unwired

SENATE
ENVIRONMENT,COMMUNICATIONS, INFORMATION TECHNOLOGY AND THE ARTS REFERENCES COMMITTEE

INQUIRY INTO THE AUSTRALIAN TELECOMMUNICATIONS NETWORK

SUBMISSION BY UNWIRED AUSTRALIA PTY LTD

19 August 2002

@ Level 10, 15 Castlereagh St, Sydney NSW 2000 AUSTRALIA
Web www.unwiredaustralia.com.au **Email** email@unwiredaustralia.com.au
Tel +61 2 9231 6055 **Fax** +61 2 9231 6044

Introduction

Unwired Australia Pty Ltd (Unwired) is pleased to be able to make this submission to the Senate Environment, Communications, Information Technology and the Arts References Committee Inquiry into the Australian Telecommunications Network.

Unwired is a licensed telecommunications carrier and holds radiocommunications spectrum licences won at auction and acquired in the secondary market. These licenses are being used by Unwired to deploy a Fixed Wireless Access (FWA) network that will provide an alternative to Telstra's customer access network in the "last mile".

Unwired welcomes this Inquiry and its contribution to the public discussion of telecommunications and broadband delivery in Australia.

About Unwired Australia Pty Ltd

Unwired holds (via a wholly owned subsidiary Akal Pty Ltd) radiofrequency spectrum licences issued under the *Radiocommunications Act 1992* in the 3.4GHz bands of the radiofrequency spectrum. These licences cover approximately 95% of the Australian population.

These licences were awarded following a spectrum auction conducted by the Australian Communications Authority ("ACA") in late 2000.

Unwired won at auction 2 x 32.5MHz of spectrum with a 100 MHz duplex. In 2001, Unwired acquired a further 2 x 17.5MHz in Sydney and Melbourne from Austar United Licenceco Pty Ltd.

Unwired now owns close to 100% of the 100MHz of 3.4GHz spectrum that was made available in Sydney and Melbourne, and a majority of the spectrum in Australia's other capital cities.

Unwired intends to use this spectrum to participate in the rapidly expanding broadband Internet market by rolling out a FWA network and by delivering bundled voice and broadband access services to residential customers, SOHO (Small Office/Home Office) and SME (Small and Medium Enterprise) customers and Government. Unwired's routes to market include wholesale services to Carriers and Internet Service Providers (ISPs), direct supply relationships initially with corporate and Government customers, and retail service provision.

Unwired is independent, having no alignment to or investment by any Australian or international telecommunication carrier.

Unwired's shareholders include a number of Australian private equity investors and New York-based private equity investment firms Credit Suisse First Boston International Equity Partners, Bruckmann Rosser Sherrill and The Invus Group Ltd.

Unwired's Technology Partners

Unwired has formed a partnering relationship with leading telecommunications and construction companies to work with Unwired to establish the network. Partners include Airspan Networks, Ericsson Australia and Vytel Pty Ltd.

Airspan Networks is a US based supplier of advanced wireless broadband technology. Airspan was selected as a supplier following a comprehensive international search and a formal expression of interest process conducted by Unwired in early 2001. Airspan will supply all equipment related to the radio interface, including central terminals (CTs) and subscriber terminals (STs).

Ericsson is a leading international telecommunications equipment vendor. Ericsson will provide telecommunication network integration systems and services to allow the Unwired network to inter-operate with other telecommunications networks.

Vytel is a subsidiary of Leightons Holdings, one of Australia's most respected construction and project management companies. Via its subsidiary companies LSE and Visionstream, Vytel will be responsible for the installation and maintenance of all equipment installed at customers premises.

Unwired Business Model

Unwired intends to provide access to alternative infrastructure over the "last mile" from the exchange to the customer on a non-exclusive basis.

The last mile, also known as the Customer Access Network (CAN), operates today on twisted pairs of copper wire. Telstra has an historical natural monopoly over the "copper CAN".

For the first time in Australia, Unwired offers the prospect of an alternative access solution to the "copper CAN", connecting customers to the telecommunications network. Unwired proposes to wholesale access to this alternative CAN infrastructure so that carriers with existing customers can supply circuit switched telephone services and broadband without using the Telstra copper CAN.

Unwired Services

Unwired will deliver a range of services, including voice and data; and CPE funding, installation and maintenance.

Unwired has access to two distinctly different technological solutions that are able to use Unwired spectrum. The first is able to deliver toll-quality voice telephony services and broadband data services (in this submission called our telephony/data solution) that are similar to the ADSL offerings being made by most broadband data suppliers in Australia today. These are asymmetrical services with more bandwidth to the customer than upstream to the network. Different service bundles will be offered by Unwired with different levels of high speed data/internet and voice access.

The second technology solution is based on high capacity, high quality point-to-multipoint fixed links that can offer dedicated symmetrical leased lines with high quality of service levels.

Initial services offered by Unwired using the telephony/data solution will include:

Unwired Broadband Internet

- Always on wireless broadband data connections
- Services offering 256/128kbps or 512/128kbps
- Bursts up to 3 Mbps depending on traffic loading and system management
- a Standard Service availability better than 99.7% measured annually

Unwired Voice

- Up to 8 circuit-switched voice services in addition to the data/internet connection per customer
- Meets definition of standard telephone service
- Will support G3 Fax and V.90/V.92 modem access and transparent access to voice and Touch Tone activated services

Unwired Data

- Leased lines with a number of standard interfaces using the purpose designed point-to-multipoint fixed link radio system
- n x 64 kbit/sec fractional E1 dedicated data services;
- Full and multiple E1 (2.048 Mbit/sec); and
- ATM at 155 Mbit/**sec.**

When customers deploy the telephony/data solution, the broadband connection may be used to supply voice telephony using voice over internet protocol (VoIP) technology, but Unwired does not intend to deploy VoIP within its network. Any deployment of VoIP would be a matter for the customer to consider and asses based on its own assessment of reliability. As a practical matter it is anticipated that some customers will use VoIP applications on their broadband services.

The leased line solution can support VoIP on virtual private networks.

Initial services provided by Unwired will address the needs of residential customers, SOHO (Small Office/Home Office) and SME (Small and Medium Enterprise) customers and Government entities (for example, schools, health institutions, etc).

Subscriber Terminal's (STs) for telephony/data services supplied by Airspan can physically support up to 8 standard telephone services. The number of services actually supplied to any customer is software configurable over the air. Therefore, additional services can be supplied quickly and cost effectively.

STs can be dynamically assigned different data rates depending on the services requested and paid for by the customer. Typical services would match retail DSL service packages such as 256/64 and 512/128 kbit/sec configurations currently in the market.

Unwired Technology Selection

Unwired's services are based on a radio systems supplied by Airspan Networks. The telephony/data solution was designed by Airspan, while the leased line solution is an OEM product offered by Airspan.

Before selecting our preferred technology for the telephony/data solution, Unwired conducted an extensive international review of the available technologies that could operate in the 3.4-3.6 GHz bands. The specified requirements for Unwired included:

- circuit switched voice telephony and data on the same platform;
- high speed data;
- low cost;
- technological stability (Unwired wanted to avoid leading edge technology and wanted to see proven field deployments of the system in a range of different situations).

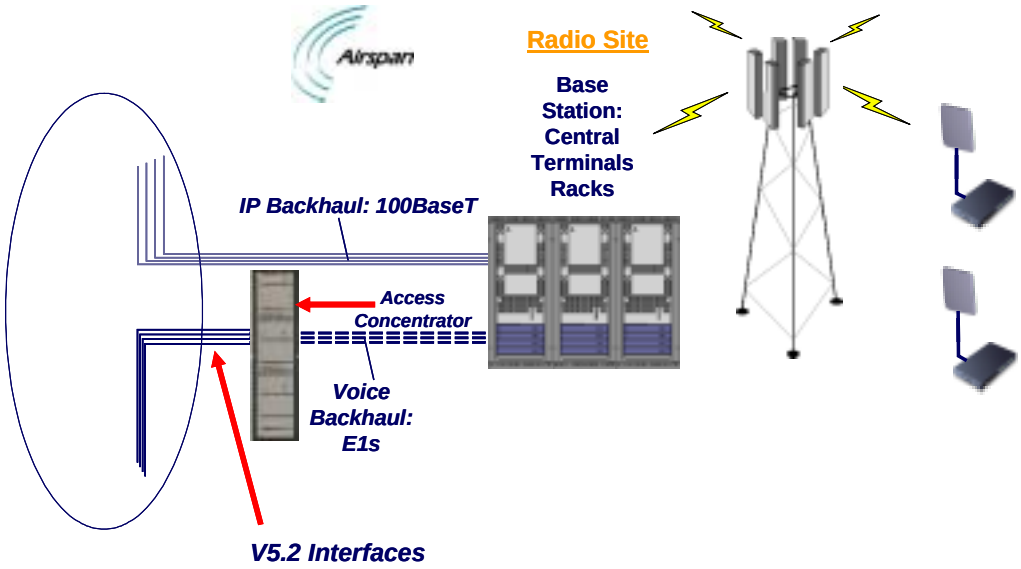
During the review, Unwired was presented with a number of data only vendors, but very few vendors that were capable of providing data and circuit-switched voice services. Many of these data only vendors have closed their doors in the last 12 months as that market has failed to mature.

Unwired is confident the combination of data and circuit-switched voice is the right one for this market.

Unwired Network Architecture

Unwired has developed its Network Architecture to support the broadest range of customers seeking telephony and data services.

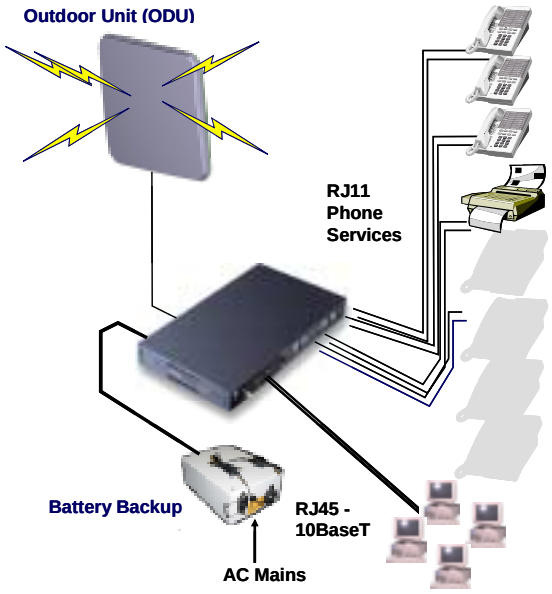
The diagram below shows at the highest level the radio network architecture provided by Airspan, including the access concentrator and its interfaces to the telecommunications system, the CT base stations and the radio link to the ST units.



Subscriber Terminals (STs), as illustrated below comprise a small box of electronics installed inside the customer's premises and an outdoor electronics unit and combined antenna which is installed outside of the premises in a position that has a clear radio link to the central terminal or base station facility. The ST includes a radio receiver and transmitter to allow two-way communication between the ST and the central terminal or base station.

Subscriber terminal

- 1 x RJ-45 Ethernet Port - always on wireless broadband data connections
- 4 x Carrier Class Phone Services Included, with RJ-11 connection and G3 Fax & V.90/92 Modem Supported
- 4 x Phone Line expansion option

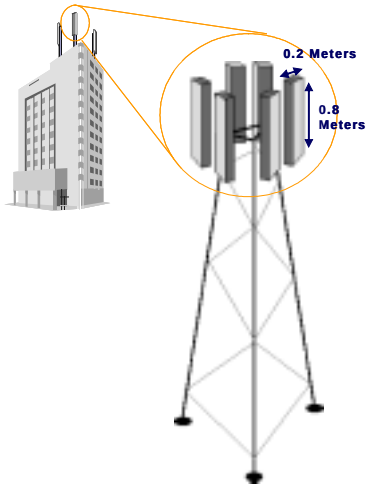


The radio emissions from the Airspan STs are very low. Independent analysis conducted by ARPANSA shows that at even at distances close to the ST where the maximum exposure levels are likely to occur the actual level is still around 15,000 times below the general public exposure limit set by the ACA.

Central Terminals (CT) are similar to the base stations used for mobile telephones. A CT includes power supplies, an equipment rack of radio transmitters and receivers and modem devices. These are installed in an equipment shelter and connected to flat panel antennas located on a mast or some other fixing point. These antennas have low visual and physical impact. Antennas are typically 0.8 metres tall x 0.2 metres wide. Typical mounts might be on a mast, such as a mobile phone tower, or on the top of buildings.

Central terminals

- Business' objective is to use existing sites to maximum extent possible, target is >90% existing sites
- Antennas are typically 0.8 metres x 0.2 metres
- Antenna can be placed from 30 metres to 45 metres above ground and will be typically on buildings
- 4 CTs are in the initial plan for the Eastern Suburbs
- Antennas will be placed with regard to ACIF Code



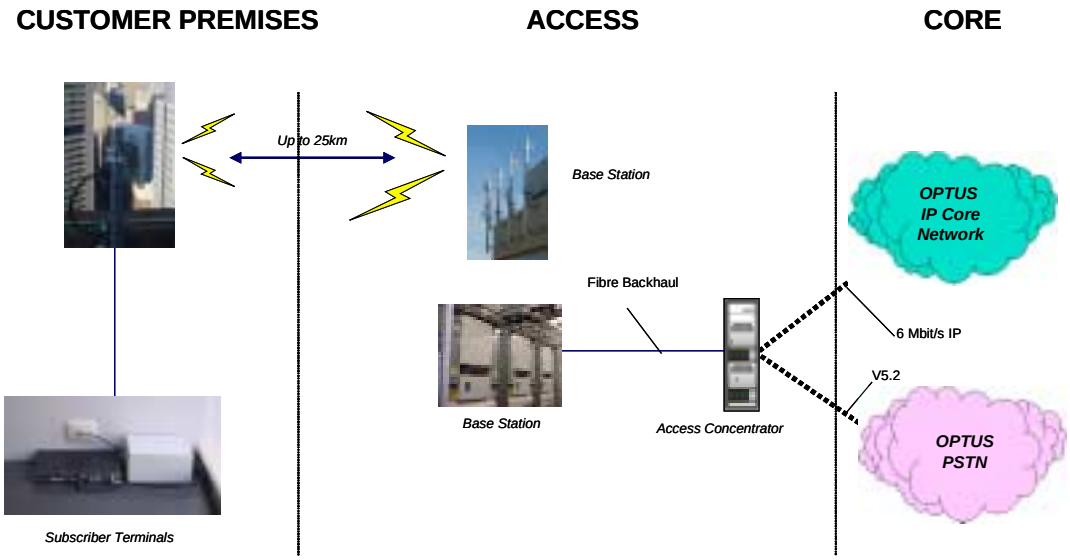
Central terminal antenna installation on the Elan Building, Kings Cross NSW.

ARPANSA also conducted an analysis of the radiation from a typical CT installation and found that compared to the levels typically experienced at GSM and CDMA cell site tower installations the CT levels are just a very small fraction in comparison at any distance from the respective antennas.

Copies of the ARPANSA assessments are attached to this submission.

Access Concentrators (AC) collect, groom and aggregate the voice traffic being managed by the CT devices and presents it in a standard interface for connection to other telecommunications networks. A single AC device might serve a number of CT devices and a CT device might serve hundreds of ST devices.

In Unwired's current Service Demonstration in Paddington NSW, these different elements are arranged as follows to provide customer service. While the core network services have been supplied by Optus on this occasion, Unwired anticipates interconnecting with a number of carriers.



At the customer's premises, the customer will connect a standard telephone handset into a jack on the back of the ST and will plug their computer's Ethernet connection or a router or other form of internet gateway into a standard Ethernet connection also on the back of the ST.

A person making a call on the standard telephone handset will receive dial-tone on lifting the handset, will place their call and will be connected. The connection will be managed over the radio link between the ST and the CT and then handled through the AC device back into an interconnected telephony switch where the call will be switched to the called-party's network and then on to that called party. As illustrated above, interconnection may be by alternate protocols.

Internet contentions will be terminated to the internet cloud at the Retail Service Provider, or their preferred supplier.

In terms of wholesale service provision, Unwired will wherever possible terminate traffic directly into the networks of the Retail Services Providers. Retail Services Providers will offer the Unwired service to their customers and will brand, market and bill for those services to the customer directly. Where Unwired provides services directly, Unwired plans to negotiate the best arrangement for termination of traffic depending on the customer's needs.

The Challenge for Unwired

Unwired faces many challenges as it deploys national broadband capability. There are a number of issues that are within the purview of the Committee to make recommendations, including:

- obstacles related to the competitive environment and the dominance of Telstra over the market segment targeted by Unwired;
- a sensitive and depressed capital market for telecommunications generally, but especially for high risk and innovative ventures such as broadband; and
- confused messages in the public domain about broadband, technology and the future of information technology more generally.

Telstra's dominance and market behaviour

Telstra dominates the last mile and works hard to protect that dominance. Its ubiquitous deployment of twisted pair copper wires for the customer access network has been the mainstay of local access and more generally telecommunications in Australia.

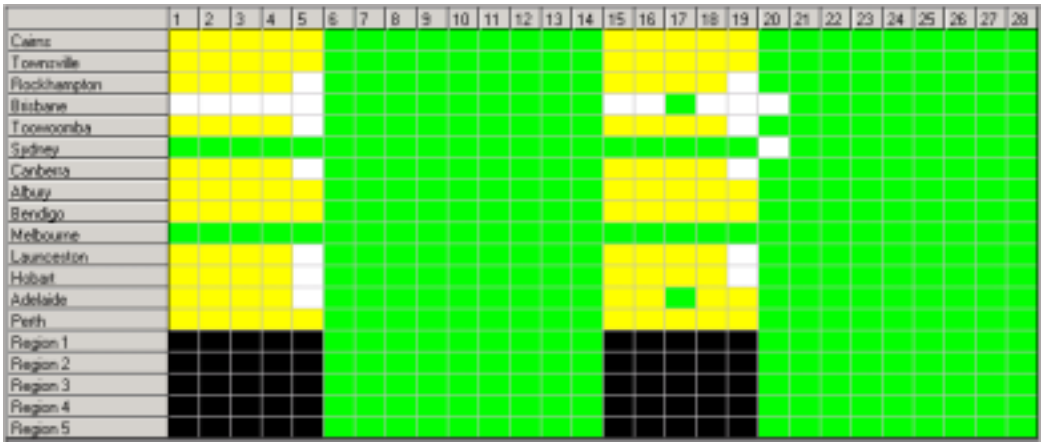
While competition has seen the erosion of this monopoly in limited areas such as Sydney and Melbourne, and market segments such as service to corporate customers, for the majority of the market the effective monopoly remains. While technology has theoretically rendered the idea of a monopoly over the last mile invalid, the market has not caught up and Telstra has worked vigorously to retain its position.

For example, the 3.4 GHz bands are acknowledged internationally as the main band for the development of FWA voice telephony and broadband. The international trends for FWA in this band can be traced back a number of years to the mid-1990s. In 1996, Telstra lobbied the former Spectrum Management Agency (SMA) for access to these bands for FWA. Telstra was given experimental access to the band to trial deployments of 3.4 GHz FWA, but on the understanding that it was the Government's intention to auction the spectrum. Telstra then proceeded to take out a large number of licences in the band, in many different parts of Australia, including the major metropolitan areas. In the original agreement with Telstra, the SMA imposed limits and conditions on the licences making clear the understanding that the spectrum would be subject to auction. The Australian Communications Authority re-affirmed the intention to auction the 3.4 GHz bands, but this did not stop Telstra from exploiting the bands by loading customers on the network.

Once the licences were held, Telstra argued against the ACA's intention to hold a public auction on the basis of its need to preserve continuity for its customers. Ultimately, Senator Richard Alston issued a Direction which imposed strict limits on Telstra's ability to bid and limited Telstra to minor markets. Telstra ultimately did not bid.

Notwithstanding the restrictions on Telstra during the auction, Telstra moved after the auction to acquire spectrum licences in the secondary market.

The following Graphic 1 illustrates the spectrum licences held by Telstra and by Unwired in the 3.4 GHz bands as at 19 August 2002.



Graphic 1 – Current licence holding in the 3.4 GHz bands for Telstra and Unwired.

Spectrum in green is licensed to Unwired, Yellow is licensed to Telstra. Spectrum denoted by white was passed in at the original auction. The application period for a second auction for the leftover spectrum closed on 30 July 2002. Akal, the Unwired bidding vehicle was the only applicant. Black represents configurations that were not offered by the ACA, however, the ACA has invited public comments on the future of this spectrum. Each square in the grid represents one lot offered at auction and each lot is a 3.5 MHz block of spectrum[1]. Two-way communication requires a pair of matched channels, so band 6 for example, would be operated in conjunction with band 20. Bands 1-5 and 15-19 are paired with 50 MHz separation and bands 6-14 and 20-28 are paired with 100 MHz separation.

Telstra has consistently tried to enter the 3.4 GHz bands and has in fact succeeded in acquiring spectrum in many markets.

The 3.4 GHz bands are recognised within Telstra as capable of supporting an alternative local access technology that could compete with their monopoly over the last mile.

Today, Telstra maintains customers using FWA in the 3.4 GHz bands. Unwired and Telstra recently entered into a commercial agreement under which Telstra has access to spectrum for the purpose of supporting customers.

Subsequent to the Government's intervention on the 3.4 Bands Telstra lobbied the Australian Communications Authority in 2001 to change licensing arrangements in the 1880-1900 MHz band for cordless telephone systems to allow licensing of the Digital Enhanced Cordless Telephone (DECT) systems at high powers to provide longer range so that the system could be used to provide voice and data services similar to FWA.

The ACA conducted public consultation on this issue and Unwired raised objections based on the premise that if Telstra was permitted to use systems under a class licence it would be in a position to offer services at a substantially different cost base to Unwired. Recall that Unwired has paid $110 million for

[1] A full description of all of the lots offered in the 3.4 GHz band auction can be found in the *Radiocommunications Spectrum Marketing Plan (3.4 GHz Bands) 2000* available from the Australian Communications Authority.

access to radiofrequency spectrum, while Telstra using high-powered DECT services would have had access to the spectrum on an annual fee basis.

Unwired is faced with a substantial task to raise the money necessary to build the planned 3.4 GHz FWA network. When successful, Unwired will be the supplier of the only technically viable alternative to the copper CAN monopolised by Telstra. Telstra clearly identifies FWA as a threat to its local monopoly and will use its considerable resources to defend its position. Unwired urges the Committee to keep this in mind as it frames its recommendations on the Australian telecommunications network and to be aware of the types of responses that Telstra might employ to protect its monopoly when Unwired launches its service. If Unwired is not successful in its efforts to establish FWA in Australia, there is a very real chance that Australia will not see a competing technology or facilities provider over the last mile for a decade or more.

Telecommunications Capital Raising

For all start-ups (including Unwired) the currently depressed capital market, particularly for telecommunications, presents a significant challenge. In 2000 - 2001, the international telecommunications capital market suffered a major collapse. The collapse can be attributed to a number of factors including the dotcom collapse, exorbitant prices paid for radiofrequency spectrum in a succession of spectrum auctions conducted by Governments in Europe and a series of ill fated acquisitions by telecommunications players. The sum is a profound shift in investor confidence.

As a result, institutional and private investors have taken a highly critical view on new telecommunications investments.

Unwired is fortunate to have backing from a number of very highly regarded international institutional and local investors who are convinced of the quality of the business proposition and fully funded the spectrum acquisition in 2000. Unwired is planning to pursue a mixture of equity and debt to fund its network roll-out although it expects that in the current climate this will no easy task.

Unwired has observed the Federal Government programs that have distributed some of the proceeds of the sale of parts of Telstra to promote communications development, particularly in regional areas.

Unwired believes that in order to properly extract the nation-building value of widespread deployment of broadband infrastructure, the Federal and State Governments need to develop a coordinated strategic approach to funding so that it is focused on coherent nation-building infrastructure, not piecemeal regional initiatives.

Unwired notes for example that the provision of funding under the Networking the Nation (NTN) programs has been limited to not-for-profit organisations except in association with contestability pilots, and so a new network provider such as Unwired has had no possibility of directly applying for funding under these programs. By funding individual and separate regional and local community initiatives, there is little prospect of a coherent national infrastructure. The very nature of the funding means that it can be captured for local initiatives rather than levered for the value that a national network provides.

Similarly, funding under the National Communications Fund has been directed to health and education projects. Funding under these programs can only be channelled to advanced broadband infrastructure when associated with these

areas of development. Again, this does little to extend the ubiquitous coverage of broadband.

Unwired would welcome a recommendation from the Committee that noted the importance of the nation-building value of infrastructure for a wireless broadband networks, and that funding programs which limit the participation of for-profit network builders and operators like Unwired to participate reduces the prospect of widespread deployment of broadband infrastructure.

The types of assistance that might be contemplated are considered further below.

Confusion in the Market

One of the problems with any debate about complex new technology is that often the discussion is masked by the complex terminology that surrounds it and a lack of understanding regarding the most suitable applications of the respective technologies. The very ideas of radiocommunications and of the technology that uses radiocommunications are hard to grasp by the lay person.

Simple terms like “wireless broadband” and “fixed wireless access” mean many things to many different people and this confusion makes room for technically unfounded or uninformed claims about one technology over another.

Unwired has undertaken a comprehensive international due-diligence study of wireless broadband within the context of a clear idea of the services it wants to provide and full understanding of the technologies available to it. In our due-diligence, we encountered product vendors from around the world who promised their technology could do what others could not. Unwired found that most of the offerings encountered were speculative and not able to be demonstrated in the field. Many of the technologies were “just around the corner” and we were forced ultimately to conclude they were not viable technical alternatives.

From our due-diligence Unwired believes that there are only three general classes of wireless broadband that are technically feasible and, in respect of the technology, economically viable today:

- 3G mobile telecommunications systems based on CDMA 2000 1x EV-DO, potentially via the European Wideband CDMA (W-CDMA) technology and possibly in the ITU designated TDD[2] bands for 3G data;
- fixed wireless access[3] over the “last mile”; and
- Wireless local area networks (WLANs) and personal access networks (WPANs) based on low powered shared use of ISM bands of the radiofrequency spectrum.

Unwired believes that all three technologies are very different in their attributes and that it is important to differentiate the technologies on the basis of these attributes.

Unwired does not believe that any one of these technologies can substitute for another, and moreover, the significant value adding can be achieved by leveraging the synergies between them in terms of delivering broadband services any time, any place via the most efficient, convenient and cost-effective means.

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2 time division duplex.

3 The technical requirements of fixed wireless access (FWA) systems have led these systems to be developed in bands such the 3.4 –3.6 GHz bands and these are now widely accepted as the international de-facto standard for FWA. These bands have propagation and bandwidth characteristics that make them ideal in terms of the compromise between range and resilience vs. data transmission capability.

The benefits for both the carriers and the public are maximized if the most appropriate mix of fixed line and wireless technologies is deployed and broadband infrastructure development as a whole is not distorted by policy decisions that bias towards the introduction of inappropriate technology.

In Australia, the internationally accepted bands for FWA (i.e. 3.4-3.6[4] GHz) have been offered at public auction and Unwired holds radiofrequency spectrum licences over nearly 100 per cent of the allocated spectrum in Sydney and Melbourne and all of the 2 x 32.5 MHz of 100MHz duplex spectrum that meets the international standard configuration for FWA.

Unwired holds the greatest promise for a true large scale coherent deployment of FWA broadband infrastructure, for only Unwired has access to the radiofrequency spectrum resources in the right technical configuration to match international practice and with sufficient geographic coverage to make it ubiquitous. Unwired has the potential to be the only real alternative national local access network in Australia.

Unwired Roll-out

Unwired will progressively deploy Base Stations to provide service to customers and expects to commence provisioning the Sydney market by the end of calendar year 2002, and to commence Melbourne and other major city markets in 2003.

A service demonstration has been established in the eastern suburbs of Sydney with one CT and approximately fifty ST devices in operation. The service demonstration was launched on 12 June 2002 by Senator the Hon Richard Alston and is being used to successfully demonstrate the Unwired technology and to gather information about the potential use of these services in the Australian market. The results of this will be used as further input into planning already underway for the rollout of the Unwired network.

Unwired is the only operator in a position to supply FWA in the internationally recognised radiofrequency spectrum for these services.

Unwired has spectrum licences that cover about 95 per cent of the Australian population. The coverage area of the collection of licences is shown in the following Map 1.

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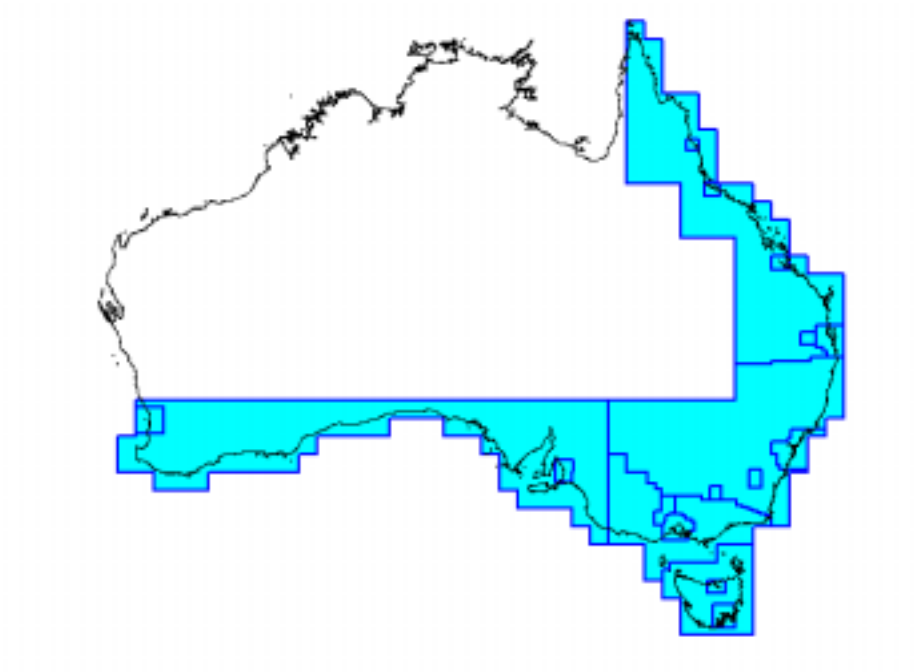
[4] ITU deliberations suggest that the bands being deployed may ultimately be between 3.4 - 3.8 GHz, however, most attention around the world to date has been focused on the 3.4-3.6 GHz bands.



Map 1 – Geographic coverage of Unwired radiofrequency spectrum licences

Unwired is initially planning to deploy network to service cover all towns and cities (within the licence areas) with a population of greater than 50,000 people.

The following Map 2 shows the arrangement of the market areas that contain these towns and cities.

Map 2 – Proposed initial target markets for Unwired services

Unwired has the flexibility and capacity to vary this deployment based on its needs and its customer requirements and so capacity will actually be installed in many other areas to satisfy customer needs.

While the threshold of 50,000 people has been used for initial network planning Unwired needs to secure a minimum number of subscribers on each CT in order to ensure that infrastructure provisioned can be financially justified. In the early stages of deployment while consumer acceptance and take-up of broadband is relatively low, by targeting the larger centres Unwired can deploy it systems with confidence that customer loading will be sufficient to warrant the investment. As the take-up of broadband services rises with consumer awareness, the capacity of smaller towns and cities to support broadband infrastructure will grow. The population able to be reached by the radio system needs to be sufficient to provide enough subscribers under normal market expectations to be able to sustain the investment decision.

As the network is deployed and Unwired has more experience with actual customer take-up, then the company expects the 50,000 population threshold to be reduced significantly.

Low cost CTs based on minimal infrastructure may be viable with only a few hundred subscribers. This would allow Unwired to extend its reach to even lower population densities and smaller towns.

Unwired believes that there is scope for commercial systems to be developed in conjunction with public services where the provision of basic broadband communications infrastructure to support health, education, law enforcement and emergency response (such as the SES) might provide the foundations for investment in core infrastructure that can then be expanded on a marginal cost basis relatively cheaply to extend the reach of commercial services. Unwired is looking to explore relationships with the many State-based regional development initiatives to fund seed infrastructure to provide broadband capability for public and community services.

Relationship between Broadband Technologies

Unwired has been concerned for some time about confusion in the public debate about wireless broadband and the place that different technologies have in extending a broadband experience to consumers.

Unwired believes that different wireless based systems serve different situations and present different solutions. The technologies are not so much substitutes as complements.

Radio-based systems, because they rely on radiofrequency spectrum, are constrained by the technical characteristics and management practices applying to the spectrum they consume. Radiofrequency spectrum management practices are in turn constrained by international treaties, existing spectrum use and the international equipment manufacturing sector. Manufacturing plays a significant role because it relies on international scale markets and standardisation to manufacture large production runs that make consumer electronics devices affordable.

The following discussion attempts to put the different “wireless broadband” technologies into context.

Fixed vs. Mobile vs. proximity systems

Amongst “wireless broadband” technologies the major point of differentiation is between mobile systems, fixed systems, and systems that Unwired calls “proximity” systems.

Fixed and mobile systems require dedicated planned and managed spectrum access in order to work as they operate in large geographic areas and therefore their operation must be carefully managed to control unacceptable interference to other spectrum users. Proximity systems are designed to operate to avoid interference to and from other services. They operate on low powers to limit the interference they cause to others and use a variety of techniques to deal with external interference. These mitigation techniques are only effective if "proximity" systems run by other operators are operating in a similar way. Under such conditions, these proximity systems can radiate just enough power to be reliably detected over short range, but without creating harmful interference to other users some distance away. It should be noted however that to achieve this, proximity systems cannot achieve anywhere near the levels of spectrum efficiency mobile or fixed systems can achieve.

Quite apart from the fact that they were designed to offer robust broadband connection inside pico ad micro cells at low cost using simple consumer hardware, the key differentiator of so called "proximity" systems is that in a stand alone mode they are not designed for the delivery of secure data that meets normally accepted quality of service standards to paying customers. In effect they serve the purpose of very localized wireless extenders in private networks.

Mobile Systems

Mobile systems include the existing GSM and CDMA mobile telecommunications systems and the potential 3G mobile telecommunications systems for which spectrum has been allocated but no services have commenced. They also include mobile data only systems in the ITU mandated 3G TDD bands such as the iBurst system proposed to be deployed by Arraycom.

GSM and the existing CDMA deployments based on IS 95 cannot be described as "broadband" systems for they are intended to be voice systems and their data payload is low, so they are not considered further in this submission.

Only the possible introduction of 3G services will bring about data speeds that could claim reasonably to be broadband on a mobile platform.

While much of the product promotion surrounding 3G technology has proposed data rate to fixed installations of up to 2 Mbit/sec, the data rate proposed for mobile devices is limited to 384 kbit/sec. In practice, however, the very architecture of mobile systems and the limits on the amount of spectrum that are available to mobile systems imply that very few customers will ever really experience these sorts of data rates with any reliability. Mobile systems must by definition dynamically handle the assignment of data capacity among many users moving into and out of the coverage area of a base station. The system must be capable of handing off the capacity assigned to one user to another base station seamlessly and without dropping the call. These are major engineering challenges that have required decades of research and development. The development cost of 3G to be reflected in handsets and base stations, and the cost of spectrum to operators garnered through spectrum auctions means that the economics of a broadband system based on mobile technologies is a difficult economic proposition.

Two alternative technologies for 3G mobile are possible at the moment. Europe, largely because of its GSM heritage, is following a deployment based on Wideband CDMA (W-CDMA). The alternative technology for 3G is CDMA 2000 and comes from the USA and is being deployed in Asia (most notably in Korea and Japan). Australia has the opportunity to travel either way and in all probability, both standards will be deployed here.

So far in Australia, only Hutchison Telecommunications Australia has committed to building a 3G mobile telecommunications network, although Telstra has shown an interest in upgrading its existing CDMA network to CDMA 2000 1X EV. While other carriers are known to be closely watching 3G developments, the level of investment required combined with the lack of clarity over the types of services that are desirable on a mobile platform and the market for those services have created an environment of caution.

3G services at 2.1GHz are only ever likely to be provided in major urban areas because the signals are necessarily being received on low-gain mobile receivers. With such a short range, subscriber densities may not reach the levels necessary to sustain investment except in urban areas.

3G services can be overlaid at 850 MHz in the spectrum currently being deployed for IS-95 CDMA systems in the spectrum formerly occupied by AMPS. CDMA 2000 is an overlay system that is backwards-compatible with earlier generation CDMA systems. The advantage of the 850 MHz band compared with the 2.1 GHz band is its superior propagation and range.

Even better range can be provided at bands such as the 450 MHz band and this band in particular opens the possibility of extending 3G services using the CDMA 2000 platform to regional areas. Lucent Technologies is an advocate of CDMA 450 and has deployed systems in these bands in a number of countries.

The ITU recommendations for 3G provide not only frequency division duplex mobile systems for voice and data, but also a small band of time division duplex (TDD) spectrum that is being developed by a number of organisations including Arraycom with its iBurst. These data-only solutions are intended to complement the voice/data handsets in traditional mobile phones and new hybrid devices to allow reasonable reliability and portability, but with comparatively higher data rates than mobile telephony devices.

Fixed systems

Fixed systems are substantially simpler than mobile systems for broadband. The cost of these systems is considerably lower as a function of this simplicity. There is no need in a fixed wireless system for the complexity necessary to support mobility.

Fixed systems come in three general types;

- point-to-point microwave links such as used to provide broadband wide area network connections;
- point-to-multipoint systems such as FWA and LMDS; and
- multi-point distribution systems (MDS and MMDS) which are distribution systems from one fixed point to many receiver points. These technologies are akin to broadcast technologies and have been used in Australia for Pay TV services and recently for some broadband trials.

Point-to-point systems have an important role in the provision of broadband systems because they provide one way of connecting base stations back to other parts of the network. Another way of doing this is to use optical fibre. However, point-to-point microwave systems are not the best or most efficient way of providing broadband capability to consumers over a wide area and so are not considered further in this paper.

Fixed point-to-multipoint systems come in a wide range of configurations. Both of the technologies able to be deployed by Unwired are fixed point-to-multipoint

systems, but there are substantial technical differences between them that render them appropriate to different business models.

A major consideration with any fixed system, and the principle differentiator between FWA and LMDS, is the type of spectrum being used.

As a general rule, the higher the frequency, the higher the bandwidth that can be managed for communication, but conversely the lower the operating range and the more difficult it is for the radiation to propagate. As systems move into high frequencies, the radiation tends to behave more like light. Range becomes shorter, and establishing a clear line of site becomes more critical to establishing a reliable communication link. FWA systems at around 3.5 GHz present a very good compromise between the bandwidth available from the spectrum, the range able to be covered and tolerance to marginal link conditions. LMDS systems, on the other hand, present higher bandwidth capacity, but over much shorter ranges and with far less tolerance to obstructions and signal loss due to environmental conditions (rain, dust, temperature etc). So LMDS systems are typically used for high-bandwidth corporate communications over short distances (for example to link a number of buildings to provide a common network between them) while FWA systems are able to cope with the range needed to deliver services to domestic premises but at more modest and consumer-useable bandwidth.

Equipment manufactured for higher frequencies used by LMDS tends to be significantly more expensive that that for FWA, because LMDS is not a mass-market service, and so economies of scale do not exist.

Unwired's leased line technology is broadly equivalent to LMDS in terms of the type and quality of service, but with all of the range and propagation advantages offered by the 3.4 GHz bands. When combined with the cost advantage of these systems over LMDS at 20-30 GHz, the Unwired wireless leased line technology offers the capability to extend an LMDS like service over a much greater range and to a much more diverse body of potential customers.

All fixed systems require ***managed*** spectrum because they operate at power levels that can transmit over long distances and so they have the capability to interfere with other spectrum users over greater distances. They must be planned so that unacceptable interference from other systems is prevented. This planning process is given effect through the spectrum management and licensing practices of the Australian Communications Authority.

Unwired will provide the first commercial wide-scale deployment of FWA technology in Australia. However, Telstra has already used apparatus licences in the 3.4 GHz bands to deploy FWA systems to meet specific difficult to serve market needs. Other systems have been trialled in Australia for example a power utility has recently been a trialling FWA using the 5 GHz ISM bands on the South Coast of New South Wales.

FWA systems have been deployed in many countries around the world. These range from developed countries where FWA is seen as a substitute for the copper CAN to developing countries where FWA is regarded as a simple and cost effect technology for the rapid extension of telecommunications to people who previously have not had any. Airspan, Unwired's chosen vendor, has deployed FWA with 90 service providers in 45 countries around the world. Current deployments of the Airspan product line can be seen at the Airspan web site http://www.airspan.com.

Other major deployments around the world include 400,000 terminals in a system supplied by Nortel Networks in Mexico.

Proximity Systems

In contrast with planned fixed wireless systems, proximity systems do not used "planned" radiofrequency spectrum, rather they share "unplanned" spectrum in common with a large number of other users. These systems rely on operating at very low powers to allow extensive radiofrequency spectrum re-use even in confined indoor areas.

In Unwired's view, there are two distinct types of proximity systems; wireless local area networks (WLANs) of which the 802.11x family of technologies is widely available and wireless personal access networks (WPANs) of which Bluetooth is an example. 802.11x systems operate at 2.4 GHz and more recently at 5 GHz, and the "Bluetooth" systems operate at 2.4 GHz.

The 2.4 GHz band of the radiofrequency spectrum is an important band. It is the band in which microwave ovens operate. This means that it is impractical to plan the band for radiocommunications systems lest they be interfered with by "leaky" microwave ovens. Instead, the public good is advanced by treating this band as a "public park" and allowing anyone to operate low interference potential devices under "class licences". These devices have low interference potential because they operate in a band where there are no planned services and because they are specifically limited in the amount of power they can radiate under the class licence.

802.11x devices have recently become very popular because they allow people to establish "local area networks" (LANs) based on wireless technology as opposed to establishing the LAN by cabling. 802.11x is typically implemented through a PCMCIA card that is inserted either directly into a lap-top computer, or into a cradle integrated into a PCI or ISA bus card that is in turn installed into a computer. All of the radio infrastructure is integrated into the card.

802.11 has a planned range of about 100 metres making it ideal as a cable substitute within a building.

802.11b operates in the 2.4 GHz band. It offers an Ethernet connection at a data rate of up to 11 MB/sec. More recently, equipment for the 802.11a standard has become available. It offers 54 MBit/sec Ethernet and operates in the 5 GHz band.

Both the 2.4 GHz and parts of the 5 GHz bands are *industrial, scientific and medical* (ISM) bands. This means that because there is a risk of unexpected and unpredicted harmful interference from ISM devices, the ACA cannot individually licence services, nor can it provide any protection from interference (which is the point of licensing). Instead, these bands are "class licensed" and the class licensing regime provides an open warrant for any person to operate a device in these bands provided that the device complies with the technical limits set out in the class licence. The technical limits for the class licences typically impose quite strict power limits to limit the potential for these devices to interfere with other devices. Users of these devices must not interfere with other spectrum users and must accept any interference caused to them. They have no redress for interference because that is the nature of the band.

It is important to note that while in the United States of America these bands are "unlicensed bands", they are becoming compromised for communication as people exploit the bands using specially adapted 802.11b devices with higher power levels in order to extend the applications well beyond "proximity". Unwired suspects that similar techniques may be being used in Australia and we are aware of a number of groups promoting the use of high gain antennas to increase the effective range of 802.11 devices.

In Australia, there is no concept of "unlicensed bands". The operation of any radiocommunications device without the authority of a licence is an offence unless the user has statutory exemption (e.g. defence and security). Even though class licences are never issued to an individual, by operating in accordance with the class licence and with the technical conditions, there is no unlicensed operation and no offence.

WLANs are self-tuning and self-managing to the extent that they will detect and select the clearest channel for operation from a limited suite. This process commences by sensing the presence of other devices operating according to the same standard. The system negotiates a connection with the other proximity devices. It is this feature that allows an 802.11 WLAN device to operate in "hotspots". "Hotspots" are public places where an 802.11 gateway has been established and a person entering that area with, for example, a laptop and 802.11 device can connect to the internet.

WPANs operate over even less range. The purpose of WPANs is to provide cable-less connectivity between a number of different types of device. Bluetooth enabled technologies include personal digital assistants (PDAs), mobile telephones and headsets. Bluetooth, for example, would allow a person wearing a headset to connect to their mobile phone, or alternatively to connect a PDA to a mobile phone to provide wireless internet access to the PDA.
WPANs are planned to operate with less range than WLANS, providing the possibility of very frequent frequency re-use so that a large number of people within an office setting could all be using WPAN devices.

Technologies like 802.11x and Bluetooth have international market scope as items of consumer electronics. Both are standardized and enjoy the support of multi-national vendors. Increasingly, products like portable or laptop computers are being bundled with 802.11 capability, because the manufacturers understand the ease with which these devices can then be networked if enabled this way. Bluetooth is similarly being marketed in this way as mobile phone manufacturers such as Ericsson (a lead proponent of the Bluetooth vision) integrate Bluetooth capability into their mobile phone product line.

From the discussion above, it is possible to see three distinct layers of broadband connectivity. All can be seen as complements rather than substitutes.

Mobile telecommunications systems are complex and sophisticated, but they provide a way for people who are away from a fixed site to obtain an array of feature rich voice telephony and data connectivity.

FWA provides wide area connectivity from customers back to the telecommunications networks and to the internet over the last mile. In that regard, they are similar to mobile systems, however, they are substantially simpler and easier to plan and manage because the customers are fixed and capacity can be specifically engineered on a per customer basis. No call "hand-off" capability is required to be engineered into the system. WLANs are well positioned to extend the reach of FWA and share that internet connection provided by an FWA system among a number of local users as well as providing broadband connectivity between those users just as they would enjoy on a cabled LAN. WPANs then allow the connection of a number of personal devices to that LAN connection and ultimately back to the internet, or alternatively to a mobile device that provides an individual internet connection.

Put another way, FWA provides the "last mile backbone" of broadband connectivity and provides the security and quality of service expected by paying customers. WLANs provide the next 100 metres or so, on the customer side, while WPANs can provide the last 5 to 10 metres to connect personal devices.

There is a strong synergy between FWA systems and their capacity to provide robust secure wide-area network capability back into the internet cloud with proximity devices and their ability to extend the bandwidth of a WAN connection to a number of local computers connected by a LAN. FWA is a technology enabler for WLANs, and WLANs offer the prospect of making more productive use of an FWA link by sharing the available bandwidth among a number of users.

On the mobile telecommunications side, both W-CDMA and CDMA 2000 handsets enabled with WPAN technology would be able to extend the function of a basic mobile phone so that a whole collection of devices can be connected to the mobile phone and then to the mobile internet service. Devices include PDAs that might include email and web browser functions, digital still and movie cameras, headsets, viewing tablets and so on.

Wireless vs Copper and Cable Systems;

One of the greatest problems faced by the builder of a fixed network based on cable technologies as that the infrastructure must be deployed before customers can be connected. The builders of these networks face an enormous capital cost in deploying infrastructure for 100 per cent coverage of an area, but with the risk that only a small portion of the homes passed will actually subscribe. If the customer does subscribe and ultimately ceases the service, the infrastructure provision (other than the customer premises equipment) remains in place, the infrastructure cannot be retrieved.

This is a very inefficient way of deploying a network and builders of these systems typically provide a very high margin to account for their risk.

Similar issues face a builder of a mobile system. Mobile networks are only useful when they can be accessed while customers are mobile. A mobile network therefore has to be planned to provide coverage wherever a particular customer might be as they move around in the market. This tends to mean that mobile coverage is deployed to be ubiquitous. A mobile network looses its appeal if a customer cannot connect when required. Mobile network operators, however, do have the advantage over a fixed cabled network provider in that they can engineer the capacity provided in geographical areas based on probability assumptions about how many customers can be expected in that area at different times.

Builders of FWA systems, on the other hand, operate on a variable cost base for a large part of their network. FWA providers are able to tailor their network more appropriately to where customers are. Once basic geographic coverage of a target area is in place, fixed wireless access operators have the ability to add capacity for more customers by adding in-fill infrastructure. They do not have to build capacity in the hope that customers will connect.

By using a technology such as the Airspan system, Unwired is further aided by the characteristic known as n=1 frequency re-use. This means that instead of planning the system to use different frequencies in geographically adjacent areas, the Airspan equipment allows the same suite of radio channels to be used again in the immediately adjacent geographical area. By careful use of this technique, it is possible to provide very wide coverage initially, from high radio sites, and then progressively “split cells” by installing new base stations within the coverage area, and reusing the spectrum.

Broadband wireless systems built this way can tailor a substantial part of their capital budget to their customer profile as it comes on line.

Nevertheless, there are elements of fixed cost in the overall capex profile and these include items in the core network that exist no matter how many customers are carried. For example items like network operations centres (NOC), and customer management infrastructure and billing systems and all of the infrastructure necessary to connect the different parts of the network together.

On the other side of the ledger, all radio based systems face compromises that are not encountered in (for example) optical fibre systems. Optical fibre systems operate at light frequencies, many times higher than radio and so the available bandwidth is higher by many orders of magnitude. New techniques for exploiting the bandwidth of optical systems are being developed and so the capacity of optical fibre systems, especially when delivered to the home, is potentially greater than a household's ability to consume bandwidth.

Radio systems, however, face some fundamental limits. The bandwidth capacity of radio spectrum is governed by the amount of spectrum available and the modulation scheme that encodes data into that spectrum. Research and development over many years suggests that most advanced modulation techniques available today are near to the limit of their ability to carry data. However, the advanced modulation schemes require very high quality communications links. The signal to noise ratio needed to maintain effective communication increases with the sophistication and payload capacity of the modulation scheme. This in turn implies that the range of a system using high-order modulation schemes will have to be decreased to maintain signal clarity.

A base station or CT in an FWA network has a total bandwidth determined by the number of radio channels in operation and the modulation scheme being used. The Airspan equipment has an advantage in that it provides dynamic selection of modulation scheme based on the real-time quality of the radio link. Subscriber terminals close to the CT may have a sufficiently strong signal to operate at a very high order modulation scheme, while those further away may default to a lower order modulation scheme to maintain integrity in the more adverse conditions.

The implication here is that the total load that a CT can support might change during the day in response to environmental conditions that affect all of the radio links. Allowance has to be made for this when engineering the system.

The base capacity of the CT after these allowances needs to be shared among all of the subscribers communicating through that CT and the provisioning needs to make allowance for dedicated capacity to handle voice calls in the worst hour and to provide customers with data rates at their serviced rate. Inevitably this means that the capacity is shared using some probability function that makes assumptions about how many customers might be trying to use the system at one time.

In this regard, wireless based broadband providers are in no different a situation than other suppliers who share bandwidth between a number of customers. For example, an ADSL provider will have a planned amount of bandwidth from the exchange back to the network, and that bandwidth will become the throttling constraint on all of the customers being served by that exchange.

Last Mile Solutions for Regional Areas

For all of the advantages of FWA systems, there are some fundamental limits on the application of the technology. It may be the best solution to broadband provision in many circumstances, but it may be less appropriate in some other areas.

FWA will work in any area where there is a good transmission path. Planning a FWA network is more difficult in the densest population areas such as within a central business districts, but the limitations can be overcome with the selection of appropriate radio sites and a higher than normal density of CT deployment. Provided that sufficient customers can be obtained to justify the investment, there are no technical limits to such a deployment.

In the most remote and sparsely populated rural areas, satellite technology comes into its own and FWA cannot compete. FWA is most suited to areas that can provide sufficient customers within the planned coverage area to sustain the infrastructure investment. In that regard, the Unwired CT on the Elan Building in Kings Cross is currently supplying services to a site in Frenchs Forest in Sydney, over a link distance of around 15 km. Our vendor Airspan has reported reliable links over distances of 20 km with line-of-sight conditions in deployments in other countries.

Even in areas where subscriber density may otherwise be marginal, it may be possible for Governments, through their support for basic community infrastructure and public services, to purchase services from Unwired that underwrite the investment in core infrastructure. Once this core infrastructure is in place, the marginal cost of extending a commercial service is much lower. Therefore the economic proposition of extending broadband wireless access services to low density communities becomes much stronger when core infrastructure is already being funded to support community needs.

The fundamental determinant of whether an FWA base station can be deployed in an area is the number of customers that can be reached, the number that will take up the service and whether the services they purchase are sufficient to justify the investment in the base station; backhaul from the base station to the closest point of interconnect and a share of core network costs. Any purchase of services from Governments for basic community services that assists in this balance ultimately means greater capacity to extend commercial services.

To illustrate with an example, assume that the coverage of the base station is a radius of 15 kilometres – enough to cover a small town and surrounding areas, and that the break-even point to justify the base station is 500 customers using a low-cost CT. If the customers are all residential, using a bench-mark of 2.3 people per household, a population of at least 1150 people within the coverage area is necessary to justify the investment. However, that assumes that every one of the households will take the service. Assuming that the FWA provider is the only provider in town, on current internet penetration rates, only half of the households would be taking the service, taking the threshold up to 2300 people. Broadband by satellite is available in Australia, and other broadband technologies including locally owned cable technologies may also be present, so even a very good FWA operator might only get one third of the market. This raises the bar further still to 6,900 people.

Unwired is currently working with our partners to try to develop a low cost base station option that can be sustained economically on as few as 500 customers. An option such as this would enable the wireless broadband experience to extend well into regional Australia. If Unwired can get access on best terms to existing Government backbone communications infrastructure, such as used along rail corridors or installed as part of regional development initiatives, the economics of wireless broadband improve further. Aggregating traffic and connecting that traffic to the internet cloud and to telecommunications voice switches will always be a substantial component of the cost of deploying a network. This is a cost component where State Governments in particular have the capacity to lever their existing investments to directly support broadband initiatives.

Unwired has observed in the public debate that the prospect that wireless broadband infrastructure might provide a solution to rural and regional areas is forefront in peoples minds, perhaps using the 802.11 family of technologies.

The advantage of WLANs is that they operate without a base station or CT device. They are instead a radio peer-to-peer network. As a LAN, they provide the opportunity for a number of people to connect their computers together. However, to leverage the power of the internet for broadband, the LAN has to be connected back into the internet with enough bandwidth to enable all the users of the LAN to enjoy a broadband experience. The internet will only function as quickly as the slowest link, and so the link back to the network from the LAN has to be engineered with capacity in the same way as the link from a CT back to the network has to be engineered.

FWA provides a way for WLANs to be connected back to the internet with enough bandwidth to not act as a choke-point for people on the LAN. In high traffic density areas, services like the Unwired leased line service can offer very high bandwidths back to internet points of presence or for private network connections.

One of the issues that differentiates FWA and WLANS is range. A high-powered planned FWA system such as being deployed by Unwired still might only have a range of a few kilometres (if limited by terrain). 802.11 equipment on the other hand is designed and manufactured for a world market to operate only over 100 metres or so in ideal situations. Unwired is aware that the use of high gain antennas to improve the sensitivity of the receiver can boost range, but always within the constraints of the local noise environment.

There will be rural and regional markets where even a high-powered system will not be able to reach sufficient customers to be cost effective. In addition to the security and quality of services issues already identified, 802.11 based systems are even more range-limited and so do not present a sound solution for the delivery of broadband to these areas.

It needs to be accepted that in some parts of Australia, the only feasible way to get economies for broadband internet connectivity is to share a satellite link.

The Regulatory Regime

Australia has one of the most advanced approaches to spectrum management in the world and has a proud record of being at the leading edge of innovation in this field. Australia is one of the very few countries around the world that takes an economic approach to spectrum management by valuing radiofrequency spectrum as a community owned resource that is scarce and valuable because of that scarcity. Australia also has a practical and enlightened approach to shared spectrum access for low powered devices through the class-licensing approach. Similarly, in telecommunications, Australia's approach to opening the market to competitive provision of services and to permit open licensing of telecommunications is consistent with international best practice.

Unwired is concerned that this environment of stability and certainty not be compromised, for that will undermine the confidence of investors to commit to undertakings such as rolling out broadband infrastructure.

Regulation of Telstra's dominance of the local loop market

Notwithstanding everything that has been done to Australian telecommunications law in order to open the market to competition, the market is still fundamentally dominated by Telstra. Even in the mobile telecommunications sector where there has been the most vigorous competition, Telstra continues to enjoy a market lead over Optus and Vodafone.

Telstra's advantage over all of the other carriers is dominance of the "last mile" and the ability to bundle a whole suite of telecommunications services (including mobile) into one account. The standard phone line is often seen as the basic account for telecommunications to which other services are added.

Telstra's last mile monopoly has provided a stable and consistent revenue platform that provides one of the cornerstones of Telstra's financial strength. Telstra has greater capacity to fund infrastructure than any other player in the market largely because of this financial strength.

Over the last year in an effort to promote broadband services using ADSL over the copper CAN, the Government has tended to treat Telstra's dominance of the last mile as a natural monopoly. Accordingly, the focus of regulation has been directed to facilitating access to that monopoly for competing services. The ACCC has recently inquired into and developed regulatory responses to promote unbundling the local loop and for making it accessible to other players on a wholesale basis, and of line sharing over the copper CAN where the bandwidth on the physical copper cable is split between the telephony service and data components and access to the different component parts is made available.

In all of these initiatives, however, the competing service providers use Telstra infrastructure for which they must pay Telstra wholesale prices.

Unwired does not believe that the last mile is a natural monopoly, and so the company questions the need for regulation such as been applied.

The effect of the regulation and the continued threat of regulation directed towards Telstra over wholesale pricing may have imposed an artificial pricing limit on wholesale broadband access prices that acts as a disincentive to investment in competing infrastructure. It is possible for Telstra's wholesale prices to be forced by regulatory action below the point where it is possible to mount a business case for new and competing infrastructure investment.

The planning of the Unwired network has been based on real costs and real investment expectations. From that business model, Unwired can evaluate at what price it needs to sell its services to justify its investment in infrastructure and to earn a reasonable rate of return for its investors. Obviously, if those prices are higher than the artificial wholesale prices regulated for the copper CAN, then the ability for Unwired to attract customers to its network and away from the copper CAN is strictly limited.

In such an environment, the network may never be built except in places where the copper CAN is not able to support broadband access and thus where it is the only real alternative.

Unwired therefore recommends that in developing its recommendations, the Committee recognises that the copper CAN should no longer be seen as a natural monopoly. The regulatory effort that works on the assumption that it is a natural monopoly and applies regulated access arrangements and regulated pricing actually works against the deployment of alternative infrastructure, because it

artificially distorts wholesale access prices below what can be sustained for alternative infrastructure investment. By artificially lowering prices by regulation in an attempt to stimulate competition, the Governments runs the risk of forcing any genuine potential infrastructure competitors out of the market. The consequence might be a reduction in competition, quite opposite to the stated goal.

Investment Certainty

Unwired participated in a public spectrum auction conducted by the Australian Communications Authority to obtain access to the spectrum that it now has licensed. Unwired paid approximately A$110 million for its current spectrum holdings.

Unwired made these investments based on understandings about the market for spectrum conveyed by the Government in its rolling forward program of spectrum auctions and about the regulatory regime.

Unwired and its investors are committed to the Australian market and are in the process of raising hundreds of millions of dollars to fund the network roll-out. Our ability to do this depends fundamentally on the stability of the telecommunications and radiocommunications regulatory regimes and an expectation that decisions of Government will not unintentionally undermine the business case.

The current telecommunications capital market is subdued. There was a substantial down-turn of telecommunications investment sentiment in 2000 - 2001 as the investment community took stock of the problems created by the "dot.com" crash, unrealistic prices paid for 3G spectrum when the business plans for 3G and the technological stability of 3G were unknown and a series of ill fated acquisitions by participants in the telecommunications industry. Investors are cautious about telecommunications investment.

While Unwired is solidly backed, our offshore investors in particular are sensitive to "headline" changes to the regulatory environment and we have noted discussion of the potential release of more spectrum for FWA.

Unwired needs *certainty* about the regulatory landscape and so we urge the Committee not to make recommendations that might compromise the business. Unwired provides what is currently the only technologically viable alternative to the copper CAN and thus the only prospect of a true alternative facilities based competitor in the last mile.

An issue of serious concern to Unwired is the possibility that alternative wireless broadband technologies might emerge on a different cost base to Unwired due to regulatory intervention and be given an unwarranted and unjustified advantage as a result of the work of this Committee.

Of most concern are calls for changes to the regulation applying to 802.11 devices that would allow 802.11 systems to operate at higher power to cover potentially larger areas. Unwired is aware that these calls are not always well informed either about the technology, how the technology uses radiofrequency spectrum, or how spectrum management practices here and overseas constrain the techniques. The fact that these calls have such currency and that some consider 802.11 to be a rural and regional panacea for wireless broadband access on a par with FWA systems is disturbing and potentially misleading.

Unwired is concerned that the Committee avoid making recommendations that seek to promote 802.11 technologies for the delivery of services in rural and regional areas they were not designed to deliver and based on their technological shortcomings will never be able to meet the legitimate expectations of the end user for a quality service.

Unwired firmly believes that 802.11 is a complementary technology to FWA in that extends the reach of an internet connection provided by FWA to a local area network so that connection can be shared. It is not, of its own, a wide area internet connection technology.

Unwired supports the existing class-licence regime for 802.11 services. This regime imposes strict power limits that allow the technology to enjoy widespread use.

The operation of any radiocommunications system depends on the ability of a receiver to detect a wanted signal against the background "noise" that exists. Electric motors, microwave ovens, radio transmitters, and natural effects such as lightning, solar radiation and the background radiation of space all contribute to the "noise floor". In urban environments, there is a lot of background noise – in rural areas there is less. Every radiocommunications transmitter adds in some way to the noise floor.

When deploying an FWA system that operates at modest powers and provide reasonable range, every new transmitter and receiver has to be planned to minimise the potential for interference. The whole approach to radiocommunications licensing and planning in Australia and most other countries in the world is predicated on the very basic need to coordinate transmitters and receivers in time, space and frequency so that intended communication is not hampered by interference and noise from other devices.

Unwired has spectrum licences and they afford Unwired the right to have exclusive access to some bands of the spectrum over a defined geographical area. That is the principle mechanism for ensuring that Unwired can communicate in its spectrum – to exclude others. Within the licence, however, Unwired needs to ensure through careful planned placement of transmitters and receivers that noise and interference are managed.

802.11x systems, on the other hand, normally operate in ISM bands on a shared basis. They cannot be planned to avoid interference, and they have to be able to accept sporadic interference from devices that operate in the band. The 2.4 GHz band (where 802.11b devices operate) coincides with a frequency that excites water molecules, making them "hotter". This is the principle on which microwave ovens work, and so this band is set aside in all international spectrum planning arrangements for devices like microwave ovens that are not used for communication. Only a few specific bands have these sorts of properties, but it makes them unsuitable for planned and coordinated radio communication. On the other hand it does make them suitable for unplanned low powered shared-use devices such as 802.11 that have the ability to operate in "noisy" environments. There is another similar ISM band at 5 GHz where the 802.11a variant of the technology operates.

By operating at low power levels, the signal from an 802.11 device can dissipate to a level below the noise floor over a very short distance. However, the operation of every 802.11 device contributes to that noise floor and as a result, in populated areas, where use of 802.11 devices is high, there is so much noise from the many devices that the effective range is understood to be around 30 to 50 metres. The effect of permitting higher powers will be simply to raise the noise-floor for all other users. There may be some short term increase in range

of the devices, but this will reduce as more users opt for higher powers, further contributing to a higher radio noise floor.

There may be some suggestions put to the Committee that 802.11 power limits be raised in the class licence for defined rural areas to permit the technology to operate over longer ranges. Unwired does not believe this will be appropriate because even though these areas might be closely defined, the ability of users to move devices freely into and out of the define areas suggests that higher power variants will inevitably find their way into urban areas. This will inevitably lead to an increase in the noise floor for no appreciable range increase in urban areas.

Unwired recommends that in making its Report, the Committee avoid any suggestion that 802.11x offers a panacea to rural and regional wireless broadband access and notes that in the overall interests of spectrum management, the greater good is maintained by keeping strict power limits on 802.11 devices so that that spectrum can be re-used to support a higher density of services.

Productivity Commission Review of the Radiocommunications Act 1992

Unwired recently participated in the Inquiry by the Productivity Commission into the *Radiocommunications Act 1992* and broadly supports the findings and draft recommendations of the Commission as expressed in its Draft Report.

Two of the issues raised by Unwired in the company's submission are relevant to the context of this Inquiry.

Unwired has for some time been proposing that the tenure arrangements for spectrum licences need to be reviewed. At the moment, spectrum licences are issued for terms up to 15 years and at the end of that term, the licences are required by the *Radiocommunications Act 1992* to be reallocated by auction, except in cases where it would be in the public interest for licences to be reissued to the licensee.

Unwired believes that this presents an increased risk to investors in major infrastructure projects such as the deployment of a true wireless broadband network. With spectrum licensing as the law currently stands, Unwired runs the risk that in 13 and one half years time, its licences will lapse with no recognition for the potentially hundreds of millions of dollars that it will have invested by that time. To hedge against the risk of losing the licences, Unwired will need to consider winding back its capital and ongoing maintenance investments in the sunset years of the licences, leading potentially to declining service levels to the detriment of consumers. Unwired did not take clear possession of these licences until recently (4 May 2002), because of the spectrum was released under the spectrum reallocation provisions of the *Radiocommunications Act 1992* and existing users of the bands were entitled to protection from interference. Notwithstanding that the licences were issued for 15 years, Unwired will only ever be able to enjoy 13 years and 6 months of the term.

Unwired therefore welcomed the Productivity Commission's recognition that perpetual licences should be regarded as a desirable public policy goal.
Unwired asks the Committee to recommend in its Report that changes be made to the licence term provisions for spectrum licences in the *Radiocommunications Act 1992* so that spectrum licensees may enjoy perpetual tenure. This will provide the sort of long term certainty necessary to give investors the confidence to make substantial long-term investments in broadband communications infrastructure.

In its response to the Productivity Commission Draft Report, Unwired also expressed concern about the administrative imposts on radiocommunications spectrum licensees that flow from over-regulation of radiocommunications device registration. These imposts add to the costs faced by a licensee in deploying infrastructure, but serve no obvious public policy benefit

The approach to spectrum licensing set out in the law and in the administration of these licences by the Australian Communications Authority promotes the idea that spectrum licensees are the managers of their own licensed space (i.e. the frequency band and geographic area authorised by the licence). Indeed, licence conditions on the licences make very explicit that the licensee is responsible for managing the spectrum and for avoiding interference with other spectrum users and for solving instances of interference that originate within the licence. Unwired supports this concept.

However, the Act provides that:

- the ACA may determine what constitutes an "unacceptable level of interference"; and
- the ACA may require a certificate from a person accredited by the ACA that a device will not cause unacceptable interference,

The ACA implements both of these as mandatory requirements.

Unwired's partners who will do the radio planning for the Unwired network are ISO quality certified. In planning the network they will be using the latest radio planning techniques and software especially developed for planning a network of this type. The radio planning exercise will be undertaken at a level of sophistication many times higher than the procedures required by the ACA, nevertheless, the ACA will not accept an application for device registration unless it is accompanied by an accredited person's certificate. Furthermore, an accredited person who signed such a certificate without satisfying themselves that the device complied with the Determination of "unacceptable interference" would be opening their accreditation to being revoked.

So, Unwired is compelled by the current administration to not only plan its network responsibly and in accordance with the company's own imperatives for good spectrum management, but at its own cost to also obtain an evaluation against a different set of procedures and guidelines that the device will not cause unacceptable interference according to the ACA's definition.

It is a matter of public record that a number of organisations including Unwired have advised the Productivity Commission that the procedures applied by the ACA through Determinations of unacceptable interference are technically flawed and inappropriate. Moreover, their mandatory application is inappropriate, costly to licensees, but they serve no real public policy purpose because of these fundamental flaws.

Unwired is currently working in association with the Australian Communications Authority to develop a new and simpler model for spectrum management under spectrum licensing.

Unwired would welcome a recommendation from the Committee that the parts of the Act that permit the ACA to determine what constitutes unacceptable interference and permit the ACA to compel that a certificates from accredited people relating to device registration for spectrum licensee be repealed. Unwired has no difficulty with the mandatory registration of transmitters provided that the ACA can provide for sensible exemptions such as already exist for mobile

telephone handsets and for these exemptions to be extended to subscriber terminals for wireless broadband access.

Forward Planning of Spectrum Use

Unwired notes that the ACA has a practice of developing a Rolling Forward Program of spectrum auctions. This practice provides some forewarning of impending changes to the arrangements for spectrum.

While there will be undoubted pressures put to the Committee for the release of more spectrum specifically to promote wireless broadband services, Unwired asks that the Committee recognise that any dilution of Unwired's business plan by opening the prospect of releases of spectrum for FWA will compromise Unwired's ability to raise the funds to roll-out a network. The most important precondition for Unwired's successful roll-out of FWA is stability and certainty in the regulatory environment. Release of new spectrum, or substantial rule changes to allow other technologies to fill an FWA role but on a lower cost base as a consequence of regulatory change will substantially affect investor confidence in FWA.

Infrastructure Funding Programs

Unwired has already noted that programs such as NTN and NCF do little to promote wide scale broadband infrastructure deployment. By targeting regional and sectoral initiatives, these programs have lost the value of wide-scale ubiquitous coverage for broadband.

Unwired believes that any further funding initiatives must be open to for-profit infrastructure providers so that they can extend facilities based competition deeper into rural and regional Australia. The economics of wireless broadband systems are not conducive to serving low population density areas in a purely commercial basis – they require a level of Government assistance to go beyond the larger towns. Such assistance could come from direct support through subsidies and tax breaks, or through "co-development" where seed infrastructure is funded by the community to support basic community services for health, education, law enforcement and emergency response, and commercial services are then added to that seed infrastructure at marginal cost to make them more ubiquitous.

The precedent for Government support for telecommunications is already well established. Already, mobile telephone coverage has been extended under the $50.5 million regional mobile phone program. Television black-spot remediation was provided in the Federal Budget to the level of $13.3 million, and provision for contestability of USO markets in telecommunications depends on explicit per customer subsidies.

In television, the Government has in the last few years provided measures to assist with television stations in meeting the costs of conversion to digital transmission. This continues a long tradition of direct financial assistance to the broadcasting sector for Band II clearance and regional television aggregation, as well as the continued annual funding of infrastructure to enable transmission of the ABC and SBS.

Unwired believes extension of broadband will have all of the nation-building attributes of broadcasting infrastructure in the future as the information economy evolves. It is equally worthy of direct financial assistance especially in the early difficult "seed" years. Assistance can come in many forms whether it is by direct subsidy, long term tax breaks, or simply by commitments to purchase goods and services on a basis that provides confidence to fund investment.

Likely future national and international trends in the development and use of wireless broadband technologies.

Unwired believes that wireless broadband technologies in all of their different formats have an important role to play in communications development. Already there are a number of trends beginning to emerge. Whether these are sustained in the long term cannot be predicted.

Firstly, there is a trend to integrate different complementary technologies into common physical devices. For example, mobile phones are already being manufactured and marketed with Bluetooth capability allowing phones enabled this way to integrate seamlessly with devices such as headsets and PDAs. The aim of the Bluetooth proponents is to extend this so that bluetooth becomes integrated into a wide range of devices that would normally be connected by cables.

Another example of complementary technologies is the announcement in May this year that Airspan (Unwired's vendor) has developed an integrated FWA/802.11 terminal and gateway[5]. The FWA segment provides the last-mile connectivity back into the internet cloud, while the 802.11 device extends the reach of that broadband service to other computers on the local area network segment.

The second major trend that can be discerned is the continued research and application of very broad spread spectrum technologies such as the ultra-wideband (UWB) initiative in the USA. These technologies aim to spread the signal over a large bandwidth at low power levels and have the potential capacity to provide broadband services at higher data rates than currently available. The FCC has recently given approval for these sorts of devices to be operated in some very specific circumstances, including in-building networking. These developments are important and they provide a way for large bandwidths to be provided in closed spaces. These technologies however do have limitations, and are not appropriate for outdoor long range use. The issue, as with all unplanned radio systems, is that they contribute to the noise experienced by other spectrum users and so dilute the utility of the spectrum for everybody.

However, while technology for wireless systems will advance, there are also significant advances being made in the capacity of fixed guided systems such as HFC and optical fibre cables. Optical fibre in particular has huge bandwidth potential that cannot be realized at radiofrequencies. There will always be a tension between the cost and fixed cost base of new optical fibre infrastructure and its broadband capacity, against the cost of deployment of radio based systems with perhaps less capacity, but ease of deployment and a variable cost base.

[5] See www.airspan.com for Airspan press release of 30 May 2002.

Summary

In this submission it is clearly demonstrated that Unwired Australia Pty Ltd, is the only company in Australia with spectrum licences able to support fixed wireless access systems in the internationally recognised bands at 3.4 to 3.6 GHz of the radiofrequency spectrum and the only company able to set up an alternative national local access network infrastructure in Australia.

Unwired plans to deploy a fixed wireless access network to supply broadband data and toll quality POTS and as such, it will be the first facilities based competitor to Telstra in the local loop.

Unwired has established a partnership with Airspan Networks, Ericsson Australia and Vytel to deploy the network using Airspan fixed wireless access technology.

Unwired plans to offer access to broadband data services and last mile telephone access.

As Unwired plans and deploys its network, it faces a number of challenges, most notably, the competitive environment and the dominance of Telstra over the local loop, a sensitive and depressed telecommunications capital market and public confusion about what is “wireless broadband”.

Unwired has outlined for the committee its roll-out plans and its intention to initially provide services in all towns and cities with more than 50,000 people within our licence areas. This threshold is likely to reduce significantly as Unwired comes to better understand the take-up of broadband services.

Unwired has identified for the Committee three general classes of broadband services and technologies:

- Mobile services;
- Fixed services including point-to-point, fixed point-to-multipoint and multipoint distribution services; and
- What we call “proximity” services such as WLANs and WPANs.

Unwired believes that these general classes of systems are complements for one another rather than substitutes and most importantly that there are very important synergies between fixed wireless systems such as that proposed by Unwired and the WLAN technologies that extent the reach at the local level of a wide area internet connection supplied by FWA.

Unwired has drawn on its own extensive due-diligence experience to highlight for the Committee that while FWA systems such as being deployed by Unwired are able to extend broadband services to many circumstances, there are some radio environments that are more challenging, such as highly built up CBD areas, and where population density is low where satellite is likely to be more cost effective. In either case, though, provided that enough customers can be connected to the infrastructure within its range to make it commercially worthwhile, then Unwired believes that there are few environments where FWA will be unable to provide a solution.

Unwired has also highlighted that WLAN technologies such as 802.11 are less adaptable in this role because of their low power and therefore restricted range.

Unwired has considered some of the regulatory issues that impact on the deployment of wireless broadband services. Top among our concerns are the current regulatory efforts that continue to treat Telstra’s monopoly over the copper CAN as a natural monopoly when the evidence suggest that is no longer

the case. These efforts are directed towards mandating access and fixing access arrangements for the copper CAN. These arrangements can artificially distort the market for these services making it more difficult to build a business case for the construction of new competing infrastructure.

Unwired is also concerned by what we perceive are calls for changes to the regulatory arrangements for WLAN devices to permit higher power levels and thus greater range. Unwired believes these moves are counter to good engineering and radio spectrum management practice and will ultimately be counter-productive as these devices are designed to operate at low powers as an interference avoidance mechanism.

Unwired has highlighted for the Committee our concern that funding arrangements directed to telecommunications technology through the State and federal Governments, are generally unavailable to for-profit enterprises such as Unwired and so they are unavailable to companies like Unwired that are attempting to engage in large scale infrastructure development. We call on the Committee to promote funding and support initiatives (for example through the taxation system) that foster an environment which supports nation-building infrastructure investment.

Unwired has also noted for the Committee that the current depressed telecommunication investment market is very sensitive to headline changes in the regulatory environment that might be perceived to threaten or devalue existing investments. Unwired therefore seeks reassurance from the Committee that its recommendations will be sensitive to the effect of its work on the investment in development of wireless broadband in Australia.

Unwired looks forward to meeting with the Committee in public session to expand on these matters.

Attachment 1

ARPANSA REPORTS

In reply please quote:

Summary of Estimated RF EME Levels around Unwired's proposed Subscriber Terminal to be located at King Cross, NSW

Introduction:

This report summarises the estimation of maximum cumulative radiofrequency (RF) electromagnetic energy (EME) levels at ground level emitted from the an Unwired subscriber terminal to be located nearby Unwired's Central Terminal that is to be situated in Kings Cross, NSW. Maximum cumulative levels estimated are for distances of 5m, 50m, 100m, 200m, 300m, 400m, and 500m from the subscriber terminal. The procedures for making the estimates have been developed by the Australian Radiation Protection And Nuclear Safety Agency (ARPANSA). These are documented in the ARPANSA Technical Report; "Radiated EME Exposure Levels - Prediction Methodologies" and is available at http://www.arpansa.gov.au

Federal Government Legal Requirements

The Australian Communications Authority, has established regulations in relation to limits for continuous exposure of the general public to RF transmissions at frequencies used radio communications. Further information can be gained from the ACA web site: http://www.aca.gov.au/standards/index.htm. The RF EME exposure limit is 200 microwatt per centimetre squared (μW/cm²).

Table of Predicted RF Power densities

Distance from base of radiating antennae (m)	RF EME Level (μW/cm²)	Times below General Public Exposure limit (200μW/cm²) or % of ACA limit
5	0.0007	286,000
50	0.0038	53,000
100	0.0010	200,000
200	0.0003	667,000
300	0.0001	2,000,000
400	0.0001	2,000,000
500	<0.0001	>2,000,000
Highest level – 17.4m	0.0133	15,000

Note: This estimation is for the maximum level of RF EME at 1.5m above the ground from the proposed Unwired Subscriber Terminal to be located at Kings Cross. The estimated levels have been calculated on the maximum output level for worst-case transmission conditions. This estimation does not include possible radio signal attenuation due to buildings and the general environment. The uncertainty in the predicted levels is +/- 3dB

Summary:

RF EME levels have been estimated from the proposed Subscriber Terminal to be installed at approximately 7.5 m above ground. The maximum level of exposure at 1.5 m above ground level is estimated to be 0.0133 μW/cm^2 at a distance of 17.4 m. This level complies with the limit established by the regulations declared by the Australian Communications Authority and is a factor 15,000 times below the general public exposure limit of 200 μW/cm^2 which is applicable for RF EME generated by radio communications equipment.

Michael Bangay
Wednesday, May 22, 2002
Technical Specialist
EMR and Optical Radiation Section
Non-Ionising Branch

AUSTRALIAN RADIATION PROTECTION AND NUCLEAR SAFETY AGENCY

ARPANSA

In reply please quote:

Summary of Estimated RF EME Levels around Unwired's Proposed Fixed Wireless Network Central Terminal at King Cross, NSW

Introduction:

This report summarises the estimation of maximum cumulative radiofrequency (RF) electromagnetic energy (EME) levels at ground level emitted from the proposed Unwired Central Terminal antennae at Kings Cross, NSW. Maximum cumulative levels estimated are for distances of 5m, 50m, 100m, 200m, 300m, 400m, and 500m from the Central Terminal's antennae. The procedures for making the estimates have been developed by the Australian Radiation Protection And Nuclear Safety Agency (ARPANSA). These are documented in the ARPANSA Technical Report; "Radiated EME Exposure Levels - Prediction Methodologies" and is available at http://www.arpansa.gov.au

Federal Government Legal Requirements

The Australian Communications Authority, has established regulations in relation to limits for continuous exposure of the general public to RF transmissions at frequencies used radio communications. Further information can be gained from the ACA web site: http://www.aca.gov.au/standards/index.htm. The RF EME exposure limit is 200 microwatt per centimetre squared ($\mu W/cm^2$).

Table of Predicted RF Power densities

Distance from base of radiating antennae (m)	RF EME Level ($\mu W/cm^2$)	Times below General Public Exposure limit ($200\mu W/cm^2$) or % of ACA limit
5	<0.0001	>2,000,000
50	<0.0001	>2,000,000
100	<0.0001	>2,000,000
200	<0.0001	>2,000,000
300	<0.0001	>2,000,000
400	<0.0001	>2,000,000
500	<0.0001	>2,000,000
Highest level – 870m	0.00026	769,000

Note: This estimation is for the maximum level of RF EME at 1.5m above the ground from the proposed Unwired antennas to be located at Kings Cross. The estimated levels have been calculated on the maximum mobile phone call capacity anticipated for this site. This estimation does not include possible radio signal attenuation due to buildings and the general environment. The uncertainty in the predicted levels is +/- 3dB

Summary:

RF EME levels have been estimated from the proposed SA15-120 and five SA 16-60 antennae (Sector 1) to be installed 110 m above ground on the Elan Building, Kings Cross, NSW. The

maximum cumulative level of exposure at 1.5 m above ground level is estimated to be 0.00026 $\mu W/cm^2$ at a distance of 870 m. This level complies with the limit established by the regulations declared by the Australian Communications Authority and is a factor 769,700 times below the general public exposure limit of 200 $\mu W/cm^2$ which is applicable for RF EME generated by radio communications equipment.

Michael Bangay
Monday, May 21, 2002
Technical Specialist
EMR and Optical Radiation Section
Non-Ionising Branch

AUSTRALIAN RADIATION PROTECTION AND NUCLEAR SAFETY AGENCY

ARPANSA

In reply please quote:

Comparison of RF EME Exposure Levels from Telephone Telecommunications Facilities

Facility types:

- Fixed Wireless Network
- GSM 900
- CDMA 800
- GSM 1800
- 3G

Facility	EME level ($\mu W/cm^2$)							
	5m	50 m	100 m	200 m	300 m	400 m	500 m	Max
Fixed Wireless Network	0.0002	0.0001	0.0001	0.0008	0.0006	0.0004	0.0002	0.0074
GSM 900	0.0005	0.0144	0.0250	0.2449	0.1554	0.0773	0.0405	0.2445
CDMA 800	0.0005	0.0219	0.188	0.122	0.0548	0.0292	0.0177	0.2097
GSM 1800	0.0002	0.0125	0.0023	0.0336	0.0334	0.0246	0.0177	0.0367
3G	0.0556	0.0084	0.0257	0.0792	0.1124	0.0842	0.0583	0.1144

Note:

1. Levels are indicative only; typical antenna, tilt, transmitter power have been used but do not necessarily predict the RF EME levels at any particular installation.
2. Estimates were performed with antennae on a 30 m mast.