify any need for action in this regard. The ETSI EN 302 502 identifies a 2.5 MHz granularity for channel bandwidth.



3.8 Give due consideration to technology neutrality and to expected licensing regimes associated to particular bands

3.8.1 *Technology neutrality as a part of frequency arrangements*

The aforementioned ECC/REC(04)05 already actively pursued the implementation of technical neutrality by following means:

- It is recommended that operators are allowed to choose freely the internal channelling inside their allocated frequency blocks;
- It is recommended that licences do not specify whether FDD or TDD systems are deployed by the operator, as the technical provisions for construction of frequency blocks would allow in principle deploying both FDD and TDD systems;
- It is recommended to allocate blocks contiguously, i.e. without external guard bands, while co-existence between operators of adjacent blocks in the same geographic areas should be ensured by inter-operator co-ordination and the technology neutral Block Edge Mask limits, established in the Recommendation;
- Further provisions foreseen in Recommendation (04)05 to allow subsequent market-driven adjustments by operators (notably swapping of duplex parts of the blocks) to improve efficiency of using the spectrum;
- No specific air interface standard is identified.

It is therefore felt that such provisions for technical neutrality should be sufficient and highly beneficial for ensuring unhindered, highly competitive and most efficient use of allocated frequency band by BWA operators.

3.8.2 *Licensed (co-ordinated) or licence-exempt (un-coordinated) deployment of BWA*

Licensed deployment

Licensed deployment foresees exclusive assignment of individual frequencies or frequency blocks to be used for a particular purpose. As such, the assignment process often involves certain co-ordination with other domestic services using licensed or adjacent frequencies, as well as international frequency in certain cases.

The exclusive access rights coupled with co-ordination process ensures high degree of “interference free” operation, hence allowing operator/licence holder to provide telecommunications service of guaranteed quality/availability.

Licence-exempt deployment

Licence-exempt deployment is based on a general authorisation (known as general licence, “blanket” licence, etc) to deploy certain type (specified in that general authorisation) of radiocommunications equipment without individual authorisation, hence without co-ordination with other users that might utilise the same frequency channel/band.

Since such use of a particular frequency channel does not involve exclusivity nor co-ordination, the user may not be guaranteed any level of protection beyond what is provided by type of authorised devices (e.g. if low power is prescribed, then interference is not like to propagate at longer distances) or some autonomous interference avoidance techniques (e.g. DFS, etc).

Light Licensing

The light licensing regime provides a compromise between full-scale licensing and licence-exempt deployment, by establishing licensing scheme on the basis of simplified licensing procedures, usually carried by the licensee using some automated means provided by administration (e.g. self-registration in the on-line database, etc).

Depending on the sharing situation in the band, the administration may built various co-ordination mechanisms in the light-licensing scheme, e.g. the online-database could perform automatic co-ordination with previously registered stations, check positioning of proposed station with respect to certain exclusion zones, etc. Alternatively, operators may be required to do their own evaluation of compatibility of the new station with other stations previously recorded in the registration database.

Of the bands considered by the JPT BWA, the band 3.4 – 3.8 GHz appeared to be the most suited to a licensing regime, with 5.8 GHz appearing to be suited to either a licence exempt or licensing (potentially light) licensing regime.



Given the different legacy situations in the two considered BWA bands as well as different deployment options, it was decided to recommend different licensing regimes in each of the bands:

- In the band 3400-3800 MHz traditional licensing scheme should be applied, based on assignment of contiguous technology-neutral frequency blocks by means of comparative analysis (“beauty contest”) or auction;
- In the band 5725-5875 MHz it is recommended that a simplified authorisation process should be applied, i.e. licence-exempt deployment or light-licensing (based on, either, a free for all (similar to licence-exempt) or first-come-first-served principle).

3.9 Collect and present any readily available and relevant information on market demand for specific frequency bands, and on costs and benefits of alternative regulatory scenarios

The content of sub-sections 3.9.1 to 3.9.3 is summarised and revised from the **TR 102 453-1 ETSI System Reference Document on Converged Fixed-Nomadic Broadband Wireless Access (BWA) systems frequencies above 3.4 GHz**. Information from some countries (examples) can be found in sub-sections 3.9.4 to 3.9.7.

3.9.1 Market information

The BWA market up until recently was a niche market due to a number of possible causes:

- Lack of open standards, which kept the component costs at a high level;
- Problematic business case, due to high cost of installing outdoor antennas;
- Lack of light-licensed spectrum, with a power allowance suitable for large cell deployments for municipal applications;
- Low cost wired infrastructure (DSL, CATV) available in many areas;
- No added value to compete with wired infrastructure (e.g. mobility, higher data rates).

However, this may change with the development of open standards for BWA (including technologies enabling indoor applications) and the introduction of flexibility into the licensing regime which may bring vitality to the BWA market.

The following target customer groups requiring spectrum can be identified:

- a) Small businesses and enterprises, which seek a competitive offering for broadband service with a guaranteed, service level agreement. In this scenario an outdoor, fixed subscriber terminal with a directional antenna is employed to provide the highest throughput connectivity. This bandwidth is then dispersed to many users within the business.
- b) Residential users in areas where DSL or cable broadband services ARE NOT available. In this scenario, a service similar to consumer DSL connectivity is offered, generally at a premium to current DSL broadband service rates. This premium is required to offset the cost of the “truck roll” required to professionally install the fixed outdoor subscriber station.
- c) Residential service in areas where DSL or cable broadband services ARE available. This is generally complementing or enhancing the wired broadband offering. The wireless approach can provide the same service if enough licensed spectrum will be available. In this case nomadic and mobile usage modes would create added value in comparison with DSL operation.
- d) In the future, possibly evolving to a Triple-play service, i.e. for multimedia, fast internet and VoIP

Using radio technologies can add nomadic and/or mobile operation to the scenarios mentioned above. Without the ability to deploy indoor modems (which are nomadic by ITU definition), wireless providers cannot offer a broadband service competitive with those offered by wire line providers, and therefore will be limited to offering BWA only where wireline services are not available. Indoor or “self-install” modems are essential for offering broadband services at competitive costs.

3.9.2 Market size, forecasts and timing

The European market size for BWA is dependent on:

- Penetration of existing wired services (most notably, DSL);
- BWA service offering.

The experience shows that if there is an existing wired service, it will usually be more cost effective than the equivalent wireless service. However, for customers beyond the wired service reach, where new infrastructure has to be deployed, the



wireless service may be preferable. In order to create competition, adding nomadic and mobile operation, will enhance the attractiveness of wireless services.

There is a huge market potential for truly broadband services as long as there is enough readily accessible spectrum to provide the requested services. In 2006 WiMAX certified equipment has become available on the market.

3.9.3 *Spectrum requirement and justifications*

There are two general cases addressed in detail in the TR 102 453-1 ETSI System Reference Document on Converged Fixed-Nomadic Broadband Wireless Access (BWA) systems frequencies above 3.4 GHz:

- Basic spectrum needed per operator, to provide the target services;
- Spectrum needed per operator, to provide both the target services and also to provide in-band feeding (backhaul) to feed the micro cells covering gaps in the coverage.

Generally there is a quantifiable requirement for 56 MHz (Total 56 MHz for TDD or 2x28 MHz for FDD) per operator for DSL-like services. This spectrum has been calculated in TDD mode, assuming up-link OFDMA and asymmetrical up-link/down-link traffic. If there is a requirement for in-band feeding, the required spectrum is increased by 25%, which would result in a requirement of 70 MHz.

Furthermore, for Triple Play service offerings, the TR 102 453-1 ETSI System Reference Document on Converged Fixed-Nomadic Broadband Wireless Access (BWA) systems frequencies above 3.4GHz: recommends an additional 70 MHz to 85 MHz of net spectrum per operator.

However it should be noted that the above figures should be weighted against the necessity, in order to ensure competition serving final users interest, of accommodating more than one operator in the available spectrum.

It should be noted that CEPT administrations as well as industry (e.g. WiMAX Forum) are still in the process of developing major market studies.

The market demand for frequency bands will be driven by a number of key factors, although these appear to fall into two distinct areas:

1) Technology developments: clearly the development of technologies will drive interest into particular frequencies bands (i.e. due to the bands the devices are designed to operate in).

2) Interest in frequency bands by potential operators: operators' demand for frequencies will be driven by technologies and their plans to deploy services. However, the commercial success of these plans will depend ultimately on consumer acceptance and take-up of the services on offer, which cannot be predicted with certainty. It is therefore important to adopt a flexible approach. If spectrum is reserved exclusively for wireless broadband applications that consumers do not find attractive, there will be a potentially substantial opportunity cost. In other words, alternative innovative applications that might have delivered sizable benefits to consumers will have been denied access to spectrum as a consequence and those benefits will have been lost or deferred.

3.9.4 *Licence-exempt applications (Ofcom UK)*

The Office of Communications (Ofcom) UK commissioned a study to investigate further options for BWA applications operated on a licence-exempt basis. Permitting higher transmitter power levels or increased radiated power levels by using directional antennas and/or making other regulatory changes was examined. The bands 2.4 GHz, 5.4 GHz and 5.8 GHz were considered. The primary objective of this study was to assess the options for revising the regulation of licence-exempt applications, including power levels, to promote use particularly where licence exempt spectrum is currently under-used. The secondary objective of the work programme was to explore the use of higher powers for licence exempt applications in order to provide wireless broadband in rural areas where other broadband technologies might be unavailable due to prohibitively high cost.

According to this study, a proposed solution is to increase the transmitted power level for licence exempt applications to improve the business case by reducing infrastructure costs. The feasibility of raising power levels depends on the increase necessary and on the consequences of higher power in terms of interference and steps to mitigate that interference.



It has been shown in the study based on several scenarios, that the consumer surplus increases with e.i.r.p. because the cost of providing a wireless broadband service decreases. Due to the nature of the applications the costs of interference are very difficult to quantify and therefore these costs have not been estimated in this analysis. However at 5.8 GHz equipment for broadband wireless must employ Dynamic Frequency Selection (DFS) to avoid interference with radars.

Flexibility concerning the technical and operational parameters for licence exempt equipment will certainly be advantageous in special cases. This flexibility to the benefit of special applications has to be evaluated carefully by national administrations and those considerations would include whether licence exempt or licensed approach is appropriate.

3.9.5 Auction in Switzerland

After a public consultation in 2005, 29 parties have shown their interest in a BWA licence. In a public tender of 3 licences (2 x 21 MHz; 2 x 21 MHz; 2 x 17.5 MHz) at the end of the year 2005, 5 companies applied for the 3 licences. Although all the 5 companies were allowed to participate in the sealed bid auction, only one company placed a bid. Therefore, just one licence (2 x 21 MHz) has been awarded for the reserve price in June 2006.

For the remaining two licenses (2 x 21 MHz; 2 x 17.5 MHz) the Federal Communication Commission decided to hold a second public tender process. The process was opened in December 2006. The final date for placing an application is 9 February 2007. If there are more applications than licences available, the licences will be awarded by the way of a sealed bid auction in spring 2007.

3.9.6 Auction in Germany

The Federal Network Agency (BNetzA) started the application procedure for BWA in December 2005. A new and innovative registration procedure for assigning BWA spectrum in the 3.5 GHz band was devised. The aim was to allow all interested parties to gain access to the spectrum as quickly as possible. Although the spectrum was and still is allocated to the fixed service only, the Federal Network Agency had held out the prospect of mobile usage. This will require a modification in the Frequency Usage Plan. Under this flexible assignment mechanism, a total of 1221 applications were received from 102 applicants by the given deadline. Of these, only nine were devoted to frequency assignments covering all, or almost all of Germany. Many applicants submitted applications encompassing several regions and entire federal states, as well as smaller, local areas. After examining and reviewing the applications received, it was clear that the level of demand they represented far exceeded the spectrum available in the 3.5 GHz band.

On account of such a demand, the spectrum had to be awarded by auction. The spectrum was auctioned for 28 regions in order to enable smaller companies to participate in the auction as well. The regions, which all have an approximate diameter of 100 km, cover the entire territory of the Federal Republic of Germany. Companies could apply until 8 November 2006 to register for the auction. The following spectrum packages were auctioned in the 28 regions: Package A (21 MHz paired), Package B (21 MHz paired), Package C (up to 21 MHz paired) and Package D (up to 21 MHz paired). Due to existing frequency usage rights, there are some areas of the defined regions where the packages C and D are partly or not available.

Six companies applied to register for the auction and were allowed to take part in December 2006. Finally five companies paid together 56 Million Euro for the BWA spectrum. Three companies got spectrum for all 28 regions (1 Package for every company per region). Two further companies got spectrum in three regions (also 1 Package for every company per region). Up to the year 2009 a basic service has to be provided at least to 15 % of the municipalities of a region by an operator, up to the year 2011 it should be at least 25 %.

3.9.7 Auction in Denmark

In Denmark four BWA licenses were granted based on a “beauty contest” already back in December 2000 after a public tender was published. Spectrum was licensed in blocks with a total bandwidth for each licensee of a little more than 50 MHz.

Then more licenses were granted until 2003 based on the “first come first served” principle. As interest for this frequency band grew rapidly, the Danish administration assessed in summer 2003 that there was shortage of spectrum and an auction was held in June 2004 by which yet another license was issued. The shortage of spectrum was limited to Copenhagen area and it was still possible to apply for licences in the rest of the country until December 2005. In April 2006 the Danish administration assessed, that there was shortage of spectrum and an auction is going to be held in first half of 2007.

From the very beginning there were no mandated guard bands between the blocks in the channelling arrangement and licenses are fully technology neutral.



3.9.8 Conclusion

It becomes clear that the BWA market is gradually taking off, helped by the two factors:

- development of new BWA technologies, such as OFDMA, that allow higher user bitrates and non-line-of-sight deployment (the latter is especially important as it reduces required investments by increasing the coverage of central stations and allowing easy self-installation of terminals by the user), and
- implementation of flexible usage modes, notably the nomadic and mobile modes, which provides certain competitive edge to BWA as compared with fixed-line alternatives as DSL. This advantage may become even more important in the future if the mobility could be developed to allow international roaming of terminals.

So it may be expected that in the future the BWA networks could develop into a vibrant and significant market player, competing on par with DSL/cable/fibre solutions. This vision is well described by the market predictions provided from ETSI document in sections 3.9.1 to 3.9.3 above.

However, the recent real-life experiences in several European countries, as described in sections 3.9.5 to 3.9.7, show that the uptake of BWA will be a gradual process and could not be taken for granted. In particular the experiences with licence awards show that the prospective operators and investors are very cautious and price conscious and, for example, when licences are awarded by auctions the demand is not overwhelming.

Therefore it may be concluded, that it is important to provide the sufficient initial bands for BWA deployment with some stable and clear regulatory environment, which would help to generate market certainty and investments. It is believed that the proposed CEPT regulatory package for 3.4-3.8 GHz and 5.8 GHz bands is providing sufficient answer to this.

3.10 Propose a work plan for further future activities on BWA

The possible use of additional frequency ranges have already been discussed in section 3.4. The future availability of additional or alternative frequency bands will, inter alia, depend on the outcome of the ECC work on the WAPECS Mandate and the Mandate on Digital Dividend. The availability of other bands, such as 3.8-4.2 GHz, within CEPT is currently very limited because of existing usage (PP fixed service links, FSS earth stations). Furthermore it should be taken into account that this band and also other bands below 6 GHz are currently also under discussion with regard to the European preparation of AI 1.4 of WRC-07.

The discussions on BWA, IMT, WAPECS clearly show that it is necessary to monitor the convergence of applications/services in the future. Any future work will have to take into account those developments as well as the BWA market developments in the currently available bands within 3400-3800 MHz and at 5.8 GHz.

In the future, when the BWA market develops from the current infancy into a more mature state with stable growth, then additional frequency bands may be considered, which could be done at a later stage by investigating the prospects offered by eventual WAPECS solutions as well as opportunities of utilising the available wireless access bands above 10 GHz.



4 SUMMARY AND CONCLUSIONS

ECC has prepared the following responses to questions/tasks outlined in EC Mandate to CEPT on identification of conditions relating to the provision of harmonised radio frequency bands in the European Union for Broadband Wireless Access applications.

1. Establish the current degree of harmonisation of BWA bands in Europe and provide information on the global situation

The detailed overview of the situation is provided in Section 3.2. Main findings are summarised below.

Frequency band 3400-3600 MHz

The band 3400-3600 MHz is identified as the widest available option for future sustainable BWA deployment in CEPT countries. Already now the existing national licensing arrangements have typical features that create favourable environment for the development of the BWA market: spectrum assigned in blocks of sufficient size; no registration of user terminals; very basic spectrum access requirements (channelling, duplex); very seldom restrictions on technology; restrictions on services in very few selected countries.

When comparing updated responses in 2006 with the original information from the desk research carried out in 2005 by ERO, it becomes obvious that the trend is clearly towards more liberal conditions for BWA in this band (2 countries removed requirement for registration of TSS, 3 countries changed their position to positive on allowing nomadic use in the band). Not a single country indicated toughening of requirements.

Frequency band 3600-3800 MHz

The band 3600-3800 MHz is identified as a natural and closest alternative/extension for BWA use after the band 3400-3600 MHz. Clear majority of European countries indicated that they either already use it for BWA or consider possibilities of such use in the future.

Besides the same general regulatory issues as in the band 3400-3600 MHz, in addition, the release of the band 3600-3800 MHz for BWA would seem largely conditional on ensuring sustainable co-existence of BWA with other services using this band, such as FSS Earth Stations and legacy PP FS links in this band.

Furthermore, the analysis of global situation shows that the bands 3400-3600 and 3600-3800 MHz would also provide for good prospects of globally harmonised BWA deployment.

Frequency band 5725-5875 MHz

The European situation with the 5725-5875 MHz band has not yet passed over the stage of initial considerations in vast majority of CEPT countries. Although certain interest for using this band by BFWA may be sensed clearly, administrations were delayed with their decision on opening this band for BFWA until the harmonised CEPT approach is developed and, in particular, until resolution of questions on sharing with other services in this band: notably FH (frequency hopping) radars, RTTT, FSS and FS.

Therefore it becomes clear that only now, after CEPT guidance for using this band for BFWA was established in the form of ECC/REC(06)04, some serious opportunities of wider usage of this band for BFWA might start developing. However, some technical issues still remain (e.g. protection of frequency hopping radars) for which additional practical experience and testing may be required.

On the global scale, this frequency band would also provide a good candidate for world-wide harmonisation.



2. Determine the frequency range(s) to focus upon initially for BWA applications, and justify this selection on the basis of clear criteria

Based on the analysis of current situation, the ECC has identified two frequency bands as the primary BWA deployment opportunities in Europe: 3400-3800 MHz and 5725-5875 MHz bands. Detailed considerations for these bands are described in section 3.3. Main outcome of these considerations is summarised by the following ECC actions.

Approval of ECC Decision (07)02 on “The availability of frequency bands between 3400-3800 MHz for the harmonised implementation of Broadband Wireless Access systems (BWA)” that establishes conditions for BWA use in the 3.4-3.8 GHz band and, inter alia, clarifies the nomadic/mobile usage modes for BWA has been developed (see Annex 3).

ECC Recommendation (06)04 on BFWA at 5.8 GHz (“Use of the band 5725-5875 MHz for Broadband Fixed Wireless Access (BFWA)”) was adopted in November 2006 (see Annex 4), which establishes conditions for BFWA deployment in this band and, in particular, clarifies the provisions necessary for protection of other services/systems operated in this frequency band.

These have been based on technical studies reported in **ECC Report 33** (*The analysis of the coexistence of point-to-multipoint FWS cells in the 3.4-3.8 GHz band*), **ECC Recommendation (04)05** (*Guidelines for accommodation and assignment of multipoint Fixed Wireless Systems in frequency bands 3.4-3.6 GHz and 3.6-3.8 GHz*), **ECC Report 100** (*Compatibility studies in the band 3400-3800 MHz between Broadband Wireless Access (BWA) Systems and other services*) and **ECC Report 68** (*Compatibility studies in the band 5725-5875 MHz between Fixed Wireless Access (FWA) systems and other systems*).

3. Study the possible use of additional frequency ranges in the future

The ECC work addressing the WAPECS Mandate and the Mandate on Digital Dividend has recently commenced. The outcome of this work will have an essential impact on the potential availability of alternative bands for BWA as well as other types of wireless access systems.

Hence no further activities on this item under BWA mandate was deemed necessary awaiting of the results of WAPECS and Digital Dividend work.

Although current BWA technology developments limit the practical usage modes, such as mobile and nomadic use, to the bands below 6 GHz as discussed in section 3.4, there may be a need to assess, in the longer term, bands above 6 GHz as well, e.g. for fixed residential access.

However any such future demand could be met from the existing CEPT allocations to P-MP/FWA/MWS systems, such as the 26 GHz, 28 GHz and 40.5-43.5 GHz (for MWS) bands.

CEPT has also considered the developments from WiMAX Forum and concluded that the bands 2300-2400 MHz and 4935-4990 MHz are not considered suitable for harmonised BWA use in Europe for the time being due to other uses of these bands. The 2500-2690 MHz band is currently addressed by CEPT as a part of WAPECS considerations.

4. Undertake required technical compatibility studies and consider the results of measurement campaigns between BWA applications and potentially affected radio services for the frequency ranges under consideration, based on expected interference scenarios

In the band 3.4-3.8 GHz the most important issues (for details, see section 3.5) that have been considered relevant in this band are:

- The intra-service sharing, i.e. coexistence rules for two BWA systems/cells of different operators. This work resulted in the development of the revised ECC Report 33, ECC/REC(04)05 as well as establishing the technical conditions for BWA reflected in the ECC Decision (07)02 for the band. These technical



conditions enable the fixed, nomadic and mobile usage of terminal stations.

- The inter-service sharing of BWA vs. other systems and/or services in the 3.4 – 3.8 GHz band. This study was finalised in September 2006 with the development of ECC Report 100 ("*Compatibility studies in the band 3 400-3 800 MHz between Broadband Wireless Access Systems (BWA) and other services*"), referenced from the ECC Decision (07)02. This Report provides guidance for Administrations on co-ordination between BWA and other systems / services in the band.

It should be noted that the two bands, 3400-3600 MHz and 3600-3800 MHz have different sharing considerations due to the different services, other than BWA, utilising these bands.

The technical compatibility studies for introduction of BFWA (based on ETSI HiperMAN radio interface specifications) in the band 5.8GHz were carried out in SE PT38 and resulted in adoption of ECC Report 68. Compatibility studies between BFWA and Radiolocation Service, FSS and RTTT lead to the establishment of technical conditions for the introduction of BFWA in the 5.8GHz band. The studies have shown that compatibility can be achieved based on specific conditions. Coordination between point-to-point fixed service links and BFWA may be necessary in countries which have existing point-to-point links. Some Administrations intend to carry out additional measurement campaigns to ensure that the proposed means for the coexistence between BFWA and Radar (DFS) is efficient. At present, some countries which have regulations for BFWA usage in these bands have an additional requirement that does not allow usage in the 5795 – 5815 MHz band in order to provide added protection for RTTT applications (notably UK and Norway). Furthermore other countries indicated that they would not open parts of the 5.8 GHz band (especially 5795-5815 MHz) for BFWA in order to protect RTTT applications which are currently in use (Austria, Czech Republic and Slovak Republic). Compatibility with other considered services in the 5.8 GHz band (SRDs, Amateur and Amateur Satellite) was found to be feasible, not requiring additional regulatory provisions for BFWA operation.

It should also be noted that the frequency band above 5855 MHz is envisaged for ITS applications. Sharing between ITS and BFWA applications has been studied in the ECC Report 101 ("*Compatibility studies in the band 5855-5925 MHz between Intelligent Transport Systems (ITS) and other systems*"), that proposes mitigation techniques to be applied to ITS to facilitate the coexistence. It should also be noted, that since the start of work on the present BWA mandate, ECC has initiated studies on the impact of UWB in bands up to 10.6 GHz, hence including BWA in the range 3400-3800 MHz. As part of those studies, mitigation techniques for UWB equipment are under consideration. However the effect from BWA into UWB has not been considered in the context of the BWA mandate.

5. Adopt a flexible use approach to the determined bands, with any specific restrictions on the usage mode(s) (i.e. fixed, nomadic, mobile, or a combination of them) to be applied in specific bands being appropriately justified

During the study it has become apparent that there is a need to consider flexible usage modes for BWA systems in the frequency band 3400-3800 MHz. In this context CEPT has looked at usage modes such as fixed, nomadic and mobile.

It is requested to consider including additional requirements for flexible BWA usage in the frequency range 3400-3800 MHz, in addition to the basic FWA/NWA requirements set up in ECC/REC(04)05.

The introduction of flexible BWA use in the band 5725-5875 MHz was not considered by CEPT as the industry participants indicated that they believed that the propagation environment and the conditions needed to facilitate sharing with other services preclude full mobility as a practical usage mode. Previous studies carried out that are highlighted in ECC Report 68 only considered sharing issues related to introducing BFWA deployments in this band. CEPT concluded that if desired further technical analysis would need to be carried out to determine the feasibility of introducing more flexible usage modes.

The provisions for flexible BWA use in the band 3400-3800 MHz are reflected in the Annex of ECC Decision ECC/DEC(07)02 on "The Availability of Frequency Bands between 3400-3800 MHz for the Harmonised Implementation of Broadband Wireless Access systems (BWA)".

Further details can be found in section 3.6.



6. Consider optimal channel plans for such bands, whilst avoiding undue discrimination towards any specific technology

The CEPT/ECC WGSE has for a long time studied the ways of providing the most optimal yet technology neutral technical conditions for utilising the band 3400-3800 MHz. The detailed information on the background and findings of those studies is given in section 3.7.

This work resulted in adoption in 2006 of ECC Recommendation (04)05 that establishes provisions for a technology neutral frequency block assignment process. Important to note, that this Recommendation also provides options for operators' co-operation in the after-licensing phase, such as provisions for swapping the paired FDD frequency blocks to form more optimal single TDD blocks and other means for efficient, market-driven utilisation of the assigned frequency blocks.

In developing ECC Recommendation (06)04 on BFWA at 5.8 GHz ("Use of the band 5725-5875 MHz for Broadband Fixed Wireless Access (BFWA)") the essential (technology neutral) technical requirements to enable sharing with other services operating in the band have been developed.

For BFWA in the frequency band 5725-5875 MHz, taking into account the technical specifications established by EN 302 502 it was considered not necessary to develop a channel plan.

7. Give due consideration to technology neutrality and to expected licensing regimes associated to particular bands

Technology neutrality was an important factor when considering technical conditions for access to the frequency bands, see response to item 6 above; for further details see section 3.8. Furthermore, technology neutrality as a part of licensing process was considered as well. It was concluded that the flexible and technology neutral licensing could be realised by assigning to BWA licence holders for the band 3400-3800 MHz, frequency blocks of a certain size (ref. ECC/REC(04)05) without prescribing a specific technology.

In the 5.8GHz band technology neutrality was achieved by recommending a combination of maximum e.i.r.p. levels and maximum e.i.r.p. spectral densities per MHz levels without any mandatory channel plans.

Given the different legacy situations in the two considered BWA bands as well as different deployment options, it was decided to recommend different licensing regimes in each of the bands:

- In the band 3400-3800 MHz traditional licensing scheme should be applied, based on assignment of contiguous technology-neutral frequency blocks by means of comparative analysis ("beauty contest") or auction;
- In the band 5725-5875 MHz it is recommended that a simplified authorisation process should be applied, i.e. licence-exempt deployment or light-licensing (based on, either, a free for all (similar to licence-exempt) or a first-come-first-served principle).

8. Collect and present any readily available and relevant information on market demand for specific frequency bands, and on costs and benefits of alternative regulatory scenarios

Information from ETSI and some administrations can be found in section 3.9. Some administrations as well as the industry (e.g. WiMAX Forum) are still in the process of developing market studies.

It becomes clear that the BWA market is gradually taking off, helped by the two following factors:

- development of new BWA technologies, such as OFDMA, that allow higher user bitrates and non-line-of-sight deployment (the latter is especially important as it reduces required investments by increasing the coverage of central stations and allowing easy self-installation of terminals by the user), and
- implementation of flexible usage modes, notably the nomadic and mobile modes, which provides certain competitive edge to BWA as compared with fixed-line alternatives as DSL. This advantage may become even more important in the future if the mobility could be developed to allow international roaming of terminals.



However, the recent real-life experiences in several European countries, as described in sections 3.9.5 to 3.9.7, show that the uptake of BWA will be a gradual process and could not be taken for granted. In particular the experiences with licence awards show that the prospective operators and investors are very cautious and price conscious and, for example, when licences are awarded by auctions the demand is not overwhelming.

Therefore it may be concluded, that it is important to provide the sufficient initial bands for BWA deployment with some stable and clear regulatory environment, which would help to generate market certainty and investments. It is believed that the proposed CEPT regulatory package for 3.4-3.8 GHz and 5.8 GHz bands is providing sufficient answer to this.

9. Propose a work plan for further future activities on BWA

The discussions on BWA, IMT and WAPECS clearly show that it is necessary to monitor the convergence of applications/services in the future. Any future work will have to take into account those developments as well as the BWA market developments in the currently available bands within 3400-3800 MHz and at 5.8 GHz. In the future, when the BWA market develops from the current infancy into a more mature state with stable growth, then additional frequency bands may be considered. This could be done at a later stage by investigating the prospects offered by eventual WAPECS solutions as well as opportunities of utilising the available wireless access bands above 10 GHz.



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

Brussels,
DG INFSO/B4

FINAL

**Mandate to CEPT
to identify the conditions relating to the provision of harmonised radio frequency
bands in the European Union for Broadband Wireless Access applications**

This mandate is issued to the CEPT without prejudice to the one-month right of scrutiny by the European Parliament, pursuant to Council Decision 1999/468/EC of 28 June 1999 (OJ L 184, 17.7.1999, p. 23) on comitology procedure. This one-month period is extended until 2nd February 2006.



Commission Européenne, B-1049 Bruxelles/Europese Commissie, B-1049 Brussel - Belgium - Office: BU33 7/09.
Telephone: direct line (+32-2)296.12.67., switchboard 299.11.11. Fax: +32.2.296.83.95.
e-mail : info-rsc@cec.eu.int



Purpose

Pursuant to art. 4 of the Radio Spectrum Decision, CEPT is mandated to undertake all necessary work to identify the most appropriate criteria for the provision of harmonised radio frequency bands in the European Union for Broadband Wireless Access (BWA) applications.

The underlying objective of this Mandate is to provide the Commission with the necessary information to consider the introduction of one or more technical implementing measures harmonising the use of the radio spectrum in support of the timely introduction and successful take-up of new BWA applications in the European Union.

Justification

One of the leading policy goals defined in the **Lisbon Agenda** is to build a fully inclusive information society, based on widespread use of Information and Communication Technologies (ICTs) in public services, SMEs, and households¹. Stronger ICT uptake is expected to lead to greater economic competitiveness, growth and employment. The EU regulatory framework aims to support this goal by fostering competition and the timely introduction of new communication technologies.

Broadband is widely considered as the enabling infrastructure of a modern knowledge based society. It stimulates **economic growth** by contributing to the improvement working and production processes. Productivity improvements in turn lead to greater investment and higher wages. Broadband enables new applications and enhances the capacity of existing ones, in particular in **rural areas**, where it is a critical element assisting local communities to attract businesses, and to provide healthcare, government and education services.

Governments in the EU and across the world recognise the impact that broadband can have on everyday lives and have committed themselves to ensure that society benefits from fast Internet connections. The Commission's **i2010 initiative**² recalls the importance of advanced and secure broadband communications to meet the challenges digital convergence and to ensure that European households and businesses access information, work more efficiently and enjoy a rich multimedia experience on widespread basis, without creating further digital gaps.

Increasingly, wireless technologies can provide competitive broadband services in number of scenarios. It is important, therefore, to establish regulatory conditions which will encourage the development of economically-viable markets for Broadband Wireless Access applications as commercial opportunities arise.

Harmonising national spectrum usage rules for BWA-enabled products across the EU shall help establish an effective single market for these applications, with the objective of obtaining greater economies of scale, interoperability and benefits to the consumer, as well as avoiding difficulties in enforcing divergent intra-EU regulations.

¹ European Council Conclusions 7619/1/05 Rev. 1 of 23.3.2005

² COM(2005)229



The present Mandate wishes to assist in the development of a common EU framework and to provide guidance on activities by CEPT required to introduce BWA applications into the European Union market.

Order and Schedule

1. CEPT is hereby mandated to undertake all relevant work to identify harmonised conditions of use of radio spectrum in the European Union for Broadband Wireless Access applications, with priority for those frequency bands considered to be more readily available and closer to user take-up. The choice of particular technical conditions of use applicable in these bands shall be duly justified. Alternatively, technical “options” shall be provided for discussion and approval by the Radio Spectrum Committee.

In the work carried out under the Mandate, the overall policy objectives of supporting widespread and timely broadband access shall be given utmost consideration. 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.

CEPT should undertake this Mandate in full awareness of the developing regulatory context for BWA outside Europe and of the potential benefits to consumers of achieving globally-compatible conditions of radio spectrum use for mass-market BWA products.

2. In order to achieve the above, CEPT is mandated to:

1. **adequately schedule and prioritise activities** under this Mandate to reflect activities already undertaken in this area and to conclude the work in a timely manner;
2. **establish the current degree of harmonisation of BWA** bands in Europe and provide information on the global situation;
3. **determine the frequency range(s) to focus upon initially** for BWA Applications³, and justify this selection on the basis of clear criteria; study the possible use of additional frequency ranges in the future;
4. **undertake required technical compatibility studies** and consider the results of measurement campaigns between BWA applications and potentially affected radio services for the frequency ranges under consideration, based on expected interference scenarios;
5. adopt a flexible use approach to the determined bands, with any specific restrictions on **the usage mode(s)** (i.e. fixed, nomadic, mobile, or a combination of them) to be applied in specific bands being appropriately justified;⁴
6. **consider optimal channel plans** for such bands, whilst avoiding undue discrimination towards any specific technology;

³ Notably by focussing primarily on the 3.4-3.8 GHz frequency range, but not on the 2.5 – 2.69 GHz band, which has already been addressed by EC IMT-2000 Mandates 4 and 5. Additionally, work on the 5.8 GHz frequency range ought to be undertaken as far as possible, including regarding any compatibility issues of BWA with existing applications (such as military radar and RTTT).

⁴ Allocation to services in accordance with article 5 of the Radio Regulations of the ITU will need to be verified.



7. give due consideration to **technology neutrality** and to **expected licensing regimes** associated to particular bands,
8. collect and present any readily available and relevant information on **market demand** for specific frequency bands, and on **costs and benefits** of alternative regulatory scenarios;
9. **propose a work plan** for further future activities on BWA⁵.

In its work under this Mandate, CEPT is expected to give appropriate consideration to related on-going EC activities, particularly the WAPECS concept and the need to allow flexibility of use in spectrum.

3. CEPT is mandated to provide deliverables according to the following schedule:

Delivery date	Deliverable	Subject
15 July 2006	Interim Report from CEPT to the Commission	Description of initial work undertaken under this Mandate.
15 th December 2006	Final Report from CEPT to the Commission	Description of work undertaken and final results achieved under this Mandate.

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

4. The result of this Mandate can be made applicable in the European Community pursuant to Article 4 of the Radio Spectrum Decision⁶.

In implementing this Mandate, the CEPT shall take the utmost account of Community law applicable.

⁵ This work, to be suitably framed by one or more additional EC Mandates, may include the finalisation of the work begun under this Mandate on the harmonisation of the 5.8 GHz band for licence-free BWA applications, in particular concerning the verification of due compatibility with other applications, as well as an extension of the 3.4 -3.8 GHz frequency range subject to market demand, for instance up to 4.2 GHz.

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, OJ L 108 of 24.4.2002, p.1.



Terms of Reference of the
Joint Project Team on Broadband Wireless Access (JPT BWA)

Terms of Reference:

1. Study the advantages and disadvantages of the development of a regulatory framework for Broadband Wireless Access in the bands 5725 – 5875 MHz and 3400 – 3800 MHz, taking account of the existing ECC deliverables and the needs of existing services:
 - ECC Report 68 '*compatibility studies in the band 5725 – 5875 MHz between Fixed Wireless Access (FWA) systems and other systems*';
 - the ECC Recommendation (04)05 on FWS systems in the band 3.4 – 3.8 GHz band,;The deliverable for this study will be an analysis, which may include economic aspects, of the possible actions, e.g. an ECC Decision, ECC Recommendation, entry in the ECA, or no action, for consideration by WG FM.
2. Following guidance from WG FM, based on discussion of the result of item 1, develop the appropriate regulatory framework to fulfill the requirements for Broadband Wireless Access^[1] in the bands 3400 – 3800 MHz and 5725 – 5875MHz and consider further technical studies that may be necessary.
3. Bands additional to the ones referred to in No.1 may only be studied after further direction from the ECC.
4. Prepare the response to the EC mandate on BWA in the bands 3400 - 3800 MHz and 5725 - 5875 MHz.
5. Finalisation of the work is foreseen during the ECC meeting to be held in Autumn 2006.

Notes:

This work requires close co-operation with ETSI BRAN and ETSI TM 4.

Chairman: Mr. Thomas Weilacher
Federal Network Agency (BNetzA)
Section 221
Canisiusstr. 21
55122 Mainz
Germany



ELECTRONIC COMMUNICATIONS COMMITTEE

ECC Decision
of 30 March 2007
on availability of frequency bands between 3400-3800 MHz
for the harmonised implementation of
Broadband Wireless Access systems (BWA)
(ECC/DEC/(07)02)





EXPLANATORY MEMORANDUM

1 INTRODUCTION

This CEPT/ECC Decision addresses the availability of frequency bands between 3400-3800 MHz for the harmonised implementation of Broadband Wireless Access (BWA) systems.

BWA is a descriptive term for radiocommunications systems providing wireless delivery (mainly to an end user but not exclusively) of broadband traffic that can encompass fixed, nomadic and mobile applications. It is also considered that BWA systems might include backhauling services for the same or a second operator.

Results of CEPT/ECC studies clearly identify the band 3400-3600 MHz as the widest available choice for current and future BWA deployment in CEPT. The band 3600-3800 MHz has been identified as a possible additional or alternative frequency band. On the basis of a survey undertaken by ERO in 2005, updated in 2006, a clear majority of European countries indicated that they already use the 3400-3600 MHz band for Fixed Wireless Access (FWA). In addition, it was also indicated in the survey that the use of the 3600-3800 MHz band for wireless access systems was at that time limited to a few European countries.

To prepare the harmonisation of the frequency bands 3400-3600 MHz and 3600-3800 MHz for BWA, the following sharing considerations have been carried out:

- The intra-service sharing (i.e. co-existence rules for two BWA systems/cells of different operators) was originally addressed in ECC Report 33 (February 2006) for FWA/NWA deployment. The subsequent studies of mobile usage mode, i.e. Mobile Wireless Access (MWA) systems, were based on certain assumptions that included un-coordinated deployment as well as possible concentration of users (with active user density representative of BWA scenarios) in indoor environment. These studies indicated that a guard band of around one channel might be needed for MWA Terminal Station (TS) to TS compatibility scenario, which is understood to be implicitly provided by Central Station (CS) Block Edge Mask requirements.
- The inter-service sharing of BWA vs. other systems and/or services across entire 3400–3800 MHz range. The other systems and/or services considered in this study were Electronic News Gathering and Outside Broadcasting (ENG/OB), Fixed Point-to-Point links, Fixed-Satellite Service (Space-to-Earth) and Radiolocation Service (primary allocation below 3400 MHz and secondary allocation above 3400 MHz). The results of these studies are contained in ECC Report 100. This Report provides guidance for Administrations on co-ordination between BWA and other systems/services in the band, the details of the coordination depending upon the characteristics of other systems/services and the BWA as well as BWA usage mode. This includes guidance for co-channel sharing scenarios as well as for some adjacent compatibility cases, such as the impact from BWA operation in the 3400-3600 MHz band into FSS earth station receivers operating above 3600 MHz.

2 BACKGROUND

In 1998 the band 3400-3600 MHz was identified as a preferred frequency band for FWA (ERC/REC13-04, ERC/REC14-03, ERC Report 25 refer). The band 3600-3800 MHz is also used in some CEPT countries for multipoint FWA systems in accordance with provisions of ERC/REC 12-08. Consequently, many CEPT administrations have already delivered FWA licences to operators in order to provide FWA services. These authorisations are more often technologically neutral and provide flexibility and freedom for operators to choose the best use of the spectrum for fixed applications. Any modification of the use of the spectrum, especially on the usage mode, shall be analysed in terms of compatibility and general policy for the licensed band.

During recent years the broadband connectivity has been increasing in Europe dramatically, boosted by the demand for high speed access to the Internet, large volume e-mailing, video and audio streaming and file sharing and further innovative multimedia services. The prospects of BWA take-up have been changing recently after the consolidated industry efforts resulted in development of open inter-operability standards and new modulation technologies, allowing to overcome the former line-of-sight requirements for links in subject bands, hence allowing deployment of easy-to-



install indoor user terminals. Recognising this ever increasing demand for broadband connectivity and the improved prospects of radiocommunications systems in satisfying these demands in a most universal way, the ECC has studied the advantages and disadvantages of the development of a regulatory framework for BWA in the frequency band 3400-3800 MHz.

BWA systems are expected to be mainly deployed in all usage modes i.e. FWA, Nomadic Wireless Access (NWA) and MWA, where the CS will be at a fixed location, while TS will be deployed in a ubiquitous way. This Decision did not consider wireless access systems using Multipoint-to-Multipoint (MP-MP, also known as Mesh) architectures. Therefore further studies might be necessary in order to verify the applicability of this Decision for MP-MP (Mesh) systems subject to market availability of such systems.

It should be noted that BWA TSs may use either directional or omni-directional antennas. It is assumed that, for FWA/NWA use, the vast majority of TSs using omni-directional antennas will be operated indoors, but this may not necessarily be the case for MWA use.

The more traditional authorisation approach required the regulator to make decisions between the service definitions identified for each particular frequency band within an allocation table (e.g. European Common Allocations table in ERC Report 25). This then required the regulator to define specific operating conditions. These conditions were required to manage the interference potential for the specific usage mode (e.g. fixed and mobile). Therefore, this may have meant that not all of the usage modes would be permitted. In some CEPT countries there has already been a move towards spectrum authorisations that allow operators flexibility in the manner in which networks are deployed and configured. These are spectrum block geographical area authorisations. This is where the operator is given authorisation to use a particular frequency block for a defined geographic area, rather than defining the operating conditions (e.g. specific location of transmitters, specific bandwidth etc.). In this regime it could be possible, depending on the national situation, to give to the operators the flexibility to determine the usage mode. However it has to be acknowledged, that the need for managing the different interference potential related to the specific usage mode might result in limiting this additional flexibility, or in different constraints for the use of some modes.

3 REQUIREMENT FOR AN ECC DECISION

The allocation or designation of frequency bands for use by a service or system under specified conditions in CEPT administrations is laid down by law, regulation or administrative action. ECC Decisions are required to deal with the radio spectrum related matters and for the carriage and use of equipment throughout Europe. The harmonisation on an European basis supports the *Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity*. A commitment by CEPT administrations to implement an ECC Decision will provide a clear indication that the required frequency bands will be made available on time and on a European-wide basis.



**ECC Decision
of 30 March 2007**

**on availability of frequency bands between 3400-3800 MHz
for the harmonised implementation of
Broadband Wireless Access systems (BWA)**

(ECC/DEC/(07)02)

"The European Conference of Postal and Telecommunications Administrations,

considering

- a) that the frequency bands 3400-3600 MHz and 3600-3800 MHz are allocated to the Fixed Service and to the Fixed-Satellite Service (space-to-Earth) on a primary basis in ITU Region 1;
- b) that the bands in considering "a" are allocated to the Mobile Service on a secondary basis and the band 3400-3600 MHz is also allocated to the Radiolocation Service on a secondary basis in ITU Region 1;
- c) that definitions of Broadband Wireless Access (BWA) applications encompassing Fixed Wireless Access (FWA), Nomadic Wireless Access (NWA), and Mobile Wireless Access (MWA) can be found in Recommendation ITU-R F.1399;
- d) that the European Common Allocation Table (ECA) specified in ERC Report 25 foresees an allocation in the frequency band 3400-3800 MHz on a primary basis to the Mobile Service, recognising that in some countries the status of the Mobile Service may be secondary;
- e) that the ECA indicates the major co-primary utilisation of the band 3400-3600 MHz for BWA applications and coordinated SAP/SAB applications for occasional use;
- f) that the ECA indicates the major co-primary utilisation of the band 3600-3800 MHz for BWA, medium/high capacity Fixed Service links and FSS applications;
- g) that the band 3400-3600 MHz has been identified as a preferred frequency band for FWA (ERC/REC 13-04, ERC/REC 14-03 refer);
- h) that the band 3600-3800 MHz has been also used in some CEPT countries for multipoint FWA systems in accordance with provisions of ERC/REC 12-08;
- i) that in some countries the band 3400 MHz to 3410 MHz is used by land, airborne and naval military radars;
- j) that FSS earth stations are operated in the bands 3400-3600 MHz and 3600-3800 MHz, especially above 3700 MHz;
- k) that Radio Amateur Services are authorised in the frequency band 3400-3410 MHz on a secondary basis;
- l) that spectrum authorisations for BWA in the bands in considering "a", based on assignment/allotment of spectrum blocks over a defined geographical area, may allow one or more of the applications of BWA referred to in considering "c";
- m) that for spectrum authorisations for BWA in the bands in considering "a" that are given by Administrations to individual equipment, i.e. Central Stations (CS), the conditions of use may need to be qualified to manage the technical arrangements between a number of different operators;
- n) that for an efficient introduction of BWA in the frequency bands identified in considering "a", administrations will have to consider an appropriate co-ordination regime, e.g. licensing on a regional, local area or on an individual



- equipment basis, that takes in to account the extent of the use of these bands by other systems or services (e.g. FSS, Point-to-Point FS, etc);
- o) that in general, if suitable separation distance is set up between BWA CS and other systems the impact of BWA Terminal Stations (TS) is not significant. Therefore registration of CSs alone may be sufficient for managing sharing issues;
 - p) that within the two frequency bands defined in considering “a”, if both bands completely available for BWA, pairing of sub-bands 3400-3500/3500-3600 MHz and 3600-3700/3700-3800 provide suitable frame conditions for Frequency Division Duplex (FDD) and Time Division Duplex (TDD) systems or their combination;
 - q) that ECC Report 33 on "The analysis of the coexistence of point-to-multipoint Fixed Wireless Systems cells in the 3.4-3.8 GHz band" (February 2006) provides guidelines for efficient, technology independent deployment of 3.5 GHz and 3.7 GHz point-to-multipoint FWA systems;
 - r) that ECC Report 76 on "Cross-border coordination of multipoint fixed wireless systems in frequency bands from 3.4-3.8 GHz" (February 2006) addresses the issue of finding a most suitable method and criteria for cross-border coordination between point-to-point systems and multipoint FWA systems located on different sides of a national border;
 - s) that ECC Recommendation (04)05 (adopted in February 2006) provides “Guidelines for accommodation and assignment of multipoint fixed wireless systems in frequency bands 3400-3600 MHz and 3600-3800 MHz”;
 - t) that ECC Report 100 on "Compatibility studies in the band 3400-3800 MHz between Broadband Wireless Access Systems (BWA) and other services" addresses the inter-service sharing and adjacent band compatibility of BWA vs. other existing services/systems (point-to-point, ENG/OB, fixed-satellite service (space-to-Earth) and radiolocation service);
 - u) that taking into account the availability of spectrum on a national basis, some CEPT administrations have already released spectrum within the 3400-3600 MHz band and may also consider providing spectrum to BWA within the 3600-3800 MHz band as far as compatible operation with earth stations in the fixed-satellite service (s-E) as well as with existing Point-to-point links in the fixed service is possible;
 - v) that it is important to make spectrum available for BWA in order to meet an overall demand for broadband connectivity;
 - w) that the identification of the bands defined in considering “a” for BWA does not preclude the future use of these bands by other systems and services to which these bands are allocated or designated;
 - x) that the frequency assignment/allotment for BWA should also take into account the existing bi- or multi-lateral international agreements and general cross-border co-ordination procedures as given in ITU Radio Regulations to ensure suitable protection of similar or different systems and services in neighbouring countries;
 - y) that in EU/EFTA countries the radio equipment that is under the scope of this Decision shall comply with the R&TTE Directive. Conformity with the essential requirements of the R&TTE Directive may be demonstrated by compliance with the applicable harmonised European standard(s) or by using the other conformity assessment procedures set out in the R&TTE Directive;



DECIDES

1. that spectrum shall be designated for BWA deployment within the band 3400-3600 MHz and/or 3600-3800 MHz, subject to market demand and with due consideration of other services deployed in these bands;
2. that administrations shall consider allowing flexible usage modes within authorised BWA deployments in the frequency bands identified in Decides 1, taking into account the considerations as described in the Annex;
3. that for the deployment of BWA networks in the frequency bands identified in Decides 1, administrations shall take into account the in-band and adjacent band compatibility with other services/systems (e.g. FS, FSS, ENG/OB, etc) and as a result, coordination of the BWA CS with existing services/systems may be required in the concerned area;
4. that this Decision enters into force on 30 March 2007;
5. that the preferred date for implementation of this Decision shall be 01 July 2007;
6. that CEPT administrations shall communicate the national measures implementing this Decision to the ECC chairman and the Office when the Decision is nationally implemented."

Note:

1 *The following Members have a derogation to implement this Decision:
Spain until 31 December 2012*

2 *Please check the Office web site (<http://www.ero.dk>) for the up to date position on the implementation of this and other ECC Decisions.*



Annex

Considerations for Implementation of Flexible Usage Mode for BWA in 3400-3600 MHz and/or in 3600-3800 MHz

1. Definitions

The reference to “flexible usage mode” means regulatory provisions (e.g. licence conditions), which would allow BWA licence holder to deploy various types of TSs: fixed (Fixed Wireless Access - FWA), nomadic (Nomadic Wireless Access - NWA) or mobile (Mobile Wireless Access - MWA).

The detailed definitions of FWA, NWA and MWA are given in Recommendation ITU-R F.1399.

A typical example of FWA TS could be a stationary roof-top user equipment. An example of NWA TS could be a desk-top portable user equipment or laptop PC equipped with the internal BWA access card. An example of MWA TS could be a handheld user terminal.

2. General considerations

When deciding on granting flexible usage mode rights to BWA licence(s), administrations shall consider following issues:

- Compliance with relevant provisions of legal instruments governing the field of radiocommunications, such as the ITU Radio Regulations, EU legislation and corresponding national telecommunications laws (i.e. national acts transposing ITU and EU acts, as well as any further sovereign regulations in the field);
- Legacy situation, e.g. consider the regulatory limitations and conditions of existing (previously issued) authorisations in the frequency bands subject to this Decision;
- Technical provisions established by existing international frequency co-ordination agreements.

3. Technical considerations

As a starting point, the guidance given in ECC Recommendation (04)05 on technical conditions for implementation of flexible usage mode, to be set in the technology neutral BWA licence process, shall be considered.

Furthermore, the introduction of MWA usage mode will be subject to following additional requirements for deployment of mobileTS:

- a. Maximum radiated power density of 25 dBm/MHz;
- b. Minimum ATPC range of 15 dB;
- c. When blocks are assigned contiguously (without external guard bands) care should be taken not to allow a TS transmit centre frequency closer than one channel width from the block edge unless co-ordination between operators is undertaken. Co-ordination may include the application of other specific interference mitigation measures. However it is understood that such a “virtual guard channel” is implicit, under normal circumstances, through application of the CS Block Edge Mask as recommended in ECC/REC(04)05.



Electronic Communications Committee (ECC)
within the European Conference of Postal and Telecommunications Administrations (CEPT)

ECC RECOMMENDATION (06)04

USE OF THE BAND 5 725-5 875 MHz FOR BROADBAND FIXED WIRELESS ACCESS (BFWA)

Recommendation adopted by the Electronic Communications Committee (ECC)

INTRODUCTION

This CEPT/ECC Recommendation provides guidance for those CEPT administrations intending to make the frequency band 5 725-5 875 MHz available for the implementation of Broadband Fixed Wireless Access (BFWA) systems. This guidance is based on the need to protect primary services in this frequency band.

The intended scope of this recommendation is for BFWA networks in which the use of the terminal stations may be fixed and/or nomadic. These types of applications may be considered to fall into the ITU-R categories Fixed Wireless Access (FWA), Nomadic Wireless Access (NWA) as defined in ITU-R Recommendation F.1399. In the future the usage of this band may be considered, subject to further studies, for Broadband Wireless Access (BWA) systems, which may also include Mobile Wireless Access (MWA).

BFWA systems are broadband radiocommunications systems, which can be deployed either inside or outside buildings, usually covering a geographically defined area. Typical BFWA systems include public and private applications offered to users in homes, schools, hospitals, hotels, conference centres, railway stations, airports, shopping centres etc. BFWA systems enhance the capacity of existing telecommunications solutions and enable new applications, in particular in rural areas.

BFWA systems enable a variety of architectures, including combinations of access as well as interconnection to some extent. BFWA architectures, which have been considered within ECC Report 68, are Point-to-Multipoint (P-MP), Point-to-Point (P-P), Mesh (Multipoint-to-Multipoint, directional or omni-directional) and Anypoint-to-Multipoint (AP-MP, hybrid of Mesh and P-MP).

ECC started to consider the use of the band 5 725-5 875 MHz for BFWA systems following liaison from industry, expressing an interest in the possibilities for larger area, licence-exempt (or lightly licensed) wireless access, based originally on the ETSI HiperMAN air interface standard described in ETSI TR 102 079. ETSI has been also developing a technology neutral harmonised standard (EN 302 502) to address the regulatory compliance matters. As a result of inter-service sharing studies conducted within CEPT/ECC, ECC Report 68 has been published. The results indicated that given certain constraints, sharing between BFWA systems and existing radiocommunication services and applications in this band is possible. Subsequently, further development of the regulatory framework was considered.

ECC Report 68 concluded that sharing is possible based on technical conditions as shown in Annexes 1-4 of this recommendation, considered for the BFWA system characteristics in the band 5 725-5 875 MHz. Additional provisions are required to ensure compatibility with systems in the Fixed Satellite Service within 5850-5875MHz. The eirp limits for BFWA systems noted within ECC Report 68, showed lower limits of eirp for P-P systems compared to P-MP systems. The studies undertaken in Report 68 may not have been in a position to fully assess the types of P-P systems that might be deployed in the 5.8 GHz band (i.e. P-P systems will share similar access technologies to those of P-MP). The recommended eirp figures for both systems have been aligned.

In parts of the world access to the 5.8 GHz band has been allowed for wireless access devices on a licence-exempt or lightly licensed basis. Many countries have followed the example of the USA which designated the band 5 725-5 850 MHz for so called Unlicensed National Information Infrastructure devices (UNII devices). As there has been no existing European regulatory framework for BFWA systems in this band so far, this recommendation identifies a basis for suitable regulatory framework for CEPT administrations, which intend to open the band for this application. It should be adequate to provide a sufficient amount of spectrum to commercial operators, even though individual frequency assignments and channel co-ordination is not envisaged in the band 5 725-5 875 MHz.



"The European Conference of Postal and Telecommunications Administrations,

considering

- a) that Broadband Fixed Wireless Access (BFWA) systems in the range 5725-5875 MHz can provide telecommunication services with user capacity of up to several Mbit/s;
- b) that within CEPT some administrations have introduced BFWA systems within the range 5725-5875MHz, based on national implementations;
- c) that a harmonised approach to the availability of this band for BFWA systems within the CEPT administrations is beneficial;
- d) that the frequency band 5725-5875 MHz is allocated to the Fixed Satellite Service (E-s) on a primary basis;
- e) that the range 5725-5850 MHz is worldwide allocated to the Radiolocation Service on a primary basis;
- f) that the frequency band 5725-5875MHz is designated for non-specific SRDs by CEPT/ERC Recommendation 70-03, and that the frequency band above 5850 MHz is under study for use by ITS applications;
- g) that the frequency band 5795-5815 MHz is designated for Road Transport and Traffic Telematics (RTTT) applications by CEPT/ECC Decision (02)01;
- h) that the frequency band 5725-5875 MHz is designated for ISM applications by footnote 5.150 of the ITU Radio Regulations;
- i) that ECC Report 68 details spectrum sharing studies between BFWA systems and the other services and applications in the band, i.e. FSS (E-s), Radiolocation, RTTT, Amateur Service (including Amateur-Satellite Service (s-E)), Fixed Service (P-P) and Non-specific SRDs;
- j) that ECC Report 68 identifies operational conditions for BFWA systems that will facilitate spectrum sharing with the services and applications mentioned in considering (i);
- k) that a simplified authorisation regime, e.g. licence-exempt or light licensing, can stimulate the development of new and innovative BFWA systems;
- l) that the harmonised standard EN 302 502 contains technical requirements for BFWA systems in this frequency band;
- m) that tests regarding the Dynamic Frequency Selection (DFS) functionality and efficiency have already been carried out and will continue to be carried out;
- n) that the results of these DFS tests may have an impact on the future usage conditions for BFWA systems in the 5.8 GHz band,

recommends

- 1) that administrations making the frequency band 5 725-5 875 MHz, or parts of it, available for Broadband Fixed Wireless Access (BFWA) systems should apply the provisions and parameters detailed in the recommends below;
- 2) that BFWA equipment should implement power limitations and Transmit Power Control (TPC) as described in Annex 1;
- 3) that for the band 5 725-5 850 MHz, BFWA equipment should use mitigation techniques as described in Annex 2 to ensure compatible operation with systems in the Radio determination Service;
- 4) that BFWA installations should comply, where appropriate, with the e.i.r.p. density limits in the elevation plane as described in Annex 3;
- 5) that administrations wishing to authorise both BFWA and RTTT systems in 5795-5815MHz in the same geographic area should consider the guidance given in Annex 4;
- 6) that administrations should consider applying simplified authorization procedures for BFWA in this band, e.g. licence-exempt or light licensing regime."

Note:

Please check the Office web site (<http://www.ero.dk>) for the up to date position on the implementation of this and other ECC Recommendations



Annex 1

**POWER LIMITATIONS AND TPC RANGE FOR BROADBAND FIXED WIRELESS ACCESS (BFWA)
SYSTEMS OPERATING IN THE FREQUENCY RANGE 5 725-5 875 MHz**

Parameters for BFWA stations depending on the system architecture:

Parameter	P-MP (Point-to- Multipoint)	P-P (Point-to-Point)	Mesh	AP-MP (Any point-to- Multipoint)
Maximum mean e.i.r.p. (Note 1)	36 dBm	36 dBm (Note 3)	33 dBm	33 dBm
Maximum mean e.i.r.p. density	23 dBm/MHz	23 dBm/MHz (Note 3)	20 dBm/MHz	20 dBm/MHz
TPC range for each station (Note 2)	12dB	12dB	12dB	12dB

Note 1: The "mean e.i.r.p." refers to the e.i.r.p. during the transmission burst, which corresponds to the highest power, if transmitter power control (TPC) is implemented;

Note 2: The TPC has a range of 12 dB with respect to the maximum permitted radiated output power of the station, to provide on average a mitigation factor of approximately 5 dB on the aggregate interference effect into the Fixed-Satellite Service (Earth-to-space);

Note 3:
In remote rural areas higher e.i.r.p. limits may be needed in order to increase link distance, this should be achieved by using the high gain directional antennas, not by increasing output power. In the band 5725-5850 MHz the higher interference potential of eirp increase should be carefully considered (e.g. impact on DFS efficiency for Radar protection and FSS Protection).



Annex 2

DFS REQUIREMENTS FOR BROADBAND FIXED WIRELESS ACCESS (BFWA) SYSTEMS OPERATING IN THE FREQUENCY RANGE 5725-5850 MHz

INTRODUCTION

DFS procedures and requirements are defined in Recommendation ITU-R M.1652 for WAS/RLANs in the 5 GHz range. The detection, operational and response requirements are described in Annex 1 of that recommendation. For the purposes of the sharing studies detailed in ECC Report 68 for BFWA systems in the band 5725-5875 MHz, it was assumed that the DFS timing requirements and operational procedures are broadly the same as those published in Rec. ITU-R M.1652 (Annex 1).

PRINCIPLES

Every BFWA station, when operating in the frequency range 5 725-5 850 MHz, employs a DFS mechanism with a radar interference detection function to detect radar signals which have a level above the interference detection threshold as defined in Recommendation ITU-R M.1652. Every BFWA station uses the radar interference detection function in order to check for any co-channel radar signal prior the usage of a channel but also during normal operation.

Finding an initial available channel:

- Before a BFWA station transmits, and if no available channel has yet been identified, it shall undertake a **channel availability check** on a radio channel before it is used for transmission;
- Having identified an available channel, the BFWA station can start operation on that channel; the checking of other radio channels to identify other available channels is optional;
- **In-service monitoring** is performed by the BFWA station to re-check the operating channel for co-channel radar signals that may have come within the range of the BFWA station or started operation on the BFWA operating channel.

DFS PARAMETERS

The essential operational and timing requirements are unchanged from those in Annex 1 of Recommendation ITU-R M.1652.

DETECTION THRESHOLD

ECC Report 68 details a specific detection threshold derived from the specific characteristics of BFWA systems in the 5725-5850 MHz range. This accounts for the expected system e.i.r.p. and has been evaluated in the sharing studies considering the specific antenna characteristics for BFWA systems. The DFS mechanism should be able to detect signals above a minimum DFS detection threshold. The interference threshold is the required radar signal strength expressed as equivalent power in dBm in front of the BFWA receive antenna.

The corresponding DFS detection threshold (Th) at the input of the receiver is obtained by adding the gain of the BFWA receive antenna to the interference threshold:

$$\text{DFS Detection Threshold (dBm)} = -69 + 23 - \text{e.i.r.p. Spectral Density (dBm/MHz)} + G$$

Examples:

Max. Tx e.i.r.p. (dBm)	ChS (MHz)	G (dBi)	Th (dBm)
36	20	0	-69
36	20	10	-59
33	20	0	-66
33	10	0	-69
30	20	0	-63
30	10	0	-66

In this table:

- Max. Tx e.i.r.p. - is the maximum allowed mean radiated output power for the BFWA station in dBm (the "mean e.i.r.p." refers to the e.i.r.p. during the transmission burst which corresponds to the highest power, if transmitter power control (TPC) is implemented)
- ChS - is the BFWA nominal occupied channel bandwidth in MHz,
- G - is the receiver antenna gain in dBi (it is assumed that the receiving antenna is also used for transmitting).



DFS ESSENTIAL REQUIREMENTS AND TESTING PROCEDURES

The DFS essential requirements and testing procedures for BFWA equipment in the 5.8 GHz range have been included in the harmonised standard ETSI EN 302 502 in accordance with article 3.2 of the R&TTE Directive. The testing procedures for DFS are based on a selection of radar test signals that would cover fixed frequency and frequency hopping radars.

Annex 3

E.I.R.P. SPECTRAL DENSITY LIMITS IN THE ELEVATION PLANE FOR BFWA INSTALLATIONS TO PROTECT GSO SATELLITE RECEIVERS IN THE FIXED SATELLITE SERVICE IN THE FREQUENCY RANGE 5725-5875 MHz

INTRODUCTION

Fixed Satellite Service (FSS) Earth-to-space deployments use the whole band 5725-5875 MHz and the majority of satellites are in geostationary orbits. In the 125 MHz portion of the band up to 5850 MHz, this is an ITU Region 1 allocation only (i.e. only Europe, Africa and some of the northernmost countries in Asia). Above 5850 MHz the band is part of the heavily utilised FSS global uplink band.

In these frequency bands, the satellite beams cover very large areas of the Earth (using global, hemispherical, zoned or regional beams). Hence, in Europe, a large number of BFWA devices may lie within the beam.

The studies presented in ECC Report 68 derived information about the projected total number of BFWA devices over the whole of the European region, in various system configurations, which could share with FSS networks. The e.i.r.p. and characteristics of the various types of antennas used with the BFWA devices have a direct impact on the aggregate interference into the receivers of the geostationary satellites. This has an impact on the total number of BFWA devices that can be deployed, but the numbers that could be accommodated were considered suitable for the predicted market penetration of BFWA devices in this band.

It was shown in the studies that sharing is feasible in the band 5725-5850 MHz depending on the ability of BFWA devices to limit their e.i.r.p. density in the direction of GSO satellites. However, in the band 5850-5875MHz, the conditions to make sharing feasible are more restrictive for certain types of BFWA devices.

The sharing studies described in ECC Report 68 took the characteristics of BFWA systems into account including typical antenna patterns that restrict the amount of radiated energy in the direction of the satellite receivers. This enabled e.i.r.p. spectral density envelopes to be derived for any positive elevation angle and it is recommended that administrations ensure that BFWA operators are able to provide a combination of antennas and power sources that enable these limits to be met.

The sharing situation between various BFWA systems and the FSS is summarised in the table below.

It is considered that BFWA systems that conform to the elevation plane e.i.r.p. density envelopes given in the following section will provide the best sharing environment with FSS satellites. Note that for BFWA devices which use an omni-directional mesh configuration, the use of the top 25 MHz of the band is not recommended to be used.

BFWA Type	BFWA Conditions (See Note 1)	Frequency Band	
		5725-5850 MHz	5850-5875 MHz
Point-to-Multipoint	e.i.r.p.: 36 dBm Bandwidth : 20 MHz TPC: 5 dB	Sharing is feasible	Sharing is feasible
Any point-to-Multipoint	e.i.r.p.: 33 dBm Bandwidth : 20 MHz TPC: 5 dB	Sharing is feasible	Sharing is feasible
Omni-directional Mesh	e.i.r.p.: 36 dBm Bandwidth : 22 MHz TPC: 5 dB	Sharing is feasible with restrictions (See Note 2)	Sharing is not feasible (see Note 2)
Point-to-Point	e.i.r.p.: 33 dBm (See Note 3) Bandwidth : 20 MHz TPC: 5 dB	Sharing is feasible	Sharing is feasible

Table A3.1: Summary of Sharing Results in Report 68 for BFWA and FSS (E-s) in the band 5725-5875 MHz

Note 1: The TPC value in the table is the assumed average reduction of e.i.r.p, not the maximum TPC range.

Note 2: A tightening of the e.i.r.p. level by 3 dB promotes a more favourable sharing situation for the case of omni-directional mesh devices. In the case of sharing with satellites that require low elevation angles from parts of Europe (where a substantial number of BFWA devices may be deployed) and which lie within the main elevation lobe of the BFWA antennas, sharing appears less straightforward. The low elevation satellites do



not use the part of the band below 5850 MHz so the difficulty in sharing here is only constrained to the top 25 MHz of the band, so this consideration does not apply to the whole of the band.

Note 3: In remote rural areas higher e.i.r.p. limits may be needed in order to increase link distance, this should be achieved by using the high gain directional antennas, not by increasing output power. In the band 5725-5850 MHz the higher interference potential of eirp increase should be carefully considered (e.g. impact on DFS efficiency for Radar protection and FSS Protection).

RECOMMENDED E.I.R.P. DENSITY LIMITS

The e.i.r.p. spectral density of the BFWA transmitter emissions should not exceed the following values for the elevation angle θ (degrees) above the local horizontal plane (of the Earth):

- For sectorised (e.g. P-MP Central or Base Station) and Omni-directional deployments:

-7 dB(W/MHz)	for $0^\circ \leq \theta < 4^\circ$
-2.2 - (1.2* θ) dB(W/MHz)	for $4^\circ \leq \theta \leq 15^\circ$
-18.4 - (0.15* θ) dB(W/MHz)	for $\theta > 15^\circ$

- For P-MP Customer Terminal Station and P-P deployments:

-7 dB(W/MHz)	for $0^\circ \leq \theta < 8^\circ$
-2.68 - (0.54* θ) dB(W/MHz)	for $8^\circ \leq \theta < 32^\circ$
-20 dB(W/MHz)	for $32^\circ \leq \theta \leq 50^\circ$
-10 - (0.2* θ) dB(W/MHz)	for $\theta > 50^\circ$

Examples are provided in ECC Report 68 to demonstrate that these limits can comfortably be achieved using typical antenna radiation pattern envelopes.



Annex 4

ENSURING CO-EXISTENCE OF BFWA AND RTTT IN THE BAND 5795-5815 MHz

The studies presented in ECC Report 68 indicated that interference may occur between BFWA and RTTT applications if they were to be deployed in the same/adjacent geographic areas, operating in the same frequency band 5795-5815 MHz. In particular, it was shown that co-channel interference range from BFWA into RTTT could be in the order of 200-2000 m depending on the scenario, whereas the range of interference from RTTT into BFWA could be in the order of 2000 m – 20 km.

Considering that RTTT does not operate across the entire band proposed for BFWA, that it is only deployed in a limited number of locations and that it will interfere with BFWA at a greater distance than vice versa (and hence BFWA installations would avoid operating in active RTTT channels), sharing between FWA and RTTT systems was deemed to be generally feasible. It should also be noted that the DFS mechanism might be effective for RTTT protection.

However, to completely avoid any interference cases, the administrations wishing to authorise deployment of both BFWA and RTTT applications in their countries should consider applying one or more of following measures:

1. To design the authorisation process for BFWA in such a manner as to ensure certain degree of co-ordination between the BFWA CS (central station) and RTTT Road Side Unit installations (light-licensing regime could be one suitable option);
2. To authorise BFWA deployment only in areas where RTTT installations are not envisaged (using the BFWA licensing process to enforce this requirement);
3. To authorise BFWA deployment only in the sub-bands outside RTTT frequency range;
4. To require additional mitigation techniques, following guidance in Report 68.



Extract of ERC Report 25 for the band 3400-5925 MHz(May 2007)

<i>RR Region 1 Allocation and RR footnotes and Frequency Band</i>	<i>European Common Allocation</i>	<i>Major utilisation</i>	<i>European footnotes</i>	<i>ECC/ERC document</i>	<i>Standard</i>	<i>Notes</i>
3400 - 3500 MHz						
FIXED	FIXED	Amateur	EU17		EN 301 783	EU 17 within the band 3400-3410 MHz
FIXED-SATELLITE (S/E)	FIXED-SATELLITE (S/E)					
Mobile	MOBILE	BWA		ECC/REC 04-05	EN 301 751	Within the band 3400-3800 MHz
Radiolocation	Amateur			ERC/REC 13-04	EN 301 753	
	Radiolocation			ERC/REC 14-03	EN 302 326	
5.431		Mobile applications			EN 302 064	For coordinated SAB/SAP applications for occasional use. In some countries the mobile service may be on secondary basis
		Radars				Upper limit for airborne radars is 3410 MHz
3500 - 3600 MHz						
FIXED	FIXED	BWA		ECC/REC 04-05	EN 301 751	Within the band 3400-3800 MHz
FIXED-SATELLITE (S/E)	FIXED-SATELLITE (S/E)			ERC/REC 13-04	EN 301 753	
Mobile	MOBILE			ERC/REC 14-03	EN 302 326	
Radiolocation						
5.431		Mobile applications			EN 302 064	For coordinated SAB/SAP applications for occasional use. In some countries the mobile service may be on secondary
3600 - 3800 MHz						
FIXED	FIXED	-				In some countries the mobile service may be on secondary basis
FIXED-SATELLITE (S/E)	FIXED-SATELLITE (S/E)					
Mobile	MOBILE	BWA		ECC/REC 04-05	EN 301 751	Within the band 3400-3800 MHz
					EN 301 753	
					EN 302 326	
		FSS		ECC/DEC/(05)09	EN 301 443	Priority for civil networks
		Medium/high capacity fixed links		ERC/REC 12-08	EN 301 751	



<i>RR Region 1 Allocation and RR footnotes and Frequency Band</i>	<i>European Common Allocation</i>	<i>Major utilisation</i>	<i>European footnotes</i>	<i>ECC/ERC document</i>	<i>Standard</i>	<i>Notes</i>
3800 - 4200 MHz						
FIXED	FIXED	FSS		ECC/DEC/(05)09	EN 301 443	Priority for civil networks
FIXED-SATELLITE (S/E)	FIXED-SATELLITE (S/E)	Medium/high capacity fixed links		ERC/REC 12-08	EN 301 751	
Mobile						
4200 - 4400 MHz						
AERONAUTICAL RADIONAVIGATION 5.438	AERONAUTICAL RADIONAVIGATION 5.438	Altimeters				
		Passive sensors (satellite)				For sea surface temperature measurements
5.439	5.440					
5.440	EU18					
4400 - 4500 MHz						
FIXED	FIXED	Defence systems	EU20			Harmonised military band for fixed and mobile systems
MOBILE	MOBILE	Mobile applications			EN 302 064	For coordinated SAB/SAP applications for occasional use
	EU2					
	EU27					
4500 - 4800 MHz						
FIXED	FIXED	Defence systems	EU20			Harmonised military band for fixed and mobile systems
FIXED-SATELLITE (S/E) 5.441	FIXED-SATELLITE (S/E) 5.441	FSS				Fixed-Satellite service not to be implemented in NATO Europe. Fixed-Satellite frequency plan in 4500-4800 MHz
MOBILE	MOBILE	Mobile applications			EN 302 064	For coordinated SAB/SAP applications for occasional use
	EU27					



<i>RR Region 1 Allocation and RR footnotes and Frequency Band</i>	<i>European Common Allocation</i>	<i>Major utilisation</i>	<i>European footnotes</i>	<i>ECC/ERC document</i>	<i>Standard</i>	<i>Notes</i>
4800 - 4990 MHz						
FIXED	FIXED	Defence systems	EU20			Harmonised military band for fixed and mobile systems
MOBILE 5.442	MOBILE except aeronautical mobile	Mobile applications			EN 302 064	For coordinated SAB/SAP applications for occasional use
Radio astronomy	Radio astronomy					
5.149	5.149 EU27					
5.339	5.339	Passive sensors (satellite)				Space Research and EESS (passive) above 4950 MHz in some countries
5.443		Radio astronomy				Continuum observations and VLBI
4990 - 5000 MHz						
FIXED	FIXED	Defence systems	EU20			Harmonised military band for fixed and mobile systems
MOBILE except aeronautical mobile	MOBILE except aeronautical mobile	Mobile applications				For coordinated SAB/SAP applications for occasional use
RADIO ASTRONOMY	RADIO ASTRONOMY					
Space research (passive)						
5.149	5.149 EU27	Radio astronomy				Continuum observation and VLBI
5000 - 5010 MHz						
AERONAUTICAL RADIONAVIGATION	AERONAUTICAL RADIONAVIGATION	Galileo				For future use by Galileo
RADIONAVIGATION-SATELLITE (E/S)	RADIONAVIGATION-SATELLITE (E/S)	Radio astronomy				Continuum observation and VLBI
	Radio astronomy	Satellite Navigation systems				Aeronautical Radionavigation and Fixed Satellite Service envisaged in some countries
	Space research (passive)					
5.367	5.367					



<i>RR Region 1 Allocation and RR footnotes and Frequency Band</i>	<i>European Common Allocation</i>	<i>Major utilisation</i>	<i>European footnotes</i>	<i>ECC/ERC document</i>	<i>Standard</i>	<i>Notes</i>
5010 - 5030 MHz						
AERONAUTICAL RADIONAVIGATION	AERONAUTICAL RADIONAVIGATION	Galileo C1				
RADIONAVIGATION-SATELLITE (S/E) (S/S) 5.328B 5.443B	RADIONAVIGATION-SATELLITE (S/E) (S/S) 5.328B 5.443B Radio astronomy Space research (passive)	Radio astronomy Satellite Navigation systems				VLBI observations Aeronautical Radionavigation and Fixed Satellite Service envisaged in some countries
5.367	5.367					
5030 - 5150 MHz						
AERONAUTICAL RADIONAVIGATION	AERONAUTICAL RADIONAVIGATION	MLS				Aeronautical Radionavigation envisaged in some countries. Fixed Satellite Service in use in some countries
5.367	5.367 EU18					
5.444	5.444					
5.444A	5.444A					
5150 - 5250 MHz						
AERONAUTICAL RADIONAVIGATION FIXED-SATELLITE (E/S) 5.447A	FIXED-SATELLITE (E/S) 5.447A	Feeder links for MSS				Aeronautical Radionavigation and Fixed Satellite Service envisaged in some countries
MOBILE except aeronautical mobile 5.446A 5.446B	MOBILE except aeronautical mobile 5.446A 5.446B					
5.446	5.446	WAS/RLANS		ECC/DEC/(04)08 ERC/REC 70-03	EN 301 893	Within the bands 5150-5350 and 5470-5725 MHz
5.447	5.447					
5.447B	5.447B					
5.447C	5.447C					



<i>RR Region 1 Allocation and RR footnotes and Frequency Band</i>	<i>European Common Allocation</i>	<i>Major utilisation</i>	<i>European footnotes</i>	<i>ECC/ERC document</i>	<i>Standard</i>	<i>Notes</i>
5250 - 5255 MHz						
EARTH EXPLORATION-SATELLITE (active)	EARTH EXPLORATION-SATELLITE (active)	Active sensors (satellite)				
MOBILE except aeronautical mobile 5.446A 5.447F	MOBILE except aeronautical mobile 5.446A 5.447F	Defence systems				Tactical and weapon system radars
RADIOLOCATION	RADIOLOCATION	Position fixing				
SPACE RESEARCH 5.447D	SPACE RESEARCH 5.447D	Shipborne and VTS radar				
5.447E	5.448A EU2	WAS/RLANS		ECC/DEC/(04)08	EN 301 893	Within the bands 5150-5350 and 5470-5725 MHz
5.448	EU22			ERC/REC 70-03		
5.448A		Weather radars				Ground based and airborne
5255 - 5350 MHz						
EARTH EXPLORATION-SATELLITE (active)	EARTH EXPLORATION-SATELLITE (active)	Active sensors (satellite)				
MOBILE except aeronautical mobile 5.446A 5.447F	MOBILE except aeronautical mobile 5.446A 5.447F	Defence systems				Tactical and weapon system radars
RADIOLOCATION	RADIOLOCATION	Position fixing				
SPACE RESEARCH (active)	SPACE RESEARCH (active)	Shipborne and VTS radar				
5.447E	5.448A EU2	WAS/RLANS		ECC/DEC/(04)08	EN 301 893	Within the bands 5150-5350 and 5470-5725 MHz
5.448	EU22			ERC/REC 70-03		
5.448A		Weather radars				Ground based and airborne



<i>RR Region 1 Allocation and RR footnotes and Frequency Band</i>	<i>European Common Allocation</i>	<i>Major utilisation</i>	<i>European footnotes</i>	<i>ECC/ERC document</i>	<i>Standard</i>	<i>Notes</i>
5350 - 5450 MHz						
AERONAUTICAL RADIONAVIGATION 5.449 EARTH EXPLORATION-SATELLITE (active) 5.448B RADIOLOCATION 5.448D SPACE RESEARCH (active) 5.448C	AERONAUTICAL RADIONAVIGATION 5.449 EARTH EXPLORATION- SATELLITE (active) 5.448B RADIOLOCATION 5.448D SPACE RESEARCH (active) 5.448C Fixed EU2 EU22	Active sensors (satellite) Defence systems Position fixing Shipborne and VTS radar Weather radars				Tactical and weapon system radars Ground based and airborne
5450 - 5460 MHz						
AERONAUTICAL RADIONAVIGATION 5.449 EARTH EXPLORATION-SATELLITE (active) 5.448B RADIOLOCATION 5.448D SPACE RESEARCH (active) 5.448C	AERONAUTICAL RADIONAVIGATION 5.449 EARTH EXPLORATION- SATELLITE (active) 5.448B RADIOLOCATION 5.448D SPACE RESEARCH (active) 5.448C EU2 EU22	Active sensors (satellite) Defence systems Position fixing Shipborne and VTS radar Weather radars				Tactical and weapon system radars Ground based and airborne
5460 - 5470 MHz						
EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION 5.448D RADIONAVIGATION 5.449 SPACE RESEARCH (active) 5.448B	EARTH EXPLORATION- SATELLITE (active) RADIOLOCATION 5.448D RADIONAVIGATION 5.449 SPACE RESEARCH (active) 5.448B EU2 EU22	Active sensors (satellite) Defence systems Position fixing Shipborne and VTS radar Weather radars				Tactical and weapon system radars Ground based and airborne



<i>RR Region 1 Allocation and RR footnotes and Frequency Band</i>	<i>European Common Allocation</i>	<i>Major utilisation</i>	<i>European footnotes</i>	<i>ECC/ERC document</i>	<i>Standard</i>	<i>Notes</i>
5470 - 5570 MHz						
EARTH EXPLORATION-SATELLITE (active)	EARTH EXPLORATION-SATELLITE (active)	Active sensors (satellite)				
MARITIME RADIONAVIGATION	MARITIME RADIONAVIGATION	Defence systems				Tactical and weapon system radars
MOBILE except aeronautical mobile 5.446A 5.450A	MOBILE except aeronautical mobile 5.446A 5.450A	Position fixing				
RADIOLOCATION 5.450B	RADIOLOCATION 5.450B	Shipborne and VTS radar				
SPACE RESEARCH (active)	SPACE RESEARCH (active)	WAS/RLANS		ECC/DEC/(04)08	EN 301 893	Within the bands 5150-5350 and 5470-5725 MHz
5.448B	5.448B EU2			ERC/REC 70-03		
5.450	EU22					
5.451		Weather radars				Ground based and airborne
5570 - 5650 MHz						
MARITIME RADIONAVIGATION	MARITIME RADIONAVIGATION	Defence systems				Tactical and weapon system radars
MOBILE except aeronautical mobile 5.446A 5.450A	MOBILE except aeronautical mobile 5.446A 5.450A	Position fixing				
RADIOLOCATION 5.450B	RADIOLOCATION 5.450B	Shipborne and VTS radar				
5.450	5.452 EU2			ECC/DEC/(04)08	EN 301 893	Within the bands 5150-5350 and 5470-5725 MHz
5.451	EU22	WAS/RLANS		ERC/REC 70-03		
5.452		Weather radars				Ground based



<i>RR Region 1 Allocation and RR footnotes and Frequency Band</i>	<i>European Common Allocation</i>	<i>Major utilisation</i>	<i>European footnotes</i>	<i>ECC/ERC document</i>	<i>Standard</i>	<i>Notes</i>
5650 - 5725 MHz						
MOBILE except aeronautical mobile 5.446A 5.450A	MOBILE except aeronautical mobile 5.446A 5.450A	Amateur	EU17		EN 301 783	Within the band 5660-5670 MHz
RADIOLOCATION	RADIOLOCATION	Amateur Satellite (E/S)	EU23		EN 301 783	Within the band 5660-5670 MHz
Amateur	Amateur	Defence systems				Tactical and weapon system radars
Space research (deep space)	Amateur-satellite (E/S)	Position fixing				
5.282	5.282 EU2					
5.451	EU17	Shipborne and VTS radar				
5.453	EU22					
5.454		WAS/RLANS		ECC/DEC/(04)08	EN 301 893	Within the bands 5150-5350 and 5470-5725 MHz
5.455				ERC/REC 70-03		
		Weather radars				Ground based and airborne
5725 - 5830 MHz						
FIXED-SATELLITE (E/S)	FIXED-SATELLITE (E/S)	Amateur			EN 301 783	
RADIOLOCATION	RADIOLOCATION	BFWA		ECC/REC 06-04		Within the band 5725-5875 MHz
Amateur	Amateur	Defence systems				Tactical and weapon system radars
5.150	5.150 EU2	ISM				Within the band 5725-5875 MHz
5.451	EU22					
5.453		Non-Specific SRDs		ERC/REC 70-03	EN 300 440	Within the band 5725-5875 MHz
5.455		RTTT		ECC/DEC/(02)01	EN 300 674	Within the band 5795-5805 MHz. RTTT in the band 5805-5815 MHz on a national basis
5.456				ERC/REC 70-03		
		Weather radars				Ground based and airborne



<i>RR Region 1 Allocation and RR footnotes and Frequency Band</i>	<i>European Common Allocation</i>	<i>Major utilisation</i>	<i>European footnotes</i>	<i>ECC/ERC document</i>	<i>Standard</i>	<i>Notes</i>
5830 - 5850 MHz						
FIXED-SATELLITE (E/S) RADIOLOCATION	FIXED-SATELLITE (E/S) RADIOLOCATION	Amateur Satellite (S/E)	EU23			Within the band 5830-5850 MHz
Amateur Amateur-satellite (S/E)	Amateur Amateur-satellite (S/E)	Defence systems		ECC/REC 06-04		Within the band 5725-5875 MHz
5.150	Mobile 5.150	ISM				Tactical and weapon system radars
5.451	EU2 EU22	Non-Specific SRDs		ERC/REC 70-03	EN 300 440	Within the band 5725-5875 MHz
5.453		Weather radars				Ground based and airborne
5.455						
5.456						
5850 - 5925 MHz						
FIXED FIXED-SATELLITE (E/S)	FIXED FIXED-SATELLITE (E/S)	BFWA		ECC/REC 06-04		Within the band 5725-5875 MHz
MOBILE 5.150	MOBILE 5.150	FSS			EN 301 443	Priority for civil networks
		ISM				Within the band 5725-5875 MHz
		Non-Specific SRDs		ERC/REC 70-03	EN 300 440	Within the band 5725-5875 MHz