

COMMERCIAL CONSIDERATIONS FOR BROADBAND FIXED
WIRELESS ACCESS SYSTEMS IN THE 5GHZ 'BAND C'
(5725-5875MHz) SPECTRUM

WIRELESS ADVISORY GROUP
MAY 2003

1. EXECUTIVE SUMMARY

This report presents the commercial drivers and opportunities for the efficient use of the 5 GHz Band C spectrum. It focuses on the key issues that will ensure the long term success of the existing and the new businesses set up to provide these services. It also addresses means to overcome barriers that may arise for the commercialisation of Band C. The report highlights the main issues that WAG has identified to facilitate Broadband FWA in the 5GHz Band C spectrum and provides recommendations that should enable non-technical users to develop and deploy systems.

WAG is also developing other complementary documents, one on sharing of Broadband FWA with other radio services in the 5GHz Band C spectrum, one on the Authorisation scheme and another on the Interface Requirement.

These four documents together form part of the advisory role of WAG and the ongoing consultation exercise with the Radiocommunications Agency.

1.1 Background

The growth in licence exempt use in the 2.4 GHz and 5 GHz bands is an established fact with the lead taken by the US market, especially for 5 GHz. It is enabling the rapid growth of new services that are bringing social and economic benefit to all parts of the population. However, there are restrictions in the use of the 5 GHz bands A and B spectrum which limit the development of broadband services. These include coverage, regulatory (mobile not fixed) and technical (HiperLAN compliant), constraints.

The early release of the 5 GHz band C (referred to in this report as Band C) will add spectrum for outdoor, long range, Broadband FWA to the range of services available. The use of fixed antennas (with necessarily narrow beamwidth for less interference) often mounted externally to buildings will result in a high availability of service for some deployments while other systems will use omni-directional antennae.

1.2 Unique characteristics

It is the possibility to provide longer range, outdoor connectivity that characterises Band C and sets it apart from the existing bands. This will significantly enhance the capabilities of, for example, community services by increasing the coverage and enabling rural community organisations to gain access to Broadband services. In this way Band C complements the existing applications and opens up the opportunity to expand them.

Band C will enable broadband services to be provided to areas and subscribers that are beyond the technical and economic reach of wire and broadband cable. Band C is a very necessary enabler for applications that need low cost, longer-range radio connections such as the interconnection of hot spot and community access 'lily pads'.

Examples of services that can be provided using Band C technologies include high speed Internet, community networks, business and residential networks, educational services, health services and community based security monitoring. The demand for these services is well demonstrated by the clamour for broadband access and there is no doubt that once established systems using Band C will find new and innovative uses.

One major conclusion of the Commercial Group is that any delay to opening Band C will mean that the opportunity to develop many highly beneficial and essential community services will be lost.

Opening Band C will:

- Provide coverage to areas that are unserved or underserved and are likely to remain so in areas where wire line connection is unlikely to be cost effective.
- Enhance the viability of the complementary licence exempt bands.
- Will enable the community of small business users to compete with larger corporate businesses by providing affordable broadband access. Thereby giving newcomers an opportunity to compete with established operators.

Due to the sensitivity of business and market plans, it is not possible within this report to demonstrate business plans. Individual businesses wishing to develop services will be better able to demonstrate the viability of their proposals since they will have full details on predicted growths, financials, markets, subscribers numbers and type etc. However, comments from a multitude of UK companies and organizations representing, manufacturer, service provider, subscriber, content providers, and other interested companies are implicit in the views and recommendations expressed in the report.

There has been a high level of enquiries and interest for spectrum allocations during the preparation of this report, which is clear evidence that large numbers wish to deploy outdoor broadband wireless services.

1.3 Recommendations

WAG recommends that:

- 1 Band C should be opened as soon as possible to catalyse the rollout of longer-range services, for example, to serve more sparsely populated areas and to interconnect access points.
- 2 Opening of the Band need not be delayed by waiting for the development of standards.
- 3 All types of fixed application, voice, data and video, should be permitted in the band, taking note of relevant of DTI and international regulations.
- 4 Any Interim Regulations shall take note of international regulatory developments within Europe and at the ITU where these are available.
- 5 It is highly desirable to promote arrangements for the rest of Europe that are as close as possible to the UK decisions in order to ensure that the UK is not isolated.
- 6 Regulations should allow flexibility for Band C to be used by any topology including point – multipoint, mesh and point-to-point links (for long range interconnection using higher gain and narrow beam width antennas e.g. for connection of community networks and for connection to national broadband networks).
- 7 The regulation regime shall ensure open access to the spectrum for all.
- 8 Regulations shall remain unchanged for a minimum of 3 years in order to support technology over its natural life span
- 9 Interim Regulations shall take note of likely technical developments

These recommendations are intended to support the aim that regulation should enable non-technical users to develop and deploy systems.

1.4 Opportunities

2. UNIQUE QUALITIES

Band C is unlike the other licence exempt bands in that with its higher power and bandwidth it can provide outdoor coverage and broadband connectivity to link local communities rapidly and economically. The ultimate goal for equipment design will be a low cost product designed for flexible deployment either by the end users or by service providers.

This could open a window of opportunity for the development of new services and new communities.

3. ESTABLISHED TECHNOLOGY

It is anticipated that low cost products, making use of established technology can be developed quickly so that new services can be launched at an early stage.

3.1 Key Issues

Band C will be fixed in place, rather than in a laptop or other portable device. Applications that require mobility while in use should be in 5GHz Band A + B or 2.4GHz if they are expected to remain in the coverage of a single cell during a session or should use mobile services such as 3G if they are required to migrate a session from one cell to another.

Band C broadband fixed wireless is an enabling technology from which will flow many new social and economically beneficial products and services. We will miss these opportunities if the band is not opened quickly. It could also provide a catalyst for wider take up of fixed wireless access in licensed bands. To enable this to happen there are a number of key issues to address.

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5. ACCESS POINT REGISTER

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A database holding information on location and height (if appropriate) may be required to assist coordination between and with other services. The location of sites, and proposed sites, is commercially sensitive information and this must be taken into account constructing the register. There needs to be a balance between easy access to information and the protection of commercial interests.

WAG should be intimately involved in the design and implementation of this database and the processes by which the information is made accessible. See the WAG Report on the Authorisation scheme for further information.

7. PLANNING

Key messages relating to planning permissions, local government policy and environment aspects need to be generated. There will need to be national harmonisation of local regulations.

8. USER REQUIREMENTS

Much of the existing common telecommunications use of licence exempt spectrum in the UK is for Wireless LAN applications. WLAN equipment is already developed to the point where it can be installed, configured and used by non-technical users. It is also being used to set up networks for business, academic and social use where it meets a need for low cost, rapid deployment broadband connectivity.

Similar goals of low cost and ease of use should apply for Band C licence-exempt operation.

9. COSTS

In some business models the costs of the consumer equipment may be carried by the end users rather than a service provider. However, the costs of the network infrastructure will usually be carried by the service providers. Hence, equipment should be available in volume and at volume production costs. Other business models exist and it is vital that the regulations allow flexible use of common elements so that all business models can co-exist. The revenues available to service providers need to be competitive with the complementary access networks.

The equipment costs for Band C will need to compare with the costs of other access technologies.

10. BACKHAUL

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Services offered in Band C will in many cases require connection to and interoperation with, other third party high-speed broadband infrastructures or access networks. These could be owned and operated by the users of Band C networks and therefore Band C may need to provide its own backhaul capability as well as point-to-point links for other purposes. There are several alternatives for the provision of Backhaul and these will need to be assessed by individual businesses.

12. INTER-OPERATION

The services provided in Band C that extend beyond a small local population will require interfaces to other broadband networks.

Where possible existing standards and protocols should be used at the Interfaces.

13. COMMUNITY NETWORKS

Where communities wish to set up their own local non-standard networks the licensing regime should have the flexibility to allow for this.

By this means Band C will encourage competition in the market place.

14. SOCIAL BENEFIT / INCLUSION

Band C will provide significant new business opportunities by providing, for example, access to High Speed Internet (HSI). Importantly, access could be provided to populations that are currently beyond the

economic reach of wire-line and Broadband cable. This can only happen if regulations make it possible to offer services that are attractive to low density rural populations.

Apart from purely commercial applications Band C will enable educational, health and community care applications to be developed. These may include school homework clubs and access to school based information to both students and their parents, health care for the elderly or physically impaired members of the community, access to local and national government information.

Licence costs must be kept to the minimum to ensure the services are affordable by as wide an audience as possible.

15. COMPETING TECHNOLOGIES

Band C is behind the market for public access to Broadband and High Speed Internet services as can be seen by the growth of service provision in areas where wire line back haul is available. A benefit of Band C is that it is the cost effective to use, for both public and for private use.

Even though it offers differentiating features such as higher speed and symmetrical capacity it may be hard to displace existing ADSL or Cable connections for fixed customers. However, there are many opportunities for Band C to be used as a complementary technology to extend the range of wire line networks.

Band C services should complement those available from 3G systems. While Band C offers wireless connectivity, it is more suited to fixed operation than the spectrum used for 3G.

16. ENABLERS

Band C brings together a number of existing enablers for the growth of broadband services and networks that are already in place.

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However, the following have been identified as needing development:

- Chip set development for Transmitter Power Control (TPC)
- Chip set development for Dynamic Frequency Selection (DFS)
- High power RF amplifier components and 'front-ends' – to gain full benefits of long range outdoor broadband services
- Devices that allow VoIP – that will increase the value of Band C and build the business case

In addition the interfaces to the core services and networks need to be defined.

The regulatory environment should encourage their rapid development by setting a clear development path.

18. DEMONSTRATED DEMAND

There are a number of public domain sources of evidence for the demand for access to licence exempt spectrum including Radiocommunications Agency data on applications for licences and commercial databases on sales volumes. These range from the sales of 802.11b to the registered requests for Broadband Fixed Wireless Access spectrum licences from operators at both national and local level.

Annexes I & II to this report address the specific areas of the Digital Divide and of Broadband Access in Rural Communities.

19. MARKET GROWTH FORECASTS

The traditional growth curve for Broadband demand has been exponential. However, there is some evidence that this trend has a natural limit. It is expected that growth in the use of Band C will very likely follow such trends.

Market growth is likely to come from increasing numbers of users and the provision of new applications rather than demand for higher speeds by individual users.

20. USER POPULATIONS

The majority of users of broadband were, initially, business related - especially the Small and Medium Enterprises (SMEs), Small Office Home Office (SOHO) and the Homeworker communities. However, it is increasingly difficult to separate these groups from the residential users. As the business related use enables the development of equipment and deployment of networks and services it is likely that Band C will move into the residential market as well.

Early indications of demand indicate that the growth of community based services will be a major driver.

21. SERVICES

Speed of deployment, ample bandwidth and power to support long range will be significant enablers for growth.

These characteristics will provide productivity gains for many small businesses where the exchange of high volumes of data is an essential element, as in the exchange of CAD files or hosting web sites.

22. APPLICATIONS

Whilst nomadic business users increasingly need access to their corporate networks, it is the Small businesses that recognise the immediate benefit. Many of these businesses are either in rural environments, or are businesses increasingly being operated from home.

The ability to gain fast broadband connection, linked to a local wireless environment, allowing staff to access the web simultaneously, significantly improves business efficiency. Some businesses such as engineering, music, graphics, publishing and design need to download large volumes of data which will require high speed connection.

Low cost security systems will benefit both business and residential users thus reducing insurance costs, and reducing crime.

23. MARKET PLAYERS

The most visible groups are:

- Wireless 'hot spot' service providers who wish to use Band C to interconnect access points.
- Existing large service providers
- Self help local communities

Each category has particular requirements to support their use. For instance, service providers will require an ability to offer a measurable Quality of Service whereas a self help group may see this as less necessary.

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25. HEALTH AND SAFETY

The general issue of the relationship between wireless systems and health is the subject of continuing, extensive expert study. WAG acknowledges this work.

26. OPENING THE BAND

There has to be a balance between early availability and long term stability. Potential service providers will have to demonstrate a return on investment for the medium to long term. End users will similarly have to have assurance that investment in hardware and systems is for the long term also. This implies that standards and regulations are all in place. This is currently not the case, but WAG has drafted Interface Requirement 2007 to assist the early stabilisation of the necessary information.

To wait for all necessary information to be put in place will delay the industry beyond the window of opportunity.

Any interim regulations should be framed to allow for known imminent developments that would enhance the performance of the systems in the band. .

27. SERVICES ALLOWED

As part of the band opening process there will need to be a view on the permitted services. Traditionally voice, video and data have been separated under different regulators. With the imminent arrival of European Directives on the introduction of regulation for Electronic Communications Networks this is no longer appropriate, as these can be generally classified as Multimedia services.

It has become generally accepted that the ISM bands are associated with point to multi-point applications. However, it is essential that simple in-band point-to-point applications are permitted for instance for the interconnection of access points.

Any limiting regulatory conditions set today will reduce the likely development of future services.

Limitations on service types should be minimised in the regulation of the band.

28. REGULATORY PRINCIPLES

It may not be appropriate to transfer US policy to systems for use in the UK. However, there may be some value in considering the principles that are applied by US regulators to the use of U-NII Band. See Annex III for further information.

29. ECONOMIC IMPACT OF OTHER LICENCES

It is expected that the growth of wireless broadband access in general will raise awareness of the possibilities and will encourage the development of services and hardware that may be used as elements of a Band C network.

The likely economic impact of the other Broadband Fixed Wireless Access spectrum licences will have a positive effect on Band C

30. LICENSING SPEED

It is likely that large numbers of license applications will be made for the deployment of Band C network infrastructure. While Band C is licence exempt there is in theory no requirement to control or plan the deployment. However, bearing in mind the social benefits that will accrue from a successful development of the industry and the industries that will flow from it, there is significant value in providing support to applicants.

A critical element of bringing any new service to maturity is the speed and ease with which it can be grown. For Band C this implies a fast process for the allocation of 'permissions'. There must be a rapid response to applications, a low 'ping factor'.

The proposed web accessed database offers a potentially practical tool to ensure this is possible.

ANNEX I

The Digital Divide.

One of the prime policy objectives of the Government is that broadband services should be made available to the whole population. The widespread uptake of broadband services is considered a vital component in the social and economic future well being of the country. Many reports exist that list advantages that can be expected from these services. For example, The Office of Technology Policy in the US Department of Commerce consider the advantages to be:

- Job creation and retention
- Reduced traffic congestion
- More successful industrial growth, recruitment and retention
- Improved educational systems
- More productive research and development
- Increased start-up and entrepreneurial activities
- Urban core revitalisation
- Improved government efficiencies and service delivery

They are completely endorsed by The UK Broadband Stakeholders Group in their 2003 report.

Most of these advantages obviously relate to major societal benefits and those excluded from these advantages will be at a disadvantage. Differences in educational status, job prospects and living environment will become more significant over time resulting in the penalty for being amongst the excluded population becoming more severe. Recent figures indicate that around 12 million people will remain without broadband services unless they are served by transmission schemes that do not use wired connection.

There are many wireless technologies that can achieve lower costs to the operator than a wire transmission equivalent scheme would. For this reason it is possible to establish a sustainable business case for deploying broadband services into less densely populated areas of the country than could be developed using wired transmission given the right regulatory environment. Thus wireless schemes have a major role to play in providing broadband services to a greater extent of the population and thus reducing the proportion of the country disadvantaged by the lack of such services.

ANNEX II

Broadband Access in Rural Communities

Recently we have seen major growth in the deployment of Point-to-Point links utilising unlicensed bands in the USA. This is enabling many businesses to achieve connectivity for the final drop and is also providing the infrastructure for the next level up in the distribution hierarchy of FWA. In this case the need for the economies of scale and chipsets is not as relevant. Capacity range and noise are extremely important for this application and these characteristics may not be provided by the high volume components mentioned in the PMP applications.

Typical examples include the village connection, intra business connections, Municipal, Utilities, Schools and Hospitals (MUSH) and WISPs. In these cases we currently have a BT supplied infrastructure that is unaffordable and slow to deploy. Unrestricted non-bureaucratic access to spectrum has been seen to provide a business boost in the USA and many of the suppliers in the table of example vendors are supplying product to fulfil this need.

One feature of the FCC regulations that enables this position in the C Band is the ability to use a high gain antenna to direct 1 Watt of energy in the direction required. Although there is sensitivity to Radar use in the band this position has now been resolved for the B band (where the radars have been pushed) by mandating DFS. The US government has recognised the importance of allowing these higher power levels to stimulate the broadband economy.

A wireless ISP success story in rural Iowa, Interlink's @anywhere wireless Internet service delivers affordable broadband across the community from local government to small business and residential use. Audiences in the UK have responded to the demonstration of new business applications of broadband Internet. The case of the local architect is a vivid one. With an affordable wireless broadband connection, he is able to manage large data files of up to 50 MB with ease throughout the day. This means that his architectural practice is now able to administer the utilities infrastructure of a city that is 2 hours drive away. The small rural community can now be home for a practice that is able to compete at both State and global levels.

The links will take you to a video edited from materials for a documentary film by S4C (17 mins).

<http://easylink.playstream.com/pads/broadband/iowa-hi.wvx>

<http://easylink.playstream.com/pads/broadband/iowa-lo.wvx>

The "wireless broadband" message is clear. Wireless really is a "first mile" broadband technology solution, empowering rural communities and small businesses to be active participants in the digital revolution.

Url's for Interlink's @anywhere wireless broadband service, which is now franchised across 3 US states:

<http://interlinklc.usonline.com/>

<http://www.interl.net/anywhere/>

In the BSG Case Studies section of the Telecoms Advice UK website there is a link to the ISP Planet article on Interlink's wireless ISP service "Fixed Wireless Marketing Case Study: InterLink's @anywhere in Iowa", ISP-Planet, 6 March 2001 ":

http://www.isp-planet.com/marketing/2001/fw_case_study.html

ANNEX III

US Experience – the U-NII Band

U-NII stands for Unlicensed National Infrastructure Initiative. Spectrum for UNII includes the 5.8 GHz Band. In the build-up to the 1996 Telecoms Act, there was widespread debate upon a "national information infrastructure" for the US.

The regulatory principle of the FCC is to allow no-licence access to spectrum for public policy purposes. The FCC established the U-NII band in 1997 to hasten the rollout of broadband access across the U.S. and to provide more cost-effective wireless networking for businesses, schools, and hospitals. While the spectrum itself is unlicensed, all equipment operated in the U-NII band is subject to FCC regulations. These regulations were designed to maximize the efficiency of spectrum usage and minimize interference.

The FCC limits the power and emissions of each transmitter to allow for the reuse of the spectrum multiple times in the same geographical area without widespread interference.

In addition, the FCC mandates that new service providers in the U-NII band must not cause radio interference with authorized incumbent operations.

The intent of the FCC was to create opportunities for new wireless LANs and to provide high-speed access to the Internet. This would also give rise to the development of new wireless devices, stimulate the growth of new businesses and allow U.S. manufacturers to compete in the global market for unlicensed digital products.