Project	**IEEE 802.16 Broadband Wireless Access Working Group**	
Title	**BWA activities within ETSI and CEPT/ERC**	
Date Submitted	**1999-11-03**	
Source	Barry Lewis UK Radiocommunications Agency 189 Marsh Wall London E14 9SX	Voice: +44 171 211 0313 Fax: +44 171 211 0115 E-mail: lewisb@ra.gtnet.gov.uk
Re:	Liaison and co-operation with other bodies addressing BWA.	
Abstract	A joint letter on behalf of ETSI WG-TM4 and CEPT SE Project Team SE19, plus two informative attachments.	
Purpose	802.16 should note the contents of the letter which offers some visibility of activities in Europe relating to BWA. These activities are very similar to those within 802.16 albeit focussing initially on different frequency bands. Further co-operation between the parties involved may be usefully encouraged considering the global view being taken.	
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Release	The contributor acknowledges and accepts that this contribution may be made public by 802.16.	
IEEE Patent Policy	The contributor is familiar with the IEEE Patent Policy, which is set forth in the IEEE-SA Standards Board Bylaws <http://standards.ieee.org/guides/bylaws> and includes the statement: "IEEE standards may include the known use of patent(s), including patent applications, if there is technical justification in the opinion of the standards-developing committee and provided the IEEE receives assurance from the patent holder that it will license applicants under reasonable terms and conditions for the purpose of implementing the standard."	

Source: ETSI WG-TM4 and CEPT WG-SE PTSE19

Title: BWA activities within ETSI and CEPT/ERC

To: Dr Roger Marks, Chairman IEEE 802.16

Copy: Roberto Macchi; Chairman ETSI WG-TM4
Markus Dreis; Chairman CEPT WG-SE PT SE19

From: Barry Lewis, RA London, obo ETSI TM4 and CEPT PT SE19

Date: 28th October 1999

Dear Dr Marks,

Your work regarding standardisation for BWA within the IEEE 802 Standards committee is noted with interest by both ETSI and CEPT/ERC[1] within Europe. Noting that you have already had some contact with the ETSI BRAN project it is thought that you may be interested in some further information regarding work of a similar nature being tackled within Europe.

Interest in BWA in Europe is growing with licensing taking place in the 26GHz and 28GHz frequency bands in many countries and a recent decision to harmonise use of the 40GHz band for Multimedia Wireless Systems (MWS). MWS are defined as terrestrial broadband fixed wireless access systems with origins in both telecommunications and broadcasting services. They include systems providing uni-directional distribution (e.g. Multipoint Video Distribution Systems - MVDS) through to fully symmetrical bi-directional systems.

The concept of MWS was developed and continues to be refined within the CEPT Frequency Management Working Group as an answer to the evolution of MVDS to provide broadband telecommunications services. MWS need not be restricted to operation in the 40GHz band and are viewed as an opportunity for a variety of technical solutions delivering a range of broadband services.

The following associated activities are under way or have been completed:

<u>CEPT Spectrum Engineering Project Team SE19:</u>
ERC Report developed to provide guidelines for administrations wishing to make spectrum available for FWA (including BFWA) entitled "Fixed Wireless Access (FWA) Spectrum Engineering and Frequency Management Guidelines (Qualitative)".
A Correspondence Group is considering issues associated with the 40.5-43.5GHz frequency band and MWS including for example, frequency plans, channelisation, inter operator co-ordination, guard bands and sharing issues.

<u>ETSI:</u>
ETSI project BRAN is developing interoperability standards for a broadband wireless access system known as

[1] Regulatory body Conference European des Postes et Telecommunications. A co-operation agreement exists between CEPT and ETSI.

HIPERACCESS. The HIPERACCESS group has recently decided to focus initially on development of a standard for application in the 40.5 - 43.5GHz band.

ETSI WG-TM4[2] has a Work Item DE/TM04097 to write a standard for MWS radio co-existence entitled "Transmission and Multiplexing (TM); Radio equipment for use in Multimedia Wireless Systems (MWS) in the band 40,5 GHz to 43,5 GHz. " This work is at an early stage and is linked with both the work of CEPT SE19 and the ETSI BRAN project. Additionally a work item has been proposed to address antenna issues for MWS in the same band.

The following attachments are included for further information:

a) Attachment 1: ERC Report "Fixed Wireless Access (FWA) Spectrum Engineering and Frequency Management Guidelines (Qualitative)".
b) Attachment 2: ETSI TM4 Work Item DE/TM04097 for MWS including the scope of the work.

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[2] ETSI WG TM4 develops radio co-existence standards for Fixed Service p-p and p-mp radio systems including antennas. It is a working group under the general area of Transmission and Multiplexing (TM) within ETSI. See www.etsi.org for further detail.

ATTACHMENT 1

DRAFT ERC-REPORT
ON
FIXED WIRELESS ACCESS (FWA) SPECTRUM ENGINEERING & FREQUENCY MANAGEMENT GUIDELINES (QUALITATIVE)

[Place, Month] 1999

FIXED WIRELESS ACCESS (FWA) SPECTRUM ENGINEERING & FREQUENCY MANAGEMENT GUIDELINES (QUALITATIVE)

Summary

This document exclusively addresses terrestrial P-MP systems used for FWA, including multimedia wireless systems (MWS) applications.

Although these guidelines are intended primarily for the use of administrations and operators, they should also be of benefit to manufacturers and all those involved in preparing corresponding standards. The material is qualitative rather than quantitative, but work is underway, within both the ERC and internationally through the ITU-R, to supplement this material with more specific and quantitative information in specific bands used for FWA.

Whilst work continues to prepare this additional material, it is expected that the current report will prove useful in its present form. Part of the report, Section 3, is of a different nature than that of the other sections in that it also contains guidance and suggested considerations for the purpose of generating frequency arrangements (band plans) appropriate to FWA use. Such plans form an important part of the work of CEPT, and this document should aid the refinement of existing plans or the generation of new ones within CEPT WG SE. It is acknowledged that extant plans were developed over many years exclusively for P-P (DRRS) systems featuring conventional channelisation schemes, but there is now a real need to tailor them to better accommodate the new generations of multipoint systems; this point has now also been recognised within the ITU-R and new Recommendations on such block-based frequency arrangements are under development.

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1 . INTRODUCTION

This document exclusively addresses terrestrial P-MP systems used for FWA, including MWS, applications. These fixed wireless access systems generally feature air-side concentration and contiguous cellular (area) deployment arrangements, and this document takes due account of the several important similarities with, and differences between, these systems and both conventional P-P systems on the one hand and cellular mobile systems on the other hand.

Although these guidelines are intended primarily for the use of administrations and operators, they should also be of benefit to manufacturers and all those involved in preparing corresponding standards. The material is qualitative rather than quantitative, but work is underway to supplement this material with more specific information on specific bands used for FWA, and this should be the subject of a subsequent ERC Report.

Whilst work continues to prepare this additional material, it is expected that the current report will prove useful in its present form. Part of the report, Section 3, is of a different nature than that of the other sections in that it also contains guidance and suggested considerations for the purpose of generating frequency arrangements (band plans) appropriate to FWA use. Such plans form an important part of the work of CEPT, and this document should aid the refinement of existing plans or the generation of new ones within CEPT WG SE. It is acknowledged that extant plans were developed over many years exclusively for P-P (DRRS) systems featuring conventional channelisation schemes, but there is now a real need to tailor them to better accommodate the new generations of multipoint systems. This would lead to the encouragement of innovative technologies in a less prescriptive and more flexible regulatory regime (multiple standards, different air interface protocols, technologies, etc.) than is the case for conventional channel arrangements.

Some of the considerations within this report also relate to compatibility of FWA systems with systems in other services, and appropriate sharing studies are underway for the different bands.

1.1 Additional guidance

The additional material mentioned above will in due course contain information on interference calculation methodology, systems parameters, reference model results for model scenarios, and some information on interpretation (inc. sensitivities, identification of simplifying assumptions and other factors which may need considering).

1.2 Terminology

As far as possible, this report is consistent with the vocabulary and terminology developed within the ITU-R at the time of preparation of this report.

2. FREQUENCY ASSIGNMENT GUIDANCE

For co-deployment of FWA systems in the same geographical area, it is necessary to:

(2.1) take account of the ERC Recommendation on preferred frequency bands for FWA systems, ref. ERC/REC/(99) [XX].
(2.2) take account of the ERC Decision on the designation of the harmonised frequency band 40.5 to 43.5 GHz for the introduction of MWS, including MVDS, ref. ERC/DEC/(99) [XX].
(2.3) assign sufficient spectrum to enable operators to be competitive; sub-bands should not be too small to preserve spectrum efficiency since any guard bands must be accounted for, and wherever possible co-sharing should be encouraged.
(2.4) take note that generally best spectrum efficiency is obtained by use of contiguous rather than non-contiguous arrangements, taking into consideration systems design and necessary frequency separation issues.
(2.5) plan for traffic growth, and to remember that in general one needs continuous spectrum, although some systems may assist planning in using non-continuous spectrum.
(2.6) take note that, whereas assigning spectrum to several potential operators across a band facilitates comparison of competitive proposals by these operators, it may be equally acceptable to facilitate competition by use of other bands.
(2.7) take note that if too many operators are assigned spectrum in a band, this may be counter-productive in terms of spectrum efficiency.
(2.8) incorporate suitable guard bands to mitigate interference, taking account of the different mix of technologies used, in order to attain an acceptable compromise between performance degradation and necessary protection/mitigation measures, including guard bands.
(2.9) specify for FDD systems, a consistent plan for the forward (CS to TS) and reverse (TS to CS) sub-band frequencies. It may be assumed that generally the forward (down) link should be at the higher frequency, similar to accepted usage in most cellular and satellite systems, but exceptional cases may dictate the reverse. Account must be taken of the added complications where mixed up/down directions are used.
(2.10) take account that for TDD systems the designation of forward and reverse link directions is no longer possible, and in this case additional interference scenarios need to be considered.
(2.11) take account that when considering accommodation of P-MP with P-P systems in the same band, e.g. for the 24.5-26.5 GHz band, one possible approach can be to make appropriate regional/national allocations for each FS type from opposite ends of the sub-bands, with the proportion of total band usage for each type perhaps determined by market or other needs; the more conventional approach is to apportion parts of the band for the two FS types on an *a priori* basis.
(2.12) note that in some cases the spectrum assigned for P-MP applications could in part be used for in-band infrastructure support for the P-MP systems. Where this is done, due account must be taken of the any regulatory or other rules / requirements set for these virtual P-P sub-links.
(2.13) take care when comparing different technologies and their spectrum usage, taking account that there is as yet no definitive guide to comparing spectrum efficiency in a simple manner; consideration needs to be taken of cluster size, consequences of mixed technologies according to these guidelines, quality and grade of service and other factors.
(2.14) use actual/typical parameters, wherever possible, for the calculation of the compatibility factors, rather than just the minimum requirement limits from the corresponding ETSI/other standards, and take account of the sensitivity of the results to these parameters.

Further studies are underway to consider interference between different FWA systems, and their compatibility with systems in other services.

3. FREQUENCY PLANS

3.1 General

For geographically co-deployed FWA systems, it is necessary to:

(3.1) take note that to date FS frequency plans have generally been prepared for P-P telecommunications systems featuring use of FDD, with symmetric channel / sub-band widths which may not be appropriate for all FWA systems.

(3.2) take account that services with *variable* asymmetry are often needed, especially for broader band applications[1].

(3.3) take account that asymmetry may be achieved by:

- pairing narrower channels in one direction with wider channels in the other
- using different orders of modulation in one direction from that used in the other
- using asymmetrical TDD.

(3.4) take account that having narrower channels in one direction and wider in the other can accommodate traffic efficiently only where this traffic exhibits a *fixed* asymmetry matching the ratio of the channel/sub-band widths. Such a fixed sub-bands approach is inherently less efficient for *variably* asymmetric traffic which may exhibit *only over time* a general bias in the traffic in favour of the channel direction enjoying the wider band.

(3.5) take note that it is possible in some cases to "pair" up and down links in widely separated bands, for example an up link within one band together with a narrower down link within a lower band to provide fixed asymmetry for certain MWS applications.

(3.6) take note that some MWS systems, especially those derived in concept from broadcast/distribution type systems, may have a bi-directional rather than unidirectional "interactivity" channel/sub-band. All the guidance provided elsewhere in this document should also apply to this situation.

(3.7) take account that different orders of modulation may be used for the two traffic directions to offer a limited degree of asymmetry (and could result in different characteristics in terms of range/robustness of the up- and down-links) and that this may permit some *variable* asymmetry if the equipment can dynamically adapt the modulation scheme independently in the two directions.

(3.8) take account that TDD with variable time allocated to up- and down-link directions can provide a manner of achieving applications having variable, asymmetrical traffic.

(3.9) take account of the need to promote an equitable burden sharing in respect to guard bands. For example, for the first FWA operator in a band it would be considered prudent and fair to ensure that any guard band/s are included within the assigned sub-band.

(3.10) note that in general a –1 dB interference criterion[2] may be considered appropriate for interference calculations between FWA systems and with other services, unless otherwise stated within ITU-R Recommendations

3.2 TDD assignments in bands with paired spectrum

3.2.1 General

In the case of TDD systems in bands with a **conventional channel arrangements for P-P** systems, it is necessary to:

(3.11) note that where part of the lower band is assigned to a TDD system then the corresponding part of the upper band should also be assigned to TDD systems, and *vice versa*.

(3.12) ensure that the TDD assignment fully respects the homogeneous pattern of frequency slots as stipulated for the FDD channel raster.

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[1] as opposed to the type of *fixed* asymmetry needed by, for example, video surveillance type systems with narrowband down-link capacity and wideband upstream capacity.

(3.13) note that for *fixed asymmetrical* applications based on FDD and operated with channel arrangements previously designed to be suitable for *symmetrical* FDD use (having equal channel widths in both upper and lower bands), it is possible for n channels of the lower sub-band to be paired with m channels of the upper sub-band. The "surplus" unpaired |m-n| channels could be usefully assigned to TDD services (including any necessary guard band allowance)

(3.14) take account that in (3.13), and notwithstanding the availability of the m+n channels for fixed asymmetric FDD services, it is possible that these channels could be assigned to one or more TDD channels.

(3.15) take into account the possibility of using the centre gap for TDD, provided the requirements of Sec. 2 are observed.

3.2.2 Implementation

In the case of TDD systems in bands with a **conventional channel arrangement for P-P** systems, it is necessary to:

(3.16) note that there may be particular spectrum engineering issues (such as constraints on transmitter masks and the need for guard bands) associated with operating TDD systems in a band already accommodating FDD systems.

(3.17) note that additional parameters may have to be considered in coexistence planning of TDD systems.

(3.18) note that it has been asserted that the issue of verifying TDD compatibility with existing FDD systems is a larger task than checking compatibility of a FDD system with existing FDD system (with the same duplex spacing).

4. DEPLOYMENT

For deployment of FWA systems, it is necessary to:

(4.1) consider the benefits of encouraging co-operation between operators in order to minimise interference and consequent economic impact, and to seek to use the spectrum efficiently.

(4.2) note that where central stations belonging to different operators in the same geographical area are proposed to be sited relatively close, it may be preferable to co-locate these stations to minimise and better define the near/far effect. This may be especially appropriate in those cases where the directions of the forward and reverse frequency sub-bands are consistent between operators.

(4.3) note that where considering compatibility with P-P and other P-MP systems, CS and TS installations should wherever possible minimize P-MP antenna heights and judiciously use antenna angular discrimination, including nulls in the polar pattern, as an additional mitigation measure and to minimise guard band requirements and assist with co-existence.

(4.4) note that similarly where considering co-existence between co-frequency operators across service - area boundaries, CS and TS installations should wherever possible minimise P-MP antenna heights and judiciously use antenna angular discrimination, including nulls in the polar pattern, as an additional mitigation measure.

(4.5) note that polarisation may be used as a system propagation discriminant, although less usefully at lower frequencies. This can be useful to mitigate interference.

(4.6) note that in some cases terrain features can usefully be exploited to minimise interference, both intra- and inter- service.

(4.7) note that where considering compatibility with FSS systems, account should be taken of ITU-R Recommendations where available, including any guidelines covering the FSS and P-MP antenna heights, separation distances, allowable range of elevation view angles, additional diffraction or other mitigation measures.

(4.8) note that where considering compatibility with the radioastronomy service, it is important to comply with both the ITU-R Radio Regs. and also the ERC Report on necessary separation distances (ref. ERC [XX-Y]), taking account the aggregation effect of P-MP systems as appropriate.

(4.9) note that where considering compatibility with radiolocation/navigation systems in adjacent bands or in neighbouring countries, account should be taken of existing relevant ITU-R Recommendations. For radiolocation / navigation systems that may be in-band, account should be taken of ITU-R Recommendations where available, including any specific methodology needed to ensure compatibility for the particular technology and radar type/s. Furthermore ERC Report 051 may be found instructive in this regard.

(4.10) take account of the need to plan and deploy CS and TS antennas which are no less directional than is required for the intended intra-system deployment and which are sited no higher than is necessary to ensure adequate performance margin.

(4.11) implement any necessary synchronisation and/or other measures to accommodate mixed technologies are implemented as appropriate.

5. EQUIPMENT DESIGN

For FWA systems, it is necessary to:

(5.1) take account of the importance of minimising spurious and out of band emissions through appropriate equipment design.

(5.2) take account of the importance of maximising receive selectivity (and noting that ETSI/other standards may be insufficiently detailed/stringent in all cases).

(5.3) take account of the desirability, consistent with compliance with the required level of quality and grade of service, of incorporating measures to ensure adequate transmit power control, dynamic channel/frequency and/or other adaptive measures to enhance compatibility.

GLOSSARY AND ABBREVIATIONS

CS	Central (base) station
DRRS	Digital Radio Relay System
FDD	Frequency Division Duplex
Forward link	CS to TS path, also termed down-link
FS	Fixed service (ITU-R service category)
FWA	Fixed wireless access
MWS	Multimedia wireless systems
Multipoint	Embraces all P-MP and MP-MP FS systems
P-P	Point - to - point
P-MP	Point - to – multipoint
Reverse link	TS to CS path, also termed up-link
RPE	Radiation Pattern Envelope
TDD	Time Division Duplex
TS	Terminal (end user) station

Attachment 2

ETSI

Draft New Work Item

Form to be used when proposing new Work Items for adoption onto the ETSI Work Programme.

Work Item details:

Which Technical Body is responsible? choose from this list: TM or from this list: (EPs in this list) or from this list: (EPPs in this list) or from this list: (other cmtees in this list) or enter name if not in either list:	**Working Group:** **Subgroup (if any):** TM4
WI reference number (if known): part *(number will be allocated by Secretariat if not shown)*	**Will an STF be requested?** ☐ STF number (if known): **EC mandate number (if relevant):** BC-
Working title: Transmission and Multiplexing (TM); Radio equipment for use in Multimedia Wireless Systems (MWS) in the band 40,5 GHz to 43,5 GHz.	**Scope of work to be undertaken:** See attached sheet.
Rapporteur (named individual person): name: Philip Whitehead organisation: Plextek Ltd postal address: London Rd postcode CB10 1NY city Gt. Chesterford, Essex country UK e-mail: pw@plextek.co.uk phone: +44 1799 533200 fax: +44 1799 533201	**Supporting ETSI Member organisations:** **(name at least four)** DTI (UK) Hughes Network Systems Radiant Networks Bosch Telecom GmbH Nortel Networks Lucent Technologies

Deliverable document details:

What type of document will be produced? choose from list: EN or enter explicitly: Possibly multi-part Proposed Harmonized Standard? ☐	**Is it a new document or a revision of an existing one?** New **If a revision, state the deliverable (e.g. ETS 300 987 ed 1) *being revised*:** edition / version
Formal title of deliverable:	Transmission and Multiplexing; Radio Equipment used in Multimedia Wireless Systems (MWS) in the band 40,5 GHz to 43,5 GHz.

Work schedule:

Milestone	Target date
Date of creation of this Work Item	4/6/99
Date Work Item approved by Technical Body	already approved? ☐
Start of work date:	June 1999 already started? ☐
Progress milestones (optional): title ToC and Scope text available First complete draft available. (specify) (specify)	 December 1999
Target date for approval of deliverable by WG:	June 2000
Target date for approval of deliverable by TB:	September 2000
For EN deliverables only: Is draft EN to be approved by OAP or TAP?	 TAP

Remarks: Activities within CEPT may lead to the future identification of additional frequency bands for MWS.

Scope of the Work Item:

Equipment performance characteristics and parameters necessary to facilitate coexistence between broadband Multimedia Wireless Systems (MWS) in either;

- adjacent frequency assignments in the same geographical area.

or

- co-frequency assignments in neighbouring geographical areas.

Multimedia Wireless Systems are defined as terrestrial multipoint systems which have their origin in telecommunication and/or broadcasting, and which provide fixed wireless access direct to the end user for multimedia services. These MWS systems may offer different degrees of interactivity.Therefore systems are anticipated that could deliver services requiring either asymmetric data rates, (including uni-directional distribution systems) or symmetric data rates between uplink and downlink. Any asymmetry between uplink and downlink may be fixed or dynamically variable to suit the traffic characteristics at any time.

This standard covers equipments that operate within the frequency band 40.5 to 43.5 GHz.