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

DRAFT ECC RECOMMENDATION (06)04

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

Recommendation adopted by the Working Groups Frequency Management (FM) and Spectrum Engineering (SE)

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;

g) that the frequency band 5795–5815 MHz is designated for 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:

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

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

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

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

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.