

Australian Wireless Audio Group

Thursday, 14 March 2013

Standing Committee on Infrastructure and Communications
Parliament House
Canberra
ACT 2600

Dear Secretary,

Re: Inquiry into the Broadcasting Legislation Amendment (Digital Dividend) Bill 2013

The Australian Wireless Audio Group ("AWAG") would like to thank you for the opportunity to contribute to this Inquiry.

In Australia, wireless audio technology underpins \$32 billion worth of economic activity and the employment of more than 140,000 people. Even before the introduction of this Bill, delays by the Government in addressing wireless audio in respect of the Digital Dividend and Restack were threatening these businesses and jobs. This Bill threatens to make a bad situation much worse, much sooner.

AWAG are very concerned about this Bill for several reasons:

1. The dates and timelines on which this Bill is predicated are directly in conflict with the timelines in other regulatory instruments promulgated by this government;
2. The Bill is explicitly predicated on a presumption that once the television broadcasters have left the Digital Dividend Spectrum, that this spectrum is cleared;
3. The Bill specifically goes about enabling changes to the regulatory environment which would be extremely deleterious to businesses and other organisations relying on the (already uncertain) regulatory environment for wireless microphones.

The Government has repeatedly positioned the Digital Dividend spectrum as "waterfront property" which will receive a premium at auction. As long as there is no coordinated plan to clear this spectrum before handover to the successful bidders, we submit that the final action prices will be discounted, and the ultimate losers will be the Australian taxpayers.

While there are costs associated with acting to solve this problem now, those short term costs are substantially less than the hits to the Australian economy and the impending spectrum auction which will result from a continued failure to act.

An Inquiry called on less than a day's notice, after years of inactivity, is a recipe for bad public policy. We implore you to consider the full implications of this Bill very carefully.

Yours sincerely

Ian Harvey
Executive Officer

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About the Australian Wireless Audio Group (“AWAG”)

AWAG is an Industry funded, non-partisan, representative group which speaks for key manufacturers, wholesalers, retailers and users of wireless audio products currently operating in the 520-820MHz frequency band.

AWAG is managed by Australian Commercial & Entertainment Technologies Association with support from the Australian Music Association.

Our members currently include:

- Jands Pty Ltd
- Syntec International
- Technical Audio Group
- Audio Products Group
- Bosch Audio
- Hills SVL (previously Audio Telex)
- Aerobic Microphones Australia (associate member, - fitness industry products)

In recent years industry has been supplying around 32,000 wireless audio products per annum to Australian users. Therefore, there are likely to be more than 150,000 units being used on a regular basis within Australia. Industry estimates that around 120,000 units operate in the 694MHz to 820MHZ range which is currently slated for use by mobile digital devices by 2015.

Removing 120,000+ existing wireless units from the Australian market even within existing timelines will be an enormous task and significant financial burden on community groups, schools, churches and small businesses.

Wireless microphones and other wireless audio products have several unique characteristics which make them critical for multiple uses such as live-to-air TV broadcasts and musical productions, through to church and school halls. Namely, these characteristics are:

- a) Real time (100% duty cycle with no lag or delay); &
- b) High quality audio (broadcast quality); &
- c) Radiated power (up to 50mW with a typical range of 100 metres).

At the present time there is no close substitute for such analogue products, although this may change over time. Nor will any other solution be more efficient in terms of spectrum utilization. Some manufacturers have developed products that operate in different frequency bands however this is relatively new technology, has received little take up by that market and is expensive.

Submission

Since the commencement of this Digital Dividend process the Government has assumed that, aside from the five television broadcasters, the spectrum between 520MHz and 820MHz is 'terra nullius'.

Nothing could be further than the truth, as this spectrum has been invested in and relied upon by hundreds of thousands of wireless audio users operating a combination of wireless microphones, wireless transmitters for musical instruments and in ear monitoring devices for more than a decade.

Collectively these devices enable around \$32 billion worth of economic activity and the employment of more than 140,000 people¹. Millions of Australians enjoy the benefits of these products everyday as enabling technologies in the following sectors:

- Broadcast
- Music and Musical Theatre
- The performing arts
- Fitness
- Meetings and conventions
- News gathering
- Tourism
- Education
- Sports

In addition these devices play an important role in many cultural, community, social and religious activities which impact on millions more Australians every week.

Contrary to the 'terra nullius' approach taken by the Government and the ACMA over the years, the devices operating in this spectrum operate under a licence originally gazetted by the then Australian Communications Authority, now the Australian Communications and Media Authority (ACMA) on July 5th 2000. Since then there have been nine variations made to the licence with a further variation pending following the consultation undertaken via IFC49/2012 released by the ACMA in November 2012.

The ACMA website states that:

The LIPD Class Licence authorises users to operate a wide range of low power radiocommunications devices operating in various segments of the radiofrequency spectrum. The LIPD Class Licence sets out the conditions under which many types of short range devices may operate. These conditions always cover frequency bands of operation and radiated power limits.

and continues:

¹ Windsor Place Consulting, *Untethering the microphone: An economic study of the benefits of spectrum use for unlicensed wireless audiovisual devices in Australia. An updated analysis*, 4 March 2010

Products imported and sold under this class licence must comply with some specific standards notably:

Devices manufactured, imported, or modified after 26 September 2001, and operating under the LIPD class licence, must comply with all radiocommunications standards applicable to them. 'Standard' in this context means a standard made under section 162 of the Radiocommunications Act 1992 (the Act).

The specific conditions applied to wireless audio devices like radio microphones can be found in section 22A and are as follows:

Item: 22A

Class of Transmitter: Wireless Audio transmitters

*Permitted operating frequency band (MHz) (lower limit exclusive, upper limit inclusive):
520MHz to 820MHz*

Maximum EIRP: 100 mW (~60.95 mW ERP)

Limitations:

- 1. Emission must be frequency modulated and have a maximum bandwidth of 330 kHz.*
- 2. Transmission in a broadcasting services bands channel must not originate in the coverage area of a broadcasting station or a datacasting service station (including a repeater or translator station) operating in the same channel.*
- 3. The origin of a transmission in a broadcasting services bands channel must be such that the resulting field strength at the nearest boundary of the coverage area of a broadcasting station or a datacasting service station using the channel does not exceed 30 dBuV/m.*
- 4. When transmitting in an unused broadcasting services bands channel, and in the coverage area of a broadcasting station or a datacasting service station (including a repeater or translator station) operating in an adjacent channel, the channel centre frequency of the wireless audio transmitter must be at least 400 kHz above the upper edge of the adjacent channel, or 400 kHz below the lower edge of the adjacent channel.*

Users operating these products outside of these limitations are liable to prosecution under the Act as stated on the ACMA website:

It is important that users of LIPDs comply with all conditions in the LIPD class licence. Subsection 132(3) of the Act expressly provides that:

Operation of a radiocommunications device is not authorised by a class licence if it is not in accordance with the conditions of the licence.

If any condition of the LIPD class licence is breached (for example, operating on a frequency not mentioned in the class licence) the operator is no longer authorised to operate under the LIPD class licence. In this instance, the operator could be liable for prosecution. Manufacturers and suppliers of radiocommunications products which come within the scope of the LIPD class licence are therefore encouraged to have regard to the above information in forming advice for

their customers, and also must have regard to the Act and any radiocommunications standards applicable to the device.

The next round of proposed changes to the LIPD pre-empted in the recent ACMA IFC49/2012 document includes the use of digital modulated as well as frequency modulated devices and, importantly, formal notification that the right under the LIPD to use spectrum from 695MHz to 820MHz is to be withdrawn from 31st December 2014. We understand the proposed changes to the LIPD are to be enacted in the near future.

The point here is that the use of wireless audio devices is recognised under law, with a clearly defined set of compliance standards, operational limitations and significant sanctions where there are proven to be licence breaches

Clearly this is not a case of 'terra nullius'. The Government and its regulator have been long aware of these devices and have created a sophisticated regulatory framework their use over more than a decade. Unfortunately, over the past five years it has seen fit to ignore their existence as an inconvenient side issue to the digital dividend.

Members of the committee will be familiar with the background and timetable concerning the digital dividend. Like other stakeholders, AWAG recognise the importance of maximising the finite resources of radio spectrum. Its members and the manufacturers they represent in this country allocate large amounts of resources to maximising the efficiency of the products they produce and sell. For the same reasons the community want to use, and will pay for, the convenience of mobile communications devices such as phone and tablets the community want the flexibility and convenience provided by wireless audio products. This results in increased demand through either new applications or an increased number of devices used per deployment.

In the Bill before the House the explanatory memorandum notes that the following:

As ACMA has noted, three key processes are required to realise the digital dividend. These are:

- *conversion of analogue television broadcasting to digital transmission (known as switchover)*
- *clearance of a contiguous block of spectrum and*
- *allocation of the cleared spectrum.*

AWAG agrees that this is the process required to realise the digital dividend. However, there has been no planning undertaken to clear the spectrum of any users other than the television broadcasters. Despite over five years of consultation, the ACMA nor the Department of Broadband, Communications and the Digital Economy, have done anything to clear the digital dividend spectrum of its most numerous and significant users - not the five TV broadcasters but the more than 150,000 wireless audio users whose current product operates between 695MHz and 820MHz.

The Bill goes on to explain the timelines involved.

Digital switchover has been in process under the Commercial Television Conversion Scheme and the National Television Conversion Scheme, since June 1999 and February 2000 respectively, and will be completed by 31 December 2013.⁹ It is expected that the digital dividend spectrum will be cleared of all existing services by the end of 2014.¹⁰ In anticipation of this clearance occurring smoothly, in December 2012 the Minister directed ACMA to undertake an auction for the digital dividend spectrum by 30 April 2013.¹¹

The assessment that, 'digital dividend spectrum will be cleared of all existing services by the end of 2014' is patently incorrect.

As of this date very few of the existing wireless audio users affected by these changes know anything of what is to happen in the coming 18 months. This lack of awareness and lack of any plan from Government can only result in policy failure that will be evidenced through:

- The creation of up to 150,000 new criminals as wireless audio users continue to use their devices in breach of the Radio Communications Act
- The reluctance of the telecommunications companies, the likely bidders for the digital dividend spectrum, to pay top dollar for spectrum that in fact remains occupied. Not by TV broadcaster but by wireless audio users.

The Bill also states that, "this Bill is not expected to have any direct financial implications on Australian Government expenditure or revenue". AWAG believe this unlikely though the financial impact will be indirect not direct. There are significant potential losses in terms of revenue and employment via the users of wireless audio devices should suitable alternative arrangements not be found. At stake is up to \$32 billion in economic activity and the employment of up to 140,000 people. The Government shares in this revenue through GST and well as income and business tax returns.

The attached case studies from organisations or individual representing a number of the sectors using wireless audio devices will demonstrate some of the impact. See Appendix B.

The consequences of this Bill cause further difficulties for wireless audio use and create further policy failures:

- There is a clear conflict between the December 31st 2014 date at which wireless audio users must cease using the 695MHz and 820MHz spectrum based on the IFC49/2012 consultation that has just been completed and the granting of access to the successful auction bidders of 'cleared' spectrum. Clear spectrum at this stage of the process is not something the Government can promise.
- The high end wireless audio users, known as Program Makers and Special Events (PMSE) users are, unlike most wireless audio users, very sophisticated in their deployment of these products. They know where and how to avoid TV broadcasts which are geographically fixed. Any access provided to telco's during what remains of the transition period will result in connection failure of either the audio signal from microphone to receiver or from the mobile device to its tower. Service failures will be high and user satisfaction low. It also begs the question of compliance should one device interfere with another who is in breach

of the Act. The wireless audio user operating legally under the LIPD or the telco operating under this new regime?

- Any pretence the Government or the ACMA have had in their dealings with wireless audio users with respect to an orderly transition by 2014 are a sham. For example in a letter to AWAG on the 4th January 2012, Senator Conroy wrote to AWAG and in part stated that, *“the government recognises that wireless audio devices provide an important service and there will be ongoing demand for spectrum for these devices...the ACMA is working with the wireless audio community, including AWAG and is taking into account the concerns raised, to make suitable provision for the operation of wireless audio equipment in the future”*.

What will likely happen if a genuine attempt led by Government and supported by industry to transition wireless audio use as a result of the digital dividend does not happen?

- Most users will continue to use their existing equipment. They will likely be unaware of the need to shift to different spectrum. Those who are aware will be unable to do so due to financial constraints or will be unconvinced of the reasons or need to move. Their product will still work and any new product will offer no technical benefit to the one they are legally required to turn off and toss in the bin.
- Up to 150,000 individuals and organisations will in effect become criminals as they breach the 1992 Radiocommunications Act either knowingly or unknowingly. Included in this new class of criminal will be priests, school principals, fitness instructors, tourism operators, sporting club volunteers, musicians and many others.
- Should the ACMA choose to enforce the Act, something it has not been keen to commit to, to date, there is the likelihood of business failures, occupational health and safety incidents, reduced community activities.

What needs to happen?

Now that most of the planning for the transition of TV broadcasters has taken place it is *past* time to implement a transition plan for wireless audio.

The loss of 126MHz from the previously available spectrum is going to challenge the wireless audio community and users. There is no solution other than to have a larger piece of spectrum available than what is on offer post the digital dividend. Clearly that is not possible.

That said the following 6 initiatives will assist the transition, allow the government to meet its obligations to the spectrum bidders, improve the efficiency of the available spectrum and ensure that there will be no policy failures.

All that said, even with these six initiatives implemented, there will be some businesses and organisations that currently rely on wireless audio which will be unable to continue operations. This is particularly likely on the Gold Coast as well as the central business and entertainment districts of Brisbane, Sydney and Melbourne.

1/ Education program. To date most users of these devices are unaware of the need to decommission and withdraw many of the products they use because they fall outside the revised LIPD spectrum of 520MHz to 694MHz.

They are unaware because there has been no effort to communicate because there is no clear transition plan.

A disparate group of users need to be informed of the need to change their products over. These users range from individual musicians, venues, schools, churches, the fitness, tourism, meetings and conventions sectors to name a few.

Two things need to be communicated:

- A. There is about to be a change and that the change needs to be completed by December 2014
- B. The change will require the majority of existing users to take action. This varies depending on the product owned. In some cases no action may be needed but for the majority of the 150,000 or so devices currently in use will need to be decommissioned and withdrawn from use

A solution needs to be offered to those who are being forced to change.

The education program would cost up to \$2 million and would need to be initiated by no later than mid 2013 and extended through until early 2015.

2/ Compensation. The prevailing Government and ACMA view is that existing users will merely vacate the space they currently occupy and that they will do this:

- Without being advised on the reason or the need;
- Without knowing what the alternatives are; and

- Without any incentive (technical, financial, operational etc) to make the change even if they are aware of the issue.

The reality is that existing users will:

- Continue to operate their current products as they have done so in the past *unaware* of the changes;
- Continue to operate their current products as they have done so in the past *knowing that it will be illegal to do so* but without the financial means to replace their existing devices with new devices that, save for a change in the spectrum, they operate offer little or no technical, operational or financial benefits.

Depending on the method used the cost of compensating all affected existing users might be expected to be between \$80 million to \$220 million².

This compensation is required to provide support to over \$32 billion in annual economic activity in a wide range of sectors as well as supporting the provision of important social and community activity.

3/ Adoption of digital products and other new product technologies. The question of digitally modulated devices is being dealt with under the revised LIPD. The public consultation for this paper (IFC49/2012) was concluded by ACMA in February 2013.

Other technologies such as search functions being built into devices to identify white space for their operation are becoming more widely available and will improve the efficiency of deployed devices in the future.

4/ Access to 1790-1800MHz has the potential to reduce some of the congestion in the broadcast band. This is also being dealt with under the revised LIPD the consultation (IFC49/2012) which concluded in February 2013.

5/ Decision on the mid band gap. This spectrum 745MHz to 755MHz sits in the middle of the digital dividend spectrum. It cannot be used by the telco's. Testing needs to be undertaken to see if this can provide another area where small scale wireless audio users can operate. Despite repeated representations from industry ACMA has not set a timeline for this testing so it is possible that this may not be resolved until after the digital dividend, subsequent television restack and occupation by successful spectrum auction bidders.

Unlike the 1790-1800MHz gap there are some existing wireless devices already operating in this spectrum. Early determination of the suitability of this spectrum for use by wireless audio users would mean that some users could continue to use existing products rather than having to decommission existing gear only to purchase new product in the future.

Items 4 and 5 should both be seen as opportunities to reduce congestion within the broadcast spectrum post digital dividend. These pieces of spectrum are not large enough to sustain larger scale productions but are viable for smaller scale use (less than 10 devices being used concurrently) such as can be found in the fitness industry.

6/ Co channel sharing. This is critical to the major users of devices such as in musical theatre, concerts, theatre, meetings and conventions, TV broadcasts and major public events.

When wireless audio devices are operated in major venues (the Opera House, large live entertainment centres, theatres and so on) they should be able to assume the role of being the *primary* user of the spectrum. Usually these venues do not broadcast TV nor are there any residential TV viewers within the footprint of a wireless audio device.

Typically any wireless audio device is attenuated by:

- the buildings mass
- the distance between the wireless audio device and TV receiver
- The lower power of the wireless audio device compared to the television transmitter.

A redrafting of the LIPD that allows for *all* of the broadcast spectrum to be accessed by wireless audio where it is the primary user in environments where the use of the devices will not impact TV broadcasts will:

- provide continuity to major users - Program Makers and Special Events producers (PMSE)
- legitimise existing practice
- allow for some continued use of existing products.

**APPENDIX 1 Case Studies on the use, effect and impact of radio
microphones and other wireless audio devices**

Australian Wireless Audio Group

Case Studies on the use, effect and impact of
radio microphones and other
wireless audio devices





Case Studies

Introduction

Our highest accomplishments still have the single aim of bringing men together.
-Antoine De Saint-Exupery, Terre des Hommes

Wireless audio devices bring people together. In business, in recreation, in learning, in prayer and in celebration radio microphones, in-ear monitoring systems, wireless devices for musical instruments and communications systems bring people together and build communities.

However, such is our familiarity with these devices that the extent to which they are used often goes unseen and we fail to recognise the extent to which they have become a critical part of the infrastructure in each of the following activities:

- Broadcasting
- News gathering
- Theatre and musical theatre productions
- Arts and culture
- Entertainment
- Education
- Tourism
- Events and Meetings
- Religious services
- Health and fitness

Some of the applications in which these devices are used have revolutionised the way these sectors operate. To point to a recent example, the on-field commentary provided by Australian cricketers Adam Gilchrist and Andrew Symons during last Summer's Twenty20 games could only have happen through the use of radio microphones.

Arguably of greater significance is the use of wireless audio products in the fitness industry. In this case these products have revolutionised the delivery of fitness classes, thereby contributing to the significant growth of that industry and hopefully the health and wellbeing of millions of Australians.

In some instances these products have enabled new opportunities for economic, social or cultural activities; the re-birth of musical theatre is just one such example highlighted in these case studies.

Of course there are other examples where the application of these products is somewhat less dramatic, less revolutionary, more mundane. In these circumstances the use of these devices merely reflects the application of the latest, state-of-the-art technology and the communities willingness to embrace the benefits of that technology.

These case studies demonstrate a range of real world uses, by users large and small who are active in each of the sectors listed above. The studies demonstrate how the

products are used and the benefits sought and derived. They demonstrate the growth of use and offer some forecasts regarding the expected future use of these products.

Of course these studies also make a number of observations on the consequences of any future limitations being placed on their access as a result of spectrum planning.

These studies also demonstrate the range of activity undertaken with these devices. How the product is used by multi-billion dollar industries, such as the fitness or convention and meetings industries, while being an equally important asset to a school, church or community groups.

Wireless audio products, though more expensive than their wired alternatives, bring many benefits to their users. The inherent benefits are:

- Access to high quality audio – whether this is for amplified live sound or sound that is recorded for later reproduction or archiving
- The ability to move freely
- The ability to operate remotely

As a consequence of these core benefits users derive a series of secondary benefits including:

- The ability to solve the occupational health and safety issues inherent with the use of cables
- Economic benefits derived through either increased scale or new activity⁽¹⁾
- Increased cultural opportunities
- Increased ability to communicate
- Increased ability to share and connect socially, and provide
- Greater creative freedoms

Already there are over 130,000⁽²⁾ wireless audio devices sold into the Australian market in the past decade. Current volumes are running in excess of 30,000⁽²⁾ new pieces per annum and increasing, as new users and an expanded range of uses drives demand. New opportunities for their use will be found by the sectors noted above, while new sectors (the auction industry for example – where they are not extensively used at present or in schools, such as those in Israel and in parts of America where each teacher is equipped with a radio mic for occupational health and safety reasons) will see further future growth.

Like many other technologies the price of wireless audio products is falling. As it does they become more attractive and more available to general users. Initially, these products were purchased by professional users such as organisations in professional musical theatre, broadcasting and news gathering. Now they are the preferred choice of musicians, schools and churches.

These 16 case studies will demonstrate that, in business, in recreation, in learning, in prayer and in celebration wireless audio devices help bring people together for the betterment of all concerned.

⁽¹⁾ For a more detailed assessment of the economic impact of wireless audio products the study, *Untethering the microphone: An economic study of the benefits of spectrum use for unlicensed wireless audiovisual devices in Australia*

⁽²⁾ Based on the information assembled by the Australian Music Association from data sourced from the Australian Bureau of Statistics.

Case Studies

- **Theatre and musical theatre productions**
 - The Show Music Go On – System Sound
 - (The Suburbs are Alive) With the Sound of Music – Loud And Clear Audio
- **Arts and culture**
 - Australian Icon – Sydney Opera House
 - The World is a Stage – Outlook Communications
- **Entertainment**
 - That's Entertainment – Norwest Communications
 - The Wedding Singers – Andy and Niki
- **Tourism**
 - Up Close and Personal with Sabu, Khan and Casper – Australia Zoo
- **Education**
 - Sound 101– Macquarie University
 - High School Musical – Various schools
- **Events and Meetings**
 - Good morning and welcome – Staging Connections
 - He Who Hath Ears, Let Them Hear – Auditoria/World Youth Day
- **Religious services**
 - Faith in the 21st Century (1) – Hillsong Church
 - Faith in the 21st Century (2) – St James, Glen Iris
- **Health and fitness**
 - The Member Experience – Fitness Australia
- **News gathering**
 - *Freelance News Gathering*

The Show Must Go On

Case Study
System Sound, Melbourne

System Sound specialise in providing sound reinforcement and system design for musical theatre. Their business is based on the provision of equipment and personnel for sound and communications under contract to the producers of theatre productions such as *Phantom of the Opera*, *Miss Saigon*, *Wicked* and *Billy Elliot*.

The use of wireless microphone and communications equipment is absolutely critical to the musical theatre industry and organisations like System Sound. Without access to sufficient spectrum to run the on-average 40 radio microphones and 18 channels of communications per show these major productions would not be staged at all. Certainly none of the major productions debuted in the West End or on Broadway would be staged locally without access to the same technical production and staging being available in Australia as it is overseas. This includes the large scale use of wireless audio.

Modern theatrical productions, such as *Billy Elliot*, have been designed to incorporate all the technical and staging benefits that can be derived from the use of radio microphones. The producers and sound designers provide the audience with an experiential sound palate where the sound is often felt as much as heard. For example, some scenes in *Billy Elliot* take place in a coal mine. The drama of these scenes is supported by the use of subsonic sound and a sound palate that has the audience believing they are in fact underground. Together with the modern music genre and immersive surround sound techniques, sound production becomes a critical device in the story telling.

However, even traditional musicals, such as *Guys and Dolls* (which is currently being revived in Melbourne) are being modernised to take advantage of new staging techniques that depend on the use of wireless audio technology. While in some theatres it is *notionally* possible to stage musicals like *Guys and Dolls* without sound reinforcement, the reality is that in 2008 a production without the use of the modern sound and staging would simply fail to gain a commercially viable audience.

Because of the trend to more realistic staging techniques the use of wireless audio devices is forecast to increase into the future. Larger productions, a more dynamic sound environment, larger casts (with all cast members being wireless equipped) are just some examples of how the use of wireless audio devices is increasing. Other trends are also seeing more and more radio mics being used per production. For example, the use of two microphones on the lead characters is an increasing trend. This is done for two reasons. Firstly, for redundancy (no one likes the loss of the vocal from the lead character mid verse) and, secondly, as a result of over dressing (where a character is wearing two costumes each with a radio microphone attached for the purposes costume change, use of hats, wigs and masks etc) is becoming *de rigueur*.

There is also an increase in the use of duplex radio communications devices due to OHS requirements. Previously, these devices were used by the stage and front of

house managers alone. However, with the increased complexity of staging such as trapdoors or 'flying', stage mechanists need to move freely and untethered to assist performers in these complex manoeuvres often in the darkened stage wings. Wireless communications devices allow these actions to take place in safety.

System Sound are typically involved in staging of up to 6 major shows that are running in Australia at any given time. There are on average a further 4 major productions engineered by others, taking the total to around 10 productions being staged at any time across Australia. In employment terms, around 40 people are engaged by System Sound directly, while a further 600 or so people are indirectly employed providing technical or front of house services to the productions that System Sound service. When all major productions are included, this number rises to more than 1,000 people employed in the delivery of music theatre at any one time.

In economic terms, each of these productions has an average income of around \$1 million per week, or combined around \$500 million annually generated through the sale of approximately 5 million seats. These figures do not include production add-on's, such as the sale of programs or food, nor does it include the economic benefits associated through tourism such as the purchase of hotel room nights or restaurant covers by theatre goers.

To support these productions System Sound supply and operate around 240 radio microphones along with 80 radio communications networks for use by stage management and stage mechanists. Typically, 40 or so radio microphones are used per production along with 18 channels of radio communications. System Sound's total investment in wireless audio products is in excess of \$2.5 million at current value.

The principals of the business have been involved in sound production for theatre for more than 30 years. They see the resurgence in public interest in the genre being closely associated with the technical advances introduced in the past decade or so, including staging and lighting but particularly through the use of wireless audio.

Put simply, without wireless audio the show could not go on.

(It's the Suburbs That are Alive) With the Sound Music

Case study

Loud and Clear Audio - Sydney

To quote Sir Laurence Olivier, " a great theatre is the outward and visible sign of an inward and probable culture". To support that probable culture Loud and Clear was formed in 1990, the company aiming to provide audio and staging services to the theatrical societies in Sydney's North. Since that first production with the Warringah Musical Society at the Glen Street Theatre, Loud and Clear have developed a unique approach to designing quality audio on a budget allowing schools and community groups to deliver a high quality experience to their audiences throughout Sydney and its surrounds.

Nearly 20 years later, that probable culture has proved to be very real as Loud and Clear have been involved with nearly 350 further musical theatre productions including *West Side Story*, *Les Miserables*, *Kiss Me Kate* and many, many others. Their most recent completed productions have been for Penrith Music and Comedy Company, *The Wedding Singer*, and for Q Theatre, Penrith Willoughby Theatre Company, *Beauty & The Beast*.

The vibrant nature of the theatre community is evident when you consider the number of companies Loud and Clear work with including the Willoughby Theatre Company, Bankstown Theatrical Society, Highlands Theatre Group, Stageartz, Penny Presents plus dozens of other groups. In all, the total audience for the approximately 50 productions Loud and Clear undertake each year exceeds 250,000 people.

Musical theatre is built around the ability to move, act and dance on stage while singing with an orchestra or band. The singers must be heard. The ability to achieve these things and ultimately create a successful production is, in many cases, underpinned by the use of radio microphones. In the Loud and Clear experience these community productions frequently use up to a dozen radio microphones, the largest production in terms of the use of radio microphones has been a staging of *Jesus Christ Superstar* in which 24 wireless mics were used, not too many fewer than a professional production which typically employs around 40 radio mics.

While community theatre may not have the budget of the big international productions, audience expectations are just as high as the following quote from an audience member attending a Loud and Clear production shows. "I don't think I have ever been to a \$70 plus per ticket professional show were the vocals and music were any better than Willoughby Musical Society's *Secret Garden*. The whole sound was CD quality." Production values must be high for these community groups to continue to secure strong community support and the use of radio microphone allows this to happen.

It is those same expectations that will continue to see the increased use of radio microphones in these environments in the opinion of Loud and Clear. In this case it is not just the demands of the audience but that of the performers and directors. This

technology allows them to further increase the standards of their productions and now that the technology is affordable the theatre companies working with Loud and Clear will naturally take the path that allows them to create the best production possible.

This attitude by the producers will see Loud and Clear expanding on their existing inventory of 140 radio microphones into the future. This will require further investment, in addition to the more than \$200,000 currently invested, to meet the future demands of users. Even if there are no additional theatre companies emerging in the foreseeable future demand will come from existing companies extending the numbers of radio devices employed in each production.

Currently, where 12 radio mics might be the norm and the example of 24 radio mics for a production of *Jesus Christ Superstar* is the exception, the trend will be to more devices per production allowing an increasing number of the cast to have vocal support. Bigger productions, such as some of the more recently released West End or Broadway shows will also find their way into community theatre in time. Just as they have taken professional musical theatre to new heights these shows, such as *Billy Elliot* or *Wicked* will see the capabilities of community theatre rise to accommodate them in the coming years.

Just as the demands for better and higher quality productions will lead to an increase in the use of radio microphones, issues surrounding occupational health and safety standards will likely see an increase in the use by schools and community theatre groups of other wireless devices, in particular communication systems.

Therefore on two fronts the expectation of Loud and Clear is that there will be more wireless audio capacity required in the future, not less. Ultimately, their view is that it is the suburbs, and not the hills, that will be alive with the sound of music.

Australian Icon

Case Study

Sydney Opera House - Sydney

The Sydney Opera house is the home to many of Australia's leading artistic organisations including the Sydney Symphony, Australian Chamber Orchestra, Sydney Theatre Company, Bell Shakespeare, The Australian Ballet and Opera Australia. In addition, it provides a performance venue for many other organisations large and small as well as being the focal point for artists visiting Sydney each year to be part of the Sydney Festival program.

The Sydney Opera House is home to all types of music and performance from the mainstream to experimental. In addition to artistic endeavours and performances, the Sydney Opera House also hosts a number of corporate events and meetings during the year. It is also of course a major tourism site.

Such is the Sydney Opera Houses' fame that over 4 million people visited the building in 2006/7. This includes over 328,000 who took one of the guided tours, as well as, the more than 1.2 million who enjoyed one or more of the 1,500 plus performances that took place during that year. Those 1.2 million performance attendees contributed to the more than \$40 million in revenue to the Opera House ⁽¹⁾.

Supporting both the artistic and tourism activities associated with the Opera House are a team of 40 audio visual staff, as well as, 5 technical support specialists. These people operate between 70 and 80 radio microphones, 22 in-ear monitoring systems and 80 wireless audio communications systems. In total, The Sydney Opera House owns and operates more than \$1 million worth of wireless audio product.

This equipment is employed to some degree in every performance, event or tourist visit undertaken at the venue, the investment and use of this equipment helping to ensure the organisations objectives are being met. These include:

- an increasing prominence as a major presenter and producer,
- a vision to present iconic and influential artists and companies,
- the presentation of performers and companies of exquisite artistry,
- responding to our community's love of the arts
- the continual enhancement of the experience for visitors

As a result and, to a greater or lesser degree depending on the programme, wireless audio products are embedded in the cultural and public functions of the Sydney Opera House.

Back stage, wireless audio products also play an important part in ensuring that occupational, health and safety standards are met. The wireless communications systems in particular are very valuable in that they allow stage hands and mechanists a greater freedom on movement when supporting artists in opera, musicals and the ballet in the semi dark and in restricted work areas. They also minimise a potential vocal stress on the venues staff including the production staff and tour guides.

In the view of the Opera House having future access to wireless audio is critical to their role as both a cultural and tourism icon. In cultural terms the venue would be seriously compromised if it were unable to meet the expectations of the hirers, both local and international who use the Opera House. The same could be said for the local and international designers who devise the staging, audio and lighting for many of the productions staged at the venue. Without continued access to wireless audio and the benefits they bring to staging, audio quality and with respect to occupational health and safety issues, many of the performances currently staged at the Opera House would simply not take place. The bottom line for the Opera House is that any reduction in production values and quality, would directly affect its reputation. Current audiences expectations would not be met in an environment where wireless audio products could not be used. The current record attendances would soon fall away. Clearly this has an impact not just on the Opera House but on the multitude of groups and organisations, large and small who use the venue as their place of contact with Sydney, and sometimes Australian audiences. Such an outcome would be calamitous for arts and cultural activity here in Australia.

In turn, it stands to reason that if the reputation and ability of the Opera House was to be diminished in cultural terms, it would very soon become diminished in tourism terms too.

⁽¹⁾ All data taken from the Sydney Opera House Annual Report 2006/7

The World is a Stage

Case Study
Outlook Communications - Melbourne

Outlook Communications provide a range of audio production services to many and varied clients throughout Melbourne and have done so for the past 20 years. Their core service is the turn key supply of operational staff and audio/audio visual equipment on a rental basis to a wide variety of clients.

To achieve this Outlook Communications operate 170 wireless microphones, as well as, a further complement of wireless communications and in ear monitoring systems. The total investment by Outlook Communications in wireless audio products is in excess of \$700,000.

Recent corporate clients have include Australian Grand Prix, Commonwealth Games, City of Melbourne – News Year Eve, The 2005 World Gymnastics Championships, the NGK Rally of Melbourne, Spring Fashion Week, The St Kilda Festival and the Melbourne Moomba Festival.

Many of these events require audio to be provided to both the live audience, as well as, an audio feed for TV and broadcast.

Amateur and professional musical theatre, as well as, school productions represent another stream of activity undertaken by Outlook Communications. There are at any given time a number of these events being stage across Melbourne. Once again Outlook Communications provide these groups with both the equipment and the staff to ensure that their productions are of a high standard.

Outlook Communications employ around 20 staff and are typically involved in 5 or 6 simultaneous events and productions across Melbourne at any one time. Weekly audiences for these events total around 25,000 people. These events may play to as few as 1,000 people attending, for example, a school or local theatre production, through to as many as 2,500 people attending a professional musical theatre production in the Comedy, Princess or Her Majesty Theatres. Clearly, larger events such as the Moomba Festival or the Australian Grand Prix have audiences that run to more than 100,000 people at the venue, as well as, a TV audience that might figure into the millions of viewers.

However, much of the activity undertaken by Outlook Communications takes place within, and as part of, the community. Venues frequently used by the producers of the programmes supported by Outlook Communications take place in metropolitan arts and cultural centres such as the Whitehorse, Darebin, Frankston and Karrilika Theatres. They also take place in school theatres and halls. Just like the St Kilda and Moomba Festivals these school and amateur productions provide their communities with important cultural connections.

All of the events that Outlook Communications support have a high dependency on wireless audio products. From professional theatre productions where as many as 40

wireless systems might be used to a school production that might employ 6 to 12 radio mics the use of these products serves the same purpose.

The producers of these events are seeking to provide the highest standard production or event that they can. Typically this requires:

- High quality sound and vocal reinforcement for the audience
- A high quality sound for the recording or archiving of the production or event
- The ability for the actors and presenters to move freely around the performance or presentation space
- The need for the producers to ensure that the cast, crew and audience remain in a safe and secure environment.

The use of radio microphones, and wireless communications systems ensure that these objectives are achieved.

In fact, without the use of these devices many of the school and community events supported by Outlook Communications could no longer be staged. This of course is detrimental to local cultural activity, the development of artistic and performance skills and the ability of schools and groups to fund raise for their school or community organisation.

Outlook Communications anticipate the continued growth of wireless audio device use. They report that there equipment 'days out' is increasing and that more events are requiring greater number of wireless audio devices as part of the audio specification.

That's Entertainment

Case Study

Chris Kennedy – CEO Norwest Productions, Sydney

Norwest Productions Pty Ltd. is one of Australia's largest professional audio service providers, with offices in Sydney, Brisbane, Melbourne and Bangkok. Norwest provides audio solutions for special events, arena concerts, sporting events, touring bands, theatre, broadcast, conferences, conventions and other corporate events.

Norwest directly employs approximately 80 people, which includes 50 full-time and about 20-30 regular contracting staff. However, once you start to consider the broad spectrum of people indirectly employed in the coordination of a production (for example a load-in team which can easily include 30-40 people, similarly a cast of a theatre production, the team behind a live television program broadcast to the nation), the number of people involved grows exponentially in relation to the production size.

Annually, Norwest is involved in a vast number of productions of varying scales. These include:

- At least 10 concert tours yearly, with each tour incorporating an average of 6-8 shows attended by hundreds of thousands throughout Australia. Recent acts include, Linkin Park, Iron Maiden, Brooks and Dunn, Keith Urban and Human Nature.
- Nationally broadcast television shows, such as "So You Think You Can Dance", "Big Brother", "Australian Idol" etc. which attracts millions of regular viewers each season.
- Sporting Events attended by thousands and broadcast nationally such as the FINA World Swimming Championships, NRL and AFL Football
- Theatre productions which easily draw 20,000 participants weekly such as The Wiggles, Barry Humphries and the Bollywood Show.

When one reflects on the extensive portfolio of productions Norwest is involved in on a day-to-day basis, Norwest estimates their activities reach around 10 million participants weekly. However, when you start to incorporate special events such as the Sydney Olympics (2000), Athens Olympics (2004), Asian Games in Doha (2006), Melbourne Commonwealth Games (2006) into the mix participation can escalate to billions through global TV audiences.

Norwest estimates their activities generate a commercial value of approximately \$20 million annually. In their daily business activities Norwest uses around 500 units of wireless audio devices. With 500 units in operation (each of which cost an average of \$2,000) Norwest's investment in inventory of wireless audio devices is estimated to be valued at an impressive \$1 million.

These wireless devices are used constantly by Norwest to provide audio solutions for special events, arena concerts, sporting events, touring bands, theatre, broadcast, conferences, conventions and other corporate events. Heavily dependent on such devices in their daily activities, their use and inventory of wireless audio devices is

continuously increasing. Norwest first invested in wireless audio devices some 20 years ago (an initial 4 devices) today with around 500 radio mics in the inventory they play such an integral part in his business' ability to supply professional audio solutions he couldn't imagine the production industry without them.

Not only are wireless devices of critical importance to the day-to-day activities of Norwest, but they also play a vital role wireless audio devices play in maintaining the strong reputation the Australian production industry holds in the global market. Norwest believe that, "one needs to seriously consider the ramifications if substantial amounts of spectrum were not made available for these devices to be used freely in Australia".

Would internationally successful productions come to Australia? Australia's ability to attract, for example, successful theatre productions (that rely heavily on wireless microphones) would diminish substantially due to their inability to execute their performance in a satisfactory manner. Gone are the days where unsightly cables are sprawled across a stage. Would executives or corporate presenters understand why a developed country is unable to provide them with spectrum (otherwise available to them globally) to use their wireless devices to execute their messages in a most professional and persuasive manner? What about the detrimental impact the lack of wireless audio devices would have on the flexibility our broadcast environment currently enjoys?

The industry is dependant on these wireless audio devices and the free spectrum required to use them. Without them we cannot enjoy the high standards of production execution, experiences and services we have all grown accustomed to and demand.

If wireless audio devices were unusable due to the confiscation of vital free spectrum, Norwest would lose a substantial chunk of their current business. Also, their sizeable investment in wireless audio devices would become worthless and useless. Mr Kennedy estimates that as much as 30% of their business activities would cease, not to mention the substantial financial expenditure required to replace these units, possibly with inferior substitutes. If the removal of free spectrum would result in such harsh ramifications for one organisation alone, one can only imagine the severe domino effect this would have on a much larger scale.

Norwest's comments indicate that the auctioning off of vital spectrum, its impact on users of wireless audio products and the subsequent rollover effects should not be taken lightly. Special events, arena concerts, sporting events, theatre, broadcast, conferences etc. are vital to Australia's social and cultural wellbeing. The high quality execution and delivery of these events/productions is largely dependant on professional audio solutions, which utilise the flexibility offered by wireless audio devices. Consequently, it is of vital importance that freely accessible spectrum is made available in substantial quantities to make these fundamental, day-to-day activities possible.

Furthermore, during our discussions with Norwest they stressed the importance freely available spectrum contributed to the global competitiveness of Australia as well. We are a developed country, operating in the international market; therefore there is an expectation that Australia will offer basic services that are available in other developed nations. Substantial quantities of freely accessible spectrum, to be utilised by users of wireless audio devices is one of these "basic services". When examining the allocation of RF spectrum, the Government needs to ensure it has considered the full impact their decisions will have on Australia, socially and internationally.

The Wedding Singers

Case Study
Andy and Niki - Noosa

Andy and Niki aren't your typical wedding singers but they are typical of thousands of musicians⁽¹⁾ throughout Australia who perform most night of the week in a variety of settings.

Guitarist Andy has played with the who's who of British rock before emigrating to Australia. Look over the liner notes of *Bob Geldof*, *Thin Lizzy* or *Roxy Music* recordings or the tour programs for the *Stranglers*, *The Boomtown Rats*, *Dave Edmunds Rockpile* or *Dr Feelgood* and you'll see Andy credited on guitar. Niki, a vocalist, has trained with some of the world's leading teachers and recorded for TV and radio in London.

Today they are based in Noosa on the Sunshine Coast providing that community with entertainment. Performing at weddings, in season, is a big part of their activities. In all, they perform at around 30 weddings each year generating an income from that activity of around \$30,000. When extrapolated to a national level we can see that there were more than 109,000⁽²⁾ marriages in 2005 with a combined cost of \$3.5 billion⁽³⁾.

Like thousands of other musicians Andy and Niki have invested in wireless audio equipment. They have done so because it represents the state-of-the-art and provides them with added flexibility in their performances while maintaining the highest quality audio. In Andy and Niki's case they have invested around \$5,000 in two wireless microphone systems and a wireless transmitter system for Andy's guitars.

Like thousands of other working musicians they couldn't do without their wireless products as they provide an ease of movement, a flexibility in their performances, as well as, the audio quality necessary to provide their audiences and wedding parties the entertainment and experience they deserve and want. In Andy and Niki's case one of the two microphones is used as a roving mic for guests making speeches to the bride and groom. The other is used by Niki for her vocals.

Andy too enjoys the ease of movement through having his guitar connected wirelessly to his amplifier, rather than by a cable. In a scene reminiscent of the best Hollywood tradition Andy is frequently asked to accompany the groom in serenading his new bride. The guitar transmitter allows Andy to get off the stage and stand behind and support the groom in sing 'that' song to his new wife. Songs like *Everything I do (I Do It For You)*, *My Heart Will Go On*, *Tonight I Celebrate My Love*, *I Got You Babe* or the dozen or so other favourites⁽⁴⁾. While the songs might be a bit cheesy, they are at the time and on that day they are some of the most emotional and heartfelt words ever uttered. And so they continue to be at hundreds of weddings week in and week out.

Andy and Niki, say that their ability to earn income from the performing at weddings would be dramatically and negatively impacted upon if they could no longer use their radio microphone and Andy's wireless Audio transmitter.

"Audiences have come to expect their entertainers to do more than just stand and play *The Bridal Waltz*, *Here Comes the Bride* or *Kiss Me as You Wave Me Goodbye*. That

might have been acceptable a decade ago but today the bridal couple want a personalised event and as such musicians like Niki and I have a central role to play. The bride and groom want engage us in their celebrations and we can only do that through the ease of movement of our wireless audio equipment gives us”, says Andy.

- (1) According the 2001 Census there were over 9,000 people giving their profession as musician. Total income earned by this group totalled \$269 million. Source: Music Council of Australia Knowledge Base.
- (2) Source: Australian Bureau of Statistics
- (3) According to *The Bride to Be Magazine*, reported in the Sydney Morning Herald on October 31st 2004 the average expenditure per wedding was in excess of \$28,000. Typically the cost of entertainment represents around 3% of the total.
- (4) The Wedding Central Australia website Top 100 Songs for Weddings
<http://mag.weddingcentral.com.au/music/songs/love-songs.htm>

Up Close and Personal with Sabu, Khan and Casper

Case Study

Australia Zoo - Sunshine Coast

Every day thousands of people visit the Sunshine Coast so they can get up close and personal with Sabu (an Indian elephant), Khan (the Sumatran Tiger) and Casper (a Saltwater Crocodile) along with the other 1,000 or so animals housed at Australia Zoo.

Set on a 30 hectares site on Queensland's Sunshine Coast, Australia Zoo is a family owned business and one of this country's major tourist attractions, offering a full day of wildlife action and adventure for the whole family. The zoo provides a hands-on experience, allowing visitors to connect with some of the world's most amazing animals while raising the bar in wildlife entertainment. The Zoo currently welcomes more than 800,000 visitors from all over the world each year and supports conservation projects on a global basis through its charity arm, Australia Zoo Wildlife Warriors Worldwide and holds firm to a commitment to achieve *Conservation through Exciting Education*.

A key element to the philosophy of providing *Conservation through Exciting Education* are the 16 wildlife presentations that take place each day. These presentations are delivered to a daily audience of more than 2,000 people through the use of wireless audio technologies. In addition, these technologies support around 20 annual 'special events' each of which bring more than 10,000 people into the zoo's grounds and to the Sunshine Coast.

Furthermore, Australia Zoo's has a global television audience of over 600 million people, from 142 countries through its productions of *Steve Irwin*, *The Crocodile Hunter* and *Bindi, the Jungle Girl*. Once again these productions rely on wireless audio products that allow presenters to safely interact with the animals in close quarters, while at the same time delivering the global audience a quality experience with high production values.

Australia Zoo currently employs approximately 600 staff, making it the second largest employer on the Sunshine Coast and boasts a direct economic benefit to the local community of approximately \$120 million. It is estimated that Australia Zoo will employ over 2,000 staff by 2015.

Of course there are a number of other economic benefits associated with the zoo which are less easy to quantify. For example, the value to Australian tourism through the two named TV programs, as well as, the official Tourist Ambassador role played by Terri Irwin. In addition, there is worldwide recognition of the Australia Zoo brand.

Wireless audio products, comprising 44 radio microphones and 14 in ear monitoring systems, fulfil a number of critical roles at the zoo: These include:

- Providing a high quality education and information experience for visitors attending the 16 daily wildlife presentations including two shows in the Crocoseum – a 5,000 seat colosseum style stadium, as well as, bird of prey, elephant and tiger presentations.

- Allowing a freedom of movement for presenters which ensures the safety of the presenter, the animal and the visitors. This same freedom of movement is equally important in the production of TV, film, internet and radio segments
- The communication of general information for staff and visitors throughout the Zoo
- Communicating emergency procedures when needed

Australia Zoo has invested around \$220,000 in wireless audio products (further equipment is hired in on the 'special event' days) because wireless audio technologies support, or in some cases make possible the physical nature of Australia Zoo's activities. As a result wireless audio products have become a critical operational element at the Zoo.

Looking ahead it is clear that Australia Zoo plans to continue to grow its operations and annual attendances. This in turn will see an increased demand for wireless audio products into the future.

Therefore, any changes in the availability of these products into the future would have a deleterious effect on Australia Zoo and on the Sunshine Coast community. These impacts include:

- Occupational Health and Safety issues for keepers/presenters and the visiting public
- A reduction in the quality of the educational experience, either live in the Zoo's ground or through the broadcast of its productions
- Safety issues for the zoo's animals – the mix of cables and wild animals such as crocodiles or tigers is not appropriate
- Additional operational costs – the current use of wireless audio is the most efficient method of providing communications amongst staff at the Zoo
- Any lessening of the Zoo experience or public appeal will have a direct negative economic impact on the Zoo, and more broadly on and the Sunshine Coast and its community

Steve Irwin showcased his passion and enthusiasm for wildlife and conservation to the world, via their lounge rooms, with his television documentaries. Now 364 days a year, visitors come to Australia Zoo to experience that same passion and enthusiasm along with the drama and excitement of meeting animals like Sabu, Khan and Casper up close and personal. The Australia Zoo's educational and conservation messages are built around the interactions between animal and man. To do that they rely heavily on the use of wireless audio technologies.

Good morning and welcome.....

Case Study
Staging Connections - National

These four words are uttered time and time again, 365 five days a year throughout Australian convention centres, hotels, town halls and other public meeting places. In many cases those four words are captured and amplified by a wireless audio products supplied by Staging Connections.

Staging Connections is a publicly listed (ASX STG) event and exhibition services group supplying audio-visual products and services to this sector. STG has 10 offices in major cities from Cairns to Perth along with a further 66 on site offices which are located in many prominent venues including international hotels and convention centres. STG also maintain operations in New Zealand, Fiji, China and Singapore.

Throughout Australia, STG directly employees 253 staff and estimates they have another 920 employed either indirectly or on a casual basis.

While there is no typical event, STG provided their services to a large number of clients. In all, over 51,000 invoices for individual events wee issued by STG during the last financial year. These events range from meetings of as few as 10 people to those catering for 1,000 or more people including live corporate production for conferences, gala dinners, product launches, annual general meetings, fashion parades and video conferences. The Staging Connections Group Limited 2007 Annual Report states that the total revenue of the group for the reporting period was \$157.7 million.

In all, the audio-visual support provided by STG and other similar suppliers contributes to the more than \$3 billion earned annually by the conventions and meetings industry here in Australia ⁽¹⁾. Of course this figure does not take into account any related economic activity such as travel, hotel room nights or restaurant covers.

Across Australia STG owns and operates approximately 1,600 wireless audio devices. These are often moved between offices depending on the varying demands dictated by the types of events, expected audience and the type of content being delivered. At a conservatively estimated average cost to STG is of the order of \$750.00 per unit, representing a total investment in excess of \$1.2 million.

The use of wireless audio devices allows STG to provide a comprehensive service to the burgeoning conference and convention industry in Australia. These are used to assist in delivering dynamic and seamless presentations. It is also worth noting that many users of these products in this environment are not professional or seasoned performers so it is important that STG provides an environment that is free of cables. STG actively chooses to use wireless audio devices when setting "question and answer" microphones in an audience to remove the risk of people tripping on leads. STG also used wireless audio devices in congested areas or areas where cables can't be laid (e.g. across fire exits, on sand, on marble or hard surfaces, where animals, children or vehicles can come into contact or get caught in the cabling).

STG estimates that their use of wireless audio devices will increase over the next few years as more conferences and events are specifying one transmitter per presenter. It can also be seen that investment in the Conventions industry by Government continues at a pace. The Gold Coast Convention Centre, just 5 years old is being extended to twice its current size and will open in 2009. At the same time the Victorian Government is investing more than \$370 million in a brand new convention centre valued to support what it claims is a \$1 billion business events industry within that State⁽²⁾.

It is essential that STG provides services in line with customer demands. Today the convention customer expects to use wireless audio devices.

The inability to freely use these devices within the convention and exhibition industry will be a substantial obstacle to the continued growth of this sector of the Australian economy. It will lead to many potential clients looking to other international destinations to host their conference.

- (1) The most recent ABS statistics on the industry date back to 2001. At that time they analysed 121 major venues national each capable of accommodating events of 500 people or more. The ABS found that over 51,000 meetings and 4,200 exhibitions took place earning an combined income of \$655 million. These activities employed over 10,000 and generated more than 4.8 million work hours during events themselves combined with a further 2.9 million work hours from the staff of supplier organisations such as Staging Connections.
- (2) The new Melbourne Convention centre is to open in 2009. It can cater for international scaled events of 5,000 people or more. The Victorian Government has allocated \$370 million in funding with a further \$43 million coming from the City of Melbourne as part of a total \$1 billion re-development of the south bank of the Yarra. Forward forecasts suggest that the new facility will earn \$197 million per annum annualised for each of the next 25 years creating a further 2,500 permanent jobs. Major Projects Victoria is quoted as having \$285 million worth of forward confirmed business for the new centre including 18 major international conventions.

University 101

Case Study
Macquarie University

University students past and present will remember their first lectures. They always ended with the numerals 101, Engineering 101, Philosophy 101, Architecture 101 and so on. More recent students will recognise the extent to which they have listened to these lectures through the use of wireless audio devices.

These products have been adopted to fulfil two major functions in tertiary education. Firstly, they have replaced wired microphones as the source of voice reinforcement in lecture theatres and are also used for 'close mic' applications for recording lectures and presentations which are then used for dissemination over the internet.

The use of these devices at Sydney's Macquarie University is not atypical. At Macquarie University there over 1,000 lecturers and academic staff provide their lecturers using these devices to the more than 30,000 enrolled students⁽¹⁾. When all universities nationally are considered these numbers rise significantly to tens of thousands of lecturers and in excess of 1 million students.

Macquarie University uses more than 120 wireless audio systems and are supported by a team of 10 audiovisual technology staff. The audio visual staff are concerned that there is no apparent alternative to the use of wireless audio products and that the Universities investment of more than \$300,000 in equipment, plus the cost of installation will be wasted.

All in all these 120 or so devices play a crucial role in delivering education services to students which is in turn the core function of the University and the basis of its \$280 million annual income⁽¹⁾.

The use of these devices brings a number of benefits to the university and its staff. Most critical is the lecturer's ability to now move freely around the lecture theatre as they are no longer tethered to the lecterns and the fixed wired microphones. This freedom in terms of audio connectivity has been for some time been available to lecturers and presenters through the use of infrared control of computers and projectors. The end result of these two technologies is a more dynamic and engaging learning experience that is no longer necessarily simply a case standing to deliver. Furthermore, the high quality of the audio provided through the use of these systems allows the lecture to be recorded and reproduced. Again this is an important additional capability in terms of ensuring students have full access to teaching materials and for the archiving of important events and presentations at the University.

There are some secondary benefits from the use of these devices, most notably the ability to ensure a cable free presentation area which eliminates potential some occupational, health and safety issues when wired microphones are employed.

Should changes to the use of the spectrum result in restrictions or even the curtailing of the use of wireless audio product altogether there is no doubt that the universities business of education provision would continue. However, this would occur in the face

of severe operational restrictions and inconvenience, which would ultimately hinder and compromise the quality and the overall delivery of the education. It would also be seen as a backward step in the application of innovative technology in the globally competitive world of education.

In recent years there has been an increase in the use of these devices at Macquarie University and Universities throughout Australia and around the world. The audiovisual staff at Macquarie University see this trend continuing into the future as the University expands its infrastructure and facilities, permitting more student spaces with a greater diversity of subject choices.

Furthermore, the desirability and need for lectures and presentations to be made available to new forms of delivery to students, such as podcasts, intranet and internet will also undoubtedly increase. While wired technologies could be employed to create the content for these delivery streams, wireless audio represents the most practicable approach to serving both on-site and external learning. The ability for the lecturer to create an interesting and dynamic presentations for those on site while, simultaneously creating a high quality recording for external or future use , as well as, archiving represents the most efficient use of the Universities resources.

⁽¹⁾ Source- Macquarie University Annual Report 2006

High School Musical

Case Studies

Various schools - nationally

Disney's *High School Musical* is a phenomena. It is a story, within a story, about the staging of a high school musical. Such is its popularity and resonance that it has captured the imagination of families throughout the world, in turn leading to the winning of an Emmy Award, as well as, being the largest selling recording in the US in 2006. What makes *High School Musical* so special is its strong connection to real world happenings. The dramatic events portrayed in at "East High" are repeated (more or less) over and over again in thousands of similar productions in high schools the world over, including Australia.

These productions provide students with a wide range of opportunities. These opportunities are the reason teachers and students willingly participate in these extra-curricula activities each year. For many students these productions represent an important performing arts opportunity, in some cases their *only* opportunity, to showcase their skills as actors, singers or dancers. Other students are involved in set design, costuming, production and so on. Underlying these aspects of the high school musical are other important learnings. These activities focus on developing co-operation and teamwork, project management, problem solving, as well as, self confidence and self expression. All in all these activities represent important and unique educational opportunities for all those who participate.

Just like their professional counterparts the producers of a high school musical want their production to be as high a standard as they can achieve. Whether it be *West Side Story* (as Melbourne High School are currently producing) or *Dream On*, a musical version of *Midsummer Nights Dream*, currently in production at St Theresa's Catholic College. This leads schools to the use of wireless audio products. In some cases these productions are supported by specialist audio companies (see the Outlook Communications case study in this document), in other cases all aspects are managed from the schools resources. A typical production would call for the use of between 4 and 20 radio mics to support, as a minimum, the principal leads through to the secondary characters and chorus.

Other similar opportunities include The School's Spectacular (NSW) and Joining the Chorus (VIC). Both these events feature over 3,000 performers and hundreds of schools performing on some of the biggest stages in Australia such as Rod Laver Arena and the Sydney Entertainment Centre. Highlights of both events are broadcast on TV. As you would expect of a modern, high quality production these events also extensively use radio microphones.

However, any radio microphone owned by a school is not just used as part of their own high school musicals. Schools, like other users seek to maximize their investment. As a result you will see and hear radio mics being used at:

- School sporting events like the athletics and swimming carnivals
- Speech or award night nights
- Trivia nights

- Assemblies
- Outdoor events such as the Anzac day celebrations, flag raising ceremonies, school fetes and other fund raising events

According to one Sydney school principal, “a good deal of the school fundraising comes of a result of the principal or P & C President speaking into one of our 4 radio microphones at our annual fete or end of year fireworks night. The nearly \$5,000 we have invested in these products has been returned to us many times over”.

Of course like other users, schools have found that these devices can impact positively on their occupational health and safety regime. A reduction in the incidence of voice strain (which is a significant issue for teachers) is one example. The use of radio microphones and the freedom on movement provided by them is also seen as a benefit by schools in the event of an emergency or the need for an evacuation of a building.

Like the computer, wireless audio products, in particular radio microphones have become embedded in our schools. Many schools would feel that they could not function without them. While the needs of the users varies widely from the singing of a song in the high school musical, the sounding of the last post on Anzac Day or as a life saving communications device in the event of an emergency they are used every day in most of our 11,000 schools nationally.

He Who Hath Ears to Hear, Let them Hear

Case Study - World Youth Day and Auditoria Pty Ltd
Sydney

World Youth Day is an event organised by the Catholic Church and held every 3 to 4 years. It was last held in Cologne Germany and saw over 1 million people attend the final mass. In July 2008 the event will be staged in Sydney with events taking place throughout the city including the Domain, St Mary's Cathedral, Sydney Opera House, Cockle Bay, Barangaroo with the final mass being held at Randwick Racecourse. The event is estimated to have around 500,000⁽¹⁾ people in attendance and is considered the largest event in Sydney since the 2000 Olympics.

Sydney company Auditoria, an audio systems design consultancy have been engaged by World Youth Day to design audio systems for all the major venues. They will be responsible for the provision of audio to live audiences that are estimated to be between 400,000 and 500,000 people as well as a television audience that will reach hundreds of millions of people worldwide.

The investment in audio systems by the World Youth Day organisers totals more than \$1.3 million, though the event is rather more substantial when all the economic inputs are factored in. According to World Youth Day the event will attract around 125,000 international visitors which together with local attendees will generate around \$150 million in gross value-add to the NSW economy, as well as, up to \$10 million in State revenues⁽²⁾. According to an independent economic study by the NSW Chamber of Commerce economic in-flows from this event are estimated to top \$231 million.

Auditoria will employ over 100 people to manage the audio for this event with a further 50 staff being allocated to manage the communications systems. The total number of people employed during the event is not known, though Auditoria expects these numbers to exceed 5,000. They in turn will be supported by a total of more than 8,000 event volunteers.

Wireless audio plays a key role in delivering the event to both the live and television audiences. Overall, more than 180 wireless audio systems will be used, the majority of these, around 140 will be radio mics. The remaining devices will take the form of in-ear monitoring systems. Specifically, the microphones will be used for amplification of speeches from the Pope, the Prime Minister, Cardinal Pell and various other dignitaries and the delivery of masses during the event. The systems will also be used by performance groups for youth festivals and concert events. Such is the scale of this event that Auditoria will use all their own wireless audio systems, as well as, drawing on rental wireless audio devices inventories.

In general terms an event such as World Youth Day would not be achievable without radio microphones. They provide an unobtrusive means for capturing the delivery of speech without limiting the speaker to one location. There is a need for a high quality audio source, one capable of capturing both spoken voice and musical performances. The quality of the source audio determines the quality the experience provided to both the live audience and those watching on TV throughout the world. Wireless audio also

provide a means of backup, which does not inconvenience or intrude with the delivery of the speech.

Furthermore, wireless audio devices minimise an potential occupational, health and safety issues. Unlike some other major events, many of the participants in World Youth Day are not professionals and in many cases they are children as speakers, or as members of choirs and other musical groups. The removal from the stage area of audio cables dramatically reduces an potential occupational, health and safety issues that might otherwise arise, making World Youth Day a safe as well as successful event.

While World Youth Day is a very large production event, other large scale activities take place throughout Australia on a regular basis. The Sydney Olympics and Melbourne Commonwealth Games are two such events. Additionally, there are a number of annual events and activities such as the Australian Grand Prix , international cricket or rugby, World Rally Championships and the Red Bull Air Race that require the support of large numbers of wireless audio devices.

Auditoria's experiences shows that there is not a single event or installation that does not include the use of wireless audio products, and in particular, radio microphones. Given these circumstances Auditoria believe it is impossible to consider the production and event industry ever doing without the use of this technology but rather see the use of these devices growing in the future as they represent an efficient, effective and elegant solution in presenting high quality sound, safely, to live and broadcast audiences.

⁽¹⁾ New South Wales Government World Youth Day Co-ordination Authority website
www.wydca.nsw.gov.au

⁽²⁾ NSW Department of State & Regional Development

Faith in the 21st Century (1)

Case Study **Hillsong Church**

Hillsong Church is a large church with 2 campuses in Sydney – Baulkham Hills and inner Sydney Waterloo. It is a Pentecostal Church with its main affiliation being with the Australian Christian Churches (also known as the Assemblies of God in Australia). Church services across both venues cater for approximately 35,000 people each week, with approximately 20,000 attending on weekends. In addition, Hillsong operates at 6 extension venues across Sydney. At the 2006 census, 219,687 people nominated their religion as “Pentecostal”, an increase of 25,095 on the previous census (www.abs.gov.au). Therefore Hillsong caters for approximately 15% of the denomination.

In addition to live church services, Hillsong Church develops other media content, including television programs, podcasts and live album recordings. In 2007, the Hillsong album “Saviour King” was ranked 36 in the top 50 albums in the ARIA charts, earning gold status for both the live album recording and the DVD of the concert (www.aria.com.au). These albums are sold internationally.

Hillsong Church also conducts two conferences each year which are held at the Sydney Olympic precinct. The “Colour Your World” Women’s Conference attracts approximately 20,000 delegates and the Hillsong Conference, which has a ministry and creative arts focus, attracts approximately 30,000 delegates annually. The majority of these delegates are traditionally not affiliated directly with the Hillsong Church – they are drawn from other churches, both mainstream and Pentecostal. Furthermore many other churches both in Australia and overseas emulate the production values of Hillsong and its ministry format.

While Hillsong is essentially a not for profit organisation, its activities do have an indirect commercial impact on the service providers of the church’s associated activities.

An outstanding feature of the services at Hillsong is the emphasis on dynamic music and the utilisation of contemporary production values and technologies. Live music and its reproduction is an essential element of the programs and content Hillsong develops.

During weekly services, Hillsong uses approximately 150 wireless audio units across its campuses representing an investment of approximately \$400,000. This is made up of a combination of wireless microphones and in ear monitoring systems. These are used for both music and voice reproduction.

The use of these devices has become critical to the delivery of the content and the standard expected by attendees at the church and associated programmes. An indication of the importance placed on these devices is the fact that Michael Cuthbertson, the Technical Director at Hillsong Church plans to increase his inventory of wireless audio devices in the next fiscal year by 7-10%. Although it would be possible to continue with limited use of the devices, production values will be severely compromised, resulting in a very difficult to measure negative impact on the organization’s fundamental Christian message.

Faith in the 21st Century (2)

Case study

St James Anglican Church – Glen Iris, Melbourne

In many respects St James Anglican Church in Glen Iris, Melbourne is a far more typical example of the use of wireless audio products than the Hillsong Church highlighted in the previous study. In fact, so typical it is likely to be replicated, more or less, in the vast majority of Australia's more than 10,000 places of worship⁽¹⁾.

In fact so typical that on a couple of occasions St James and the nearby St Roch's Catholic Church, about 100m away, have 'swapped' sermons inadvertently. The result of crosstalk from their respective radio microphones. Such sharing might perhaps lead to a new definition of the word ecumenical.

Like other users, it is the ease of movement provided by wireless audio technologies that lies at the heart of its appeal. Typically, the St James Vicar will move to five separate locations within the church during the course of a service. For example, from the pulpit to the sacrament table and so on. In these circumstances the use of a radio microphone provides a very cost effective alternative to the use of up to five wired microphones. In addition, the lapel system used is also far more aesthetically pleasing than the fixed microphones on stands and resolves issues concerning running wires within old, often stone buildings, as well as, the obvious occupational, health and safety concerns inherent with the use of cabled devices.

Wireless audio also offers other benefits to the St James congregation all of which help enhance the experience of the services.

While the St James Vicar has been voice trained, and as a result is more than capable of filling the church with sound, it is not the case with many of his lay speakers. To be heard these speakers require audio support. While not the case at St James, increasingly churches have female clergy, many of whom lack the vocal power to fill the church without supporting sound reinforcement. There is after all, from the congregations point of view, very little point in attending a church service if you cannot hear what is being said. It is a very much diminished experience otherwise.

St James, like most churches in Australia is equipped with a hearing loop for the elderly who in this case make up a significant proportion of the congregation. The wireless audio microphone attached to the Vicar and other speakers provides better, high quality sound for the churchgoers using this facility.

Just as the hearing loop system engages some of the elderly amongst the congregation the use of wireless audio assists in connecting with and involving the children attending services each week. The freedom of movement provided by the wireless microphone allows him to move to and interact with the children. That combined with a hand held wireless microphone that is used for the children to respond with allows the whole of the congregation to hear and join in those activities. Again, the use of wireless audio enhances the experience for all in the congregation.

Of course, it is not just the weekly services that this equipment is used. St James, holds its share of the more than 45,000 church-based weddings and 130,000 funerals conducted each year in Australia⁽²⁾. Again for the reasons outlined above the wireless audio devices owned by the church play a part in these rites.

St James, like other churches serves both its congregation and the broader community. The investment by the congregation in wireless audio equipment has helped extend that community reach. At a local level the St James hosts church services for nearby Korowa Girls School. In addition, the church frequently plays host to community groups that require a meeting place. The Osteoporosis Society is one such group that has been a regular user of these facilities in recent years.

This equipment also plays a part in the churches fundraising activities. Apart from the services themselves the Church also hosts a number of congregation dinners and an annual Garden Show. Combined with collections (and some other income streams) the operating budget for St James totals around \$350,000 per annum. The vast majority of these funds are directed to community development programs such as aged care. In addition, this congregation has been supporting the Lockington community (near Echuca in northern Victoria) who have been hard hit by drought in recent times.

While not dependent on the use of wireless audio technology at these fundraising events the use of this technology enhances the experience making them more attractive and effective to both the congregation and the broader local community.

Overall, St James has invested a total of around \$40,000 in audio visual equipment including their 5 wireless audio systems.

⁽¹⁾ According to the Australian Bureau of Statistics there are over 10,000 designated places of worship in Australia. The 2006 Census showed that 15.3 million Australians maintained some religious affiliation, around 73% of the population. Of this the Anglican Church of Australia serves around 3.9 million Australian Anglicans.

⁽²⁾ Australian Bureau of Statistics Year Book 2006

The Member Experience

Case Study - Fitness First
Throughout Australia

Fitness First is the largest health club operator in the world based on number of clubs and membership base. They currently have 80 centres in Australia with a goal of 100 clubs by the end of 2009. Membership is currently in excess of 400,000 individuals who make more than 5.5 million visits per year.

Wireless audio products are used extensively in each of these centres as they have become important tools in the provision of fitness services that help clients maintain a healthy lifestyle and more broadly support the fight against obesity and the looming epidemic if left unchecked.⁽²⁾ The predominant uses of wireless audio products by Fitness First and other similar centres is through group fitness classes, where an instructor undertakes a series of exercises to music with a group of people including BODYPUMP, Mind/Body Disciplines and Cycling. Typically there are up to three such equipped areas in each club. In addition, some centres also offer an aqua-aerobics program. Each of the group fitness or aqua-aerobics spaces are equipped with audio systems that include wireless microphones.

There is a clear need for sound reinforcement within these centres as it provides the means for the instructor to maintain communication with the class. The instructors' voice is the key tool in maintaining the energy, tempo and motivation of the group as they progress through their session. Also giving the audience clear instructions on how to move in time with the music, how to perform correct and proper technique so that each member can have a successful experience and aim towards their individual goals of improving their well being. Within that context wireless audio products perform three key functions. Being:

- The ability to move freely around the class and to be fully engaged in the exercises being undertaken (specially designed radio mics and audio systems are used to teach Aqua classes) increases the impact of the activity and the quality of the experience;

while solving two critical occupational health and safety issues being:

- The potential damage to the instructors voice through prolonged use, and
- The removal of any cables within the high activity group fitness class environment

As a result Fitness First have become a large user of wireless audio products and currently own 4 radio mic equipped systems in each club throughout Australia. The total investment in wireless audio products is estimated to be in the region of \$500,000

Fitness First expect their group fitness activities to continue to grow into the future. They plan to expand the current 79 locations to 100 locations prior to the end of 2009. Further future demand will be stimulated by the communities increasing recognition of the need

to engage in more healthy lifestyle and the solutions provided by Fitness First and the similar centres. This of course has longer term economic benefits for the country that run into billions of dollars through the prevention and minimisation of disease, in particular diabetes, heart disease and stroke.⁽³⁾

This will require the further expansion and use of wireless audio products by Fitness First.

In addition to the 1.4 million monthly paying attendees (who each invest over \$700 annually) in group fitness classes, Fitness First also offer an *Adopt a School* program. Currently each centre has on average 4 schools who use the facilities free of charge during school hours. This service again is in response to the obesity epidemic with the students having access to the instructors and facilities (including the wireless audio) at no charge.

Any future environment where wireless audio access was limited, compromised or simply not available would have a deleterious effect on Fitness First and the fitness industry more broadly.

The success of any group fitness program is based on the motivation that comes with doing these activities with others and through the connection between the instructor and the class. Participants expect a quality experience that sees them working with music and have good communications with the instructors. To achieve this, instructors need to be connected to sound reinforcement systems and the safest and most practical way to achieve this is through the use of wireless audio systems.

- (1) According to the Australian Bureau of Statistics report 2004-05 on Sports and Physical Recreation Services 824 organisations (with a staff of 20 or more people) were operating as health and fitness centres generating income of \$679.4 million. These centres employed nearly 17,000 people and provide services to more than 2 million individuals. Aerobics/fitness is the second most popular form of exercise after walking.

Further information from Fitness Australia suggests that when the sub-20 staff centres are included the number of centres national rises to 1,500 'traditional' fitness. These numbers increase to around 2,600 businesses when non-traditional business, such as personal trainers are included. Fitness Australia estimates that around 45,000 are employed in the sector and that the value derived from servicing around 3 million Australians is in the order of \$1.2 billion annually.

- (2) Forward government estimates show that without corrective action as many as 28% of the Australian population will be obese by 2025.
- (3) According to the Government the direct cost of obesity to the Australian community is \$3.7 billion annually with a further cost of \$17 billion in obesity associated disease such as diabetes, heart and cardio-vascular disease and so on.

In Tonight's News

Case Study
Freelance news gathering and video production

Scott and Nigel are typical of the 700⁽¹⁾ or so freelance audio and camera operators that gather the news, cover political and other media conferences and attend major events such as the recent Black Saturday fires or Queensland floods. In addition, they work on a diverse range of live or outside broadcast TV productions such as *Masterchef*, *Australian Idol* or entertainment events such as *ARIA's*, *Logies* or *Brownlow Medal* broadcasts.

Scott and Nigel are able to do this work and get the days news stories to air because they are mobile. In fact, the whole premise behind CNN's which first launched the 'breaking news' concept or the local broadcasters that followed this approach with the promise of being 'Live at 5' or their viewers being 'Be the First to Know' is built on the mobility, flexibility and speed afforded by wireless audio technologies.

The wireless audio technologies give AV crews the ability to arrive at a location and be recording and broadcasting those images across the country (and the world) in minutes because they are no longer connected to their production vans by cables.

Typically 5 or 6 wireless radio microphones are included in the kit used by these production crews and combined they represent an investment of about \$25,000⁽¹⁾. Extrapolated across all the freelance AV crews around Australia this represents more than 4,000 radio microphones with a combined value in excess of \$17 million at replacement value. Unfortunately, the vast majority of these microphones are designed to work in the 700MHz plus band, the precise part of the spectrum that will most likely be re-allocated as a result of the Digital Dividend so most of the existing equipment will need to be decommissioned and replaced.

This is before any of the TV or radio broadcasters extensive (and generally more expensive) AV inventories are included.

For a major media announcement it is not uncommon to see as many as 15 radio and TV crews in attendance, as well as, some freelancers. Similar numbers of units can be found deployed at many major entertainment events such as the ARIA's where wireless audio devices are used to cover the red carpet arrivals, back stage and table interviews, as well as, the main on stage production.

For this reason AV operators are already complaining about of the difficulty in finding available clear spectrum in high usage areas such as the central business districts and entertainment precincts of Melbourne and Sydney at peak load times. The potential loss of around 40% of the current available spectrum as a result of the Digital Dividend means that it will only be harder to find clear spectrum. AV operators are concerned that service levels will fall and anticipate a time when some stories will simply not get to air because there is no available spectrum to work with.

The difficulties facing AV operators has a direct impact on broadcasters either through a failure to gather the content through lack of spectrum or the quality of the content

provided. The likely result of a reduction in the quality of the product aired is a loss of viewers and, in turn, advertisers.

Nigel and Scott see the demand for wireless products growing within their sector as it represents best practice and meets the demands of the broadcasters, advertisers and consumers as it provides quality on the spot, interesting and timely content.

In addition to aiding the content and production standards, wireless also solves significant logistical as well as occupational, health and safety issues. The widespread use of wireless devices as overcome the problem of multitudes of cables laying across floors or the need to 'tether' speakers to a fixed point.

Another growth area for at least some AV crews is the wedding market. Increasing professional videographer is being used at weddings. This is creating a new sub type of AV professional and growing demand for wireless audio equipment⁽²⁾. Generally speaking the equipment used is not as expensive as those crews providing news and other broadcast content but these wedding videographers have on average 2 to 3 wireless microphones.

In the main these freelance AV operators work as either sole traders or have just one or two additional staff, so in total around 1,000 or so individuals are employed in this way throughout Australia. According to their representative body Australian Freelance Forum, individuals can typically earn around \$100,000 per annum. In turn the content provided by these small businesses helps underpin the multi billion TV, radio broadcast and online news and entertainment industry.

⁽¹⁾ Data provided by Australian Freelance Forum

⁽²⁾ Yellow Pages search shows over 650 wedding videographer listings nationally

APPENDIX 2 Untethering the microphone: An economic study of the benefits of spectrum use for unlicensed wireless audiovisual devices in Australia. An updated analysis



Untethering the microphone:

An economic study of the benefits of spectrum use for unlicensed wireless audiovisual devices in Australia

An updated analysis

4 March 2010

Principal Consultants

Scott W MINEHANE
Managing Director
Windsor Place Consulting Pty Ltd

Simon MOLLOY
Associate
Windsor Place Consulting Pty Ltd

Barry BURGAN
Associate
Windsor Place Consulting Pty Ltd

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1 Executive summary

Windsor Place Consulting was commissioned by the Australian Music Association ('AMA') to prepare an economic analysis of the benefits of use of wireless audiovisual devices in Australia. The purpose of this study is to estimate these benefits quantitatively where possible and to examine other non-quantifiable categories of benefit. This March 2010 paper is update of a previous analysis undertaken in April 2008. It updates the analysis using new information.

The context of this investigation is the transition from analogue to digital television broadcasting in Australia. Starting in 2010 and to be completed by the end of 2013, this transition will result in the so called 'digital dividend' – the freeing up for new uses of electromagnetic spectrum in the UHF/VHF band including the 700 to 800MHz frequency band. The Australian Government has decided that it will seek to restack spectrum to maximise the digital dividend in line with major developed economies. Since this is the spectrum band that is currently used extensively by wireless audiovisual devices (which include wireless microphones), the reallocation of this spectrum to possible new uses represents a risk to the future use of the existing stock of such devices and this category of spectrum use in the future. It is therefore important to determine the economy- and society-wide benefits of this type of use in order to better inform spectrum allocation decisions by Government and the Australian Communications and Media Authority ('ACMA').

This paper develops estimates of the benefits of using spectrum for wireless audiovisual devices and discusses issues relating to the future use of spectrum for these devices. We also consider a range of non-quantified benefits that result from the use of such spectrum by wireless audiovisual devices.

Table 1 provides a summary of the annual, 5-year present value and 10-year present value of user benefits arising from the use of wireless audiovisual devices.

Table 1: Benefit estimates by user category: disaggregated consumer surplus method

Method	Annualised net benefit	5 year PV (\$ million)	10 year PV (\$ million)
Aggregate Consumer Surplus Ratio	140	559	939
Disaggregated cost saving and quality benefits	190	759	1,275
Disaggregated Consumer Surplus Ratio	200	799	1,342

This represents the value in use of wireless audio equipment, a value put at risk by the change in spectrum. The cost to the sector, if there was no compensation is dependent on the options available – and for some equipment this would be replacement, and for other equipment it would be modification. It is indicatively estimated that the cost would be somewhere between \$80 million and \$220 million given a combination of these approaches.

2 Background

Windsor Place Consulting ('WPC') was commissioned in early 2008 by the Australian Music Association (see www.australianmusic.asn.au) to prepare an economic analysis of the benefits of use of wireless audiovisual devices in Australia. The Australian Music Association is the trade body for the music products industry, representing wholesalers, manufacturers, retailers and associated services for musical instruments, pro audio, print music, lighting and computer music products. This March 2010 report represents an update of this previous analysis and is based on updated and new information.

Australia is currently in a transition from analogue to digital television broadcasting with the analogue television signal switch off (ASO) scheduled to be completed by the end of 2013. The main benefit of ASO, besides quality improvement in TV picture quality, will be the freeing up of significant amounts of spectrum in the Ultra High Frequency and Very High Frequency bands ('UHF/VHF') including in the valuable 700 MHz frequency bands. The Australian Government has decided that it will seek to restack spectrum to maximise the digital dividend in line with major developed economies, and has agreed on a set of principles and a target digital dividend of 126 MHz.¹ This spectrum will become available because digital TV broadcast uses much less spectrum than analogue for comparable levels of programming (6 standard definition digital TV channels can be broadcast in the same frequency as 1 analogue TV channel).

It is likely that the Australian Government will promote the national interest by auctioning part, if not most, of this spectrum freed up by ASO. The global trend in spectrum management practice is to auction spectrum with few conditions regarding the use to which it can be put (subject to any interference issues) in the belief that the market will make the best (i.e. socially optimal) decision about spectrum use. This is in contrast to the traditional practices in which spectrum was allocated on a 'first come, first served basis' or by a 'beauty contest' process – the latter relying on assessment of the spectrum authorities of the best qualified applicant, or by sale with significant conditions and prescriptions about the use to which the spectrum was to be put.

These developments constitute a threat to a large, dispersed and diverse group of wireless audio device users in Australia. Wireless microphones, for example, are used in live music performance, conferences, live sporting events and in many other situations.

Wireless audio products currently operate in the same piece of the radio spectrum as analogue TV broadcasting. Wireless audio products share this piece of spectrum using a "class licence," operating in the gaps or "white space" between the comparatively widely spaced TV broadcasts. Even this space has been flagged for possible auction once analogue TV broadcasting ceases.

This paper develops estimates of the benefits of using spectrum for wireless audiovisual devices and discusses issues relating to the future use of spectrum for these devices. We also consider a range of non-quantified benefits that result from the use of such spectrum by wireless audiovisual devices.

¹ see Australian Government, *Digital Dividend Green Paper*, January 2010.

3 Use of spectrum for wireless audio-visual devices

3.1 Description of users

The users of spectrum for wireless audiovisual applications in Australia are diverse and dispersed. This characteristic of the users complicates the analysis of the economic benefits of this type of spectrum use and also has implications for the economic efficacy of market-based spectrum allocation processes.

Probably the most thorough study of the economic of wireless audio-visual use of spectrum has been undertaken by the United Kingdom's communications regulator, Ofcom².

Ofcom has conducted a public consultation on this type of spectrum use and published the results of this consultation in mid-2007. This consultation was undertaken in the context of digital switchover ('DSO') which is scheduled to be completed in the UK by 2012. Ofcom published its direction of use of spectrum for 'programme-making and special events' ('PMSE') in 2008³. PMSE is Ofcom's term for the type of spectrum use discussed in this report and it is intended to be a broad term that captures the diversity of this type of use. It is a broader category than the one that is the focus of this paper but it shares many similar characteristics and presents a similar profile in terms of economic analysis and policy issues.

Background social use: This is typically small-scale use for social or community purposes. It is referred to as 'background' because it is geographically widespread and relatively uniform in volume (compared to other types of use below). Users include many schools, churches and other religious institutions, local fêtes and fairs, amateur-theatre productions, and many community and local events;

Background commercial use: This is similar in character to the background social use except that the users are commercial in character, and include typically small regional theatres, meeting venues and racecourses.

Larger scale use within fixed sites: with multiple channels required. These users typically have multiple pieces of equipment. They may make quite extensive use of spectrum for PMSE, but the use is fixed in one location. This use is more geographically concentrated than the background use, with a focus in major urban areas, though some use is found in almost all parts of the country. Typical users in this category include larger theatres, television studios, and major exhibition sites.

Special events: This category includes large, one-off, short-term events. These can have spectrum needs that vary widely, from modest to very large indeed (such as the Live8 and Bushfire relief

² see *Programme-making and special events: future spectrum access*, Ofcom, 20 June 2007

³ see *Access to interleaved spectrum for programme-making and special events after digital switchover*, Ofcom, 16 January 2008.

events). Examples of these events include many music concerts, sporting events, and public commemorations of various kinds. Special events of this kind can take place in densely populated urban centres, or in rural areas; and

Tours: This category involves use of spectrum by a touring company operating over multiple sites. The spectrum requirements can be similar to those of special events, but the category is distinguished by the need to move from one geographical location to another. Examples of this category include tours by bands and theatrical productions.

In Australia: In Australia there is a similar pattern of users. Key types of users include:

- Educational institutions including Schools (e.g. radio microphone at school assembly, school musicals etc), Universities and TAFEs;
- The convention and meetings industry;
- Concert promoters, festival organisers and other entertainment providers;
- Churches;
- TV, radio and other broadcasters;
- Performing arts organisations – both professional and amateur;
- Music theatre groups – both professional and amateur;
- Independent musicians;
- The fitness/aerobics industry (eg instructor wireless microphones);
- Auctioneers;
- Major events (e.g. Grand Prix);
- Political parties (e.g. state and federal conferences); and
- Home users as digital editing and voiceovers etc become easier with new lower cost home audiovisual technologies.

3.2 Description of wireless audiovisual devices

Wireless audiovisual devices include wireless microphones, wireless guitar transmitters and wireless video cameras across a range of product quality covering profession, 'prosumer' and home user groups.

In Australia, wireless audiovisual devices use spectrum in the 520-820MHz frequency range. They tend to be low transmission power devices and therefore operate in a short range – typically around 100 metres with some significant variations for particular types of specialist devices.

Wireless audiovisual devices have several unique characteristics which make them critical for multiple uses such as live-to-air TV broadcasts and musical productions, through to church and school halls. These characteristics are:

- Real time (100% duty cycle with no lag or delay);
- High quality audio (broadcast quality); and
- Radiated power (up to 50mW with a typical range of 100 metres).

At the present time and probably for period of perhaps five (5) years there will be no close substitute for such analogue wireless products. Nor will any other technical solution be more efficient in terms of spectrum utilisation.

Although analogue products do not use spectrum as efficiently as digital technology the critical requirement for very low latency excludes the use of wireless digital products at this time. This very low latency is particularly required in live music and other performance applications where a time delay would make performance impossible. It is likely that digital audiovisual devices will eventually achieve the latency of analogue devices but, as mentioned, this is some time away, depending on the real time ability of wireless digital devices to digitally process speech.

4 Economic analysis of spectrum use for wireless audiovisual devices

4.1 Management of spectrum resources

Spectrum is a 'sovereign resource' that is managed by governments within the international frameworks set by the International Telecommunications Union ('ITU') with the objective of maximising national economic welfare or, to use the appropriate term from economic theory, 'social welfare'.

Over the past 15 years, spectrum management policy has undergone a shift towards a more market-based approach. This approach is characterised by (i) less prescription from government and industry regulators about the uses to which particular parts of the spectrum will be put and (ii) the allocation of spectrum being on the basis of some form of price based allocation systems (including auctions). The underlying belief of this approach is that markets are better than governments at making decisions about the optimal use of spectrum - especially in periods where technology and demand patterns are changing rapidly. This is the approach being followed by most developed country markets including the United States, United Kingdom, New Zealand and, in Australia, ACMA follows this approach. For defined parts of the spectrum, successful spectrum auction bidders who become spectrum licensees 'are able to deploy any device from any site within their spectrum space, provided that device operation is compatible with the core licence conditions and the technical framework established for the band by ACMA'⁴.

The use of auctions is based on the belief that they will ensure that the bidder that places the highest valuation on the spectrum resource will be the best licensee from the economic social welfare perspective. The highest bidder will theoretically be the one with the business plan that will generate the greatest return from providing the services that consumers are willing to pay for and so end user benefits will be maximised.

There are a number of theoretical questions regarding this conclusion namely (i) there is significant uncertainty and risk about new services which utilise spectrum, and (ii) there may be significant market power issues. As such spectrum auction processes may not necessarily identify the best bidder from the social welfare perspective. Nonetheless, these problems also apply to government selection of licensees by other means and it is generally agreed that, for a range of spectrum bands and spectrum uses, that the market produces superior social welfare outcomes.

However, not all spectrum allocations are undertaken via market-based processes. Various allocations are made and need to be made by government for community groups, public safety, research, military and various other uses. Allocations of spectrum are also made available on a class licence basis. The alternatives, apparatus licences and spectrum licences, assign exclusive spectrum usage rights to particular licensees. In contrast, in the case of class licences, the types of devices that can be used within a particular spectrum band are defined along with their permitted

⁴ ACMA website, www.acma.gov.au/WEB/STANDARD/pc=PC_300172, accessed 09/03/08

characteristics and use limitations. This distinctive characteristic of class licences has a range of implications for spectrum allocation policy.

The class licence under which wireless audiovisual devices are used is *Radiocommunications (Low Interference Potential Devices) Class Licence 2000*.

4.2 The economics of class licence allocation

The need for class licence arises because many economic benefits are created by the use of low power, short range devices however it is not efficient to individually licence these devices because the costs of creating and administering the large number of licences required would be prohibitive.

The nature of class licence and the characteristics of class licence users mean that market-based spectrum allocation may not produce socially optimal results. The main barriers to socially optimal outcomes are *transactions costs* and the *free rider* problem.

Because there are so many users of short range devices, the costs to organise the whole group of current users and for them to make a single entity bid for spectrum in an auction exceeds the benefits of spectrum use. Even if major users of this spectrum could band together to bid, their bidding entity is likely to be unstable because any particular member of such a group would have an incentive to defect in order to avoid paying and hence 'free ride' on the spectrum. Class licences are a way of bypassing these transactions costs and still achieving the small per user but widely distributed benefits of spectrum use.

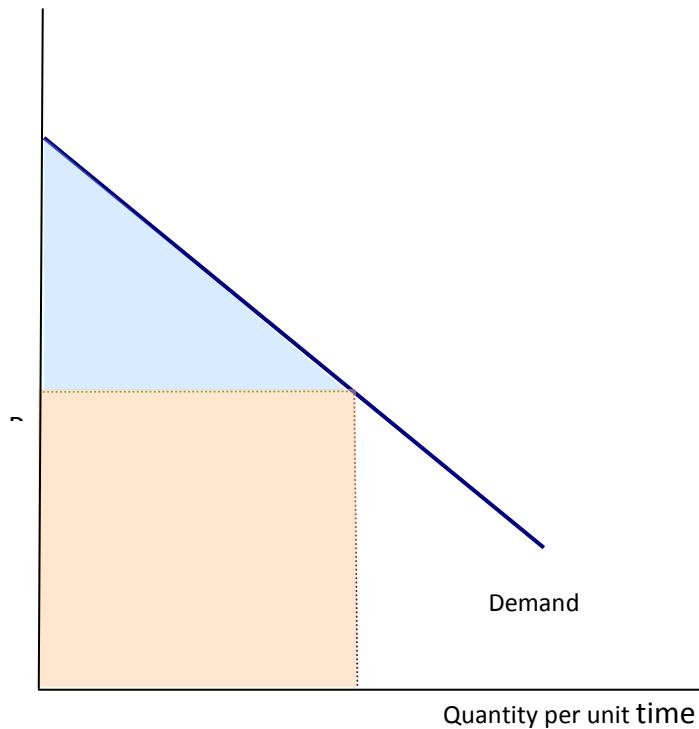
4.3 Economic benefits of spectrum use

4.3.1 The demand curve and consumer surplus

Economic theory provides a precise description of why the consumption of any product or service generates a benefit for consumers. This description is based on the concept of a market demand curve. [Figure 1](#) shows a simple linear demand curve with price on the vertical axis and the quantity demanded per unit time on the horizontal axis. The demand curve can be thought of as a ranking of consumers from those that place the highest (subjective) valuation on the product to those that place a low value on it. The consumer that would be prepared to pay the highest price are represented by the top left of the curve. The highest price any consumer would be willing to pay is represented by the point at which the demand curve intersects the vertical axis (called the *choke point*).

If we assume that the market price is 'P' (for reasons that we will explain later) then we can see that, according to the demand curve, some consumers would be willing to buy the product for more than they actually have to pay (in fact, this is true of all consumers represented by the demand curve *above* the horizontal line at P).

Figure 1: The demand curve and consumer surplus



This exposition elaborates the simple notion that consumers will buy a product only if they believe that the benefits of consuming it are greater than or equal to the costs (in this case, the price). Therefore, we can assume that, on average, some amount of *net* value over and above the price paid is created in the act of consumption. This net benefit over and above price is called 'consumer surplus'. In diagrammatic terms consumer surplus is illustrated by the blue shaded triangle in Figure 1, usually described as the area above the price line and below the demand curve. What consumers pay in total is the rectangular orange area (equal to price times quantity). Total benefit is the sum of the two areas but the net benefit is just the consumer surplus triangle.

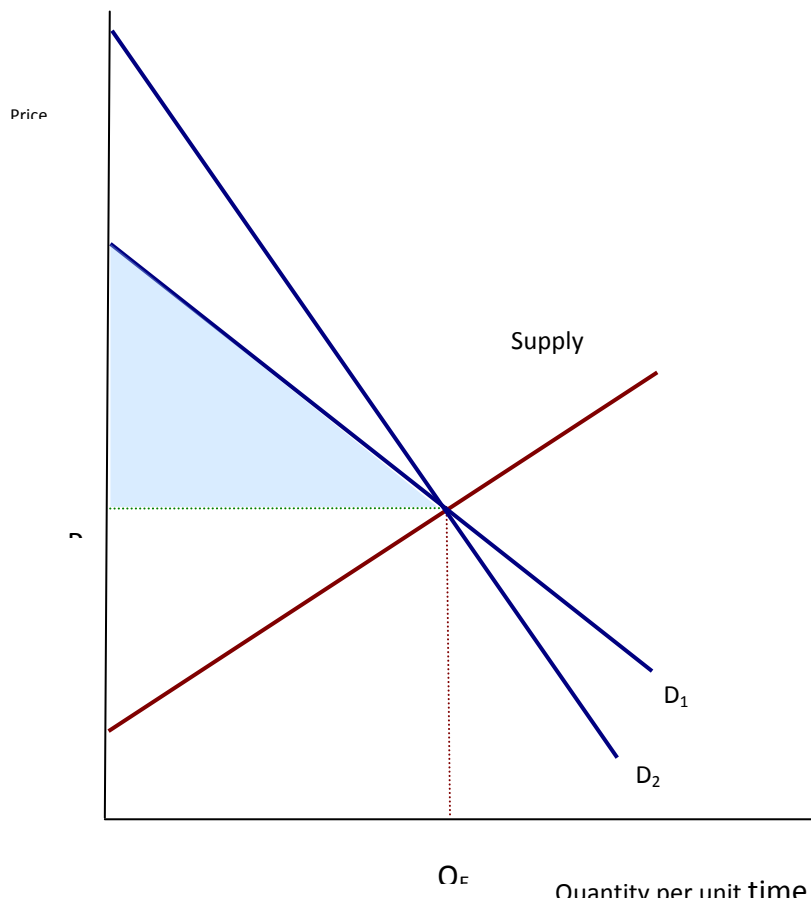
4.3.2 Elasticity of demand

Another important concept is 'elasticity of demand' usually represented by the symbol ' \mathcal{E}_D '. Elasticity of demand is a measure of the sensitivity of changes in the quantity demanded in response to a change in price and is defined as:

$$\mathcal{E}_D = \text{percentage change in quantity demanded} / \text{percentage change in price}$$

Because demand *increases* in response to a price *decrease*, the value of \mathcal{E}_D is typically negative. Elasticity depends on two things: 1) the slope of the demand curve and 2) the point on the demand curve at which elasticity is being measured. [Figure 2](#) illustrates why it is critical to know the slope of the demand curve for calculating consumer surplus. The flatter the demand curve and the higher (negative) the value of elasticity, the lower the value of consumer surplus. Goods and services that consumers regard as 'necessities' are likely to have a lower elasticity of demand than goods regarded as 'luxuries'.

Figure 2: Effect of the slope of the demand curve on consumer surplus



Elasticity will tend to be higher if a particular good has close substitutes – other products that consumers regard as acceptable alternatives. It is usually the case that the elasticity of demand for any good is usually more elastic in the long run than in the short run.

A relevant example of such variations in elasticity would be the elasticity of demand for wireless devices by businesses and by consumers. Because a company that, for example, stages major popular music concerts derives a large value from the use of wireless equipment, it would be willing to pay a much higher price for that equipment than a home consumer. As such these two types of consumer effectively constitute two different markets. This is reflected, to some degree, in the fact that professional equipment will tend to be significantly more expensive than consumer equipment. Nonetheless, some consumers will be willing to pay very high prices for good quality equipment. Such consumers are represented by the top left-hand extreme of the demand curve.

We will use the concepts of consumer surplus and elasticity of demand below in the discussion of the valuation of the benefits of wireless use. The point to note at this stage is that in a market where voluntary exchange takes place, benefits are created because some or most consumers obtain some benefit over and above what they are required to pay in the marketplace.

4.3.3 Flow on benefits to other markets

It is clear that wireless audiovisual devices are *inputs* to a range of commercial activities such as conferences, sporting events and music performances. If wireless audiovisual equipment provides cost advantages for such activities then it will be possible to stage such events at lower cost than otherwise would be the case. In practice it might seem that wireless equipment would constitute a relatively minor input in these activities, particularly considering its cost relative to venue, talent etc. However, it is important to note that the availability of wireless equipment has now been so thoroughly incorporated into the staging of many such events that, were it to become unavailable, it is probably likely that Australia would be left off the touring calendar of some performers. Consider also, for example, the important role played by the driver-point-of-view camera in motor sport and the frequent use of wireless headset microphones by music performers.

The fact that the cost of this equipment is relatively low in these commercial use contexts suggest that the surpluses associated with their purchase and use are very high at least in these types of high-value commercial activities.

4.3.4 Cultural benefits and broader economic benefits

The consumer surplus approach to measuring benefit will only capture benefits that are realised in well-functioning markets. But there are sources of benefit that are not generated within markets. Thus benefit estimates based on consumer surplus estimates will tend to understate the actual society-wide benefit because of factors such as:

- Impacts on productivity and therefore economic activity – where the product is used commercially, costs savings result in increased competitiveness, with the potential for higher levels of economic activity resulting from this increased competitiveness. The impacts in terms of employment and the general level of economic activity are not considered in the evaluation above;
- Impacts on social value – large proportions of the use of this equipment are in areas of not for profit activity (eg churches). Given the financial resources of such sectors, it is arguable that the quality outcomes associated with wireless is well above the price that the user group can afford to pay, and therefore community value is above the surplus estimated based on the underlying price; and
- In the context of both of the above, there is a probable outcome that some activities will not occur at all without access to this spectrum for this use. So for example, without availability of wireless, Australia would not be on the visiting schedule of major musical acts, theatre productions or conferences, where wireless is part and parcel of the presentation.

4.4 Other developments in wireless audiovisual device markets

The transition from analogue to digital television is not the only issue facing current and future users of wireless audiovisual devices. There are a number of developments in the market for wireless devices that will tend to add to the pressure for spectrum allocation to this class in the future.

There is currently rapid growth in the demand for wireless audiovisual devices: Ofcom estimates that growth in the UK is around 10 to 20% per year and WPC's discussions with the AMA suggests that growth in Australia is at a similar level.

Technological advances are creating more applications for wireless audiovisual devices and the availability of low-end devices imported from South East Asia is becoming more widespread.

These developments, in the long term, will inevitably increase in the pressure on the spectrum allocated to these devices and it is likely that longer term solutions will be need to encourage efficient spectrum use. This pressure will exacerbated by competition for spectrum by other uses such as mobile telephony and wireless broadband.

Thus there is a need to find a solution in the short term to avoid the significant disruption that would result from the loss of the use of this spectrum in the transition to digital TV broadcasting but this is also a need for a long term solution that balances the benefits created in the use of wireless audiovisual devices with the benefits created in other uses.

In the UK use of spectrum for this various short-range applications is managed by Joint Frequency Management Group ('JFMG') Limited. JMFG is a UK-based private limited company, which is contracted by Ofcom to exclusively co-ordinate spectrum frequency assignments, and to collect usage fees. Historically, these fees have been based on the recovery of administrative costs but it is a familiar principle of spectrum management policy that charging for spectrum use encourages efficiency in its use.

The more general conclusion from this discussion is that the use of spectrum continues to grow rapidly and that this means that the potential benefit from use, in all applications, will grow over time.

5 Modelling the benefits of spectrum use for wireless audiovisual devices

5.1 Discussion of methodology

Professional and consumer users of wireless audiovisual devices obviously purchase such devices because such devices create benefits or value for such users. The value created in the use of short range wireless devices comes in at least two (2) distinct ways:

- Cost savings: the equipment enables users to do similar things at a lower cost than with wired products, for example, not having to use microphone cables may reduce the labour time required to set up a venue for a performance; and
- Quality improvements: for example, the use of wireless devices may enable a sports reporter to get closer to the action an aerobics instructor will be able to communicate more efficiently to a larger class and so on.

These sources of value will vary type and extent from one type of application to the next and from one type of user to the next.

There are two basic approaches to assessing the quantification of this value in use:

- Estimates based on an aggregate perspective: this method entails estimating the benefit per device to the user and then applying this to the number of units in the market; and
- A disaggregated approach: this entails identifying the combination of costs savings and value creation due to quality improvement according the type of user or user group. This is the approach taken by Quotient Associated Ltd in 2006, for Ofcom.

There are limitations to both of these approaches. The first and critical limitation is the quality of data on the number of users and devices. Data quality issues include:

- A number of short range wireless devices are not captured in any Australia data. This is because they are brought into Australia by individuals from overseas or are purchased on-line and therefore are not recorded either in the Australian Wireless Audio Group ('AWAG') sales data, or in ABS import data (note the quantum of ABS recorded imports is over double that of AWAG sales). While much of this will be in the lower end equipment for personal consumer use, and therefore may not affect the value calculations significantly, there is likely to be some in the medium-end personal use particularly in music and semi-amateur theatre.
- There is limited information on who uses the equipment and what it is used for. Unlike the UK, where Ofcom has commissioned detailed studies, in Australia, users do not have to be licensed, and therefore use is not tracked.

It should be noted that this study is not a benefit cost valuation of a given policy change. The issue that will eventually be before ACMA is what to do with respect to the UHF/VHF spectrum utilised by short range wireless audiovisual devices. The brief for this study is to investigate the current

benefit derived from the use of spectrum for these devices. This partly informs the questions that ACMA will need to consider in the future.

In any valuation or benefit analysis, what is included as value or benefit can vary quite considerably. For example, respondents to the Ofcom research project suggested that short-range wireless equipment was worth in value some £15 billion annually to the UK economy. This value was relative to an estimated spend on equipment of some £60 million. However Ofcom noted that within the submissions there was no rationale provided that justified this value. It is possible that the £15 billion was estimated as the value added (or contribution to GDP) of the industries that make extensive use of wireless technologies.

In the Australian market it is also possible to identify the contribution to the overall economy of the industries that use wireless audiovisual devices. We can identify under Australian and New Zealand Industry Classification Codes (ANZIC), industries that are likely to make relatively extensive use of wireless equipment (film, radio and television production, the performing arts, and sport and recreation) and using Input Output tables (ABS 2005/06) indicates that in 2005/06 these sectors⁵ had gross value added (wages and salaries and returns to capital) of \$14 billion. The hospitality sector is also likely to be a significant user (particularly with respect to the entertainment component of the services they provide).

Table 2 shows the contribution of these industries to the Australian economy.

Table 2: Contribution of wireless device using industries to the economy

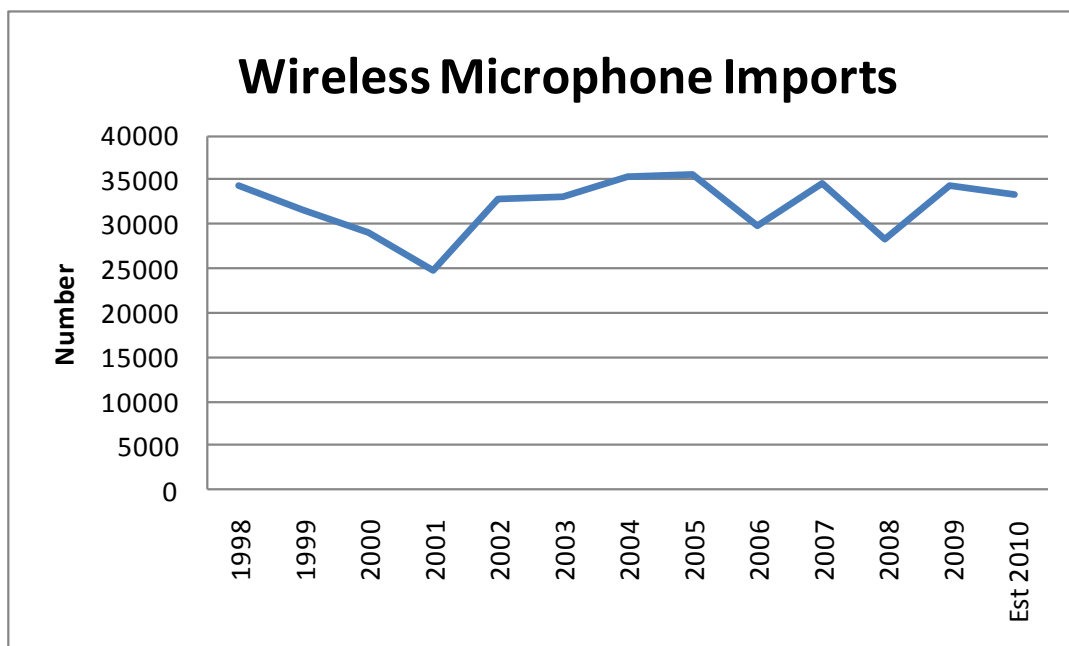
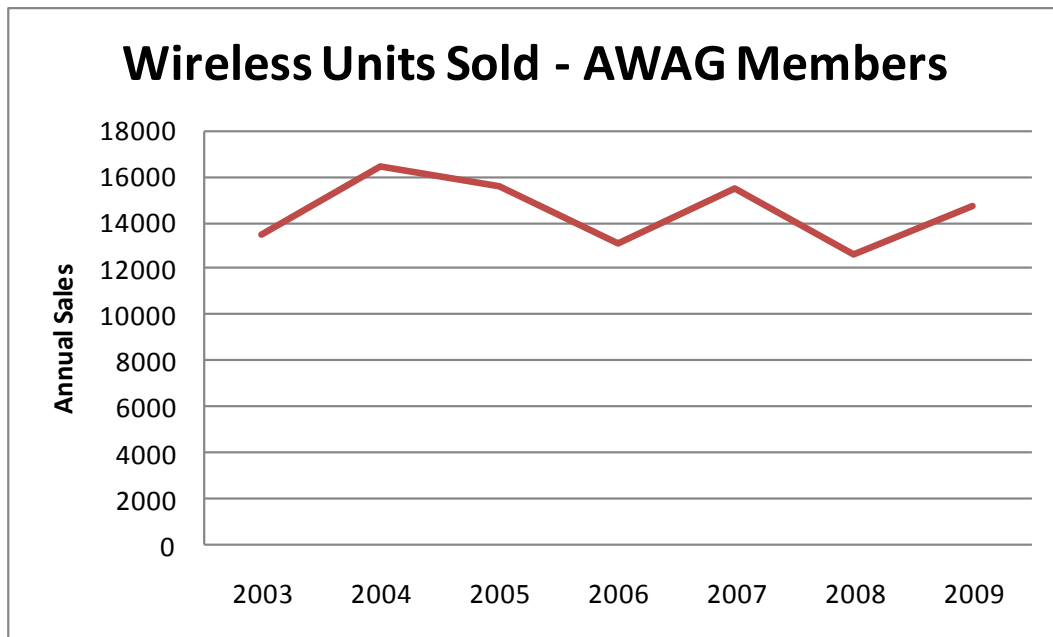
	Gross value added 2005/06 (\$ million)	Proportion of Total Value Added (GDP), 2001/02	Employment 2005/06 (\$ million)	Proportion of Total Employment, 2005/06
Motion picture, radio and television services	4,388	0.45%	50,104	0.50%
Libraries, museums and the arts	3,054	0.32%	77,496	0.77%
Sport, gambling and recreational services	6,649	0.69%	146,900	1.46%
Total "Heavy" Users	14,091	1.46%	274,500	2.73%
Accommodation, cafes and restaurants	20,092	2.08%	479,875	4.78%
Total "Regular" Users	34,183	3.53%	754,375	7.51%

Source: ABS Input Output Tables, 2005/06

⁵ The input output tables are defined at 109 industry sectors, and some parts of the sector (eg video distribution) will not use wireless equipment significantly, but other parts will be heavily dependent.

5.2 Aggregate approach to estimating benefit

Data provided by AWAG indicates that there are average annual sales of devices of approximately 15,000 units per year by AWAG members (see figure below). ABS data (also provided by AWAG) indicates that there are some 32,000 units imported per year. As there is minimal local production of this type of equipment it can be presumed that the 32,000 units are inclusive of 15,000 sales of AWAG members and not additional (AWAG members therefore represent around 40% of total units). If it is assumed that average life of each unit is five years, and using the 2009 import volumes this would suggest that in the long term there are of the order of 133,000 units in use within the community (and more if they have a longer average life).



The average wholesale price of wireless audiovisual devices is reported by AWAG as approximately \$650. If it is assumed there is a retail margin (including GST) of 150%⁶, then the average retail price would be of the order of \$1,625.

Therefore, the average user spend per year on this equipment is approximately \$50 million, and the replacement value of wireless audiovisual equipment currently in use within Australia at the present time is around \$220 million (assuming a 5 year life and allowing for straight line depreciation).

It should be noted, however, that the price of a device includes, in most cases, the cost of the underlying equipment. So, for example, in paying for a wireless microphone, the customer pays for the microphone and for its wireless feature. The ratio of wireless functionality to the underlying functionality will vary from very high in some equipment (for example, a wireless guitar signal transmitter that replaces a simple guitar cable) to somewhat lower in others (a high-value microphone). It is assumed that the average ratio of inherent value in wireless to value of equipment is 80%, and therefore the annual value paid by users for wireless is of the order of \$40 million annually. There are some additional costs, such as electricity, but they would generally be minor.

The average spend on such equipment can be taken to represent a *minimum* annual value of the use of wireless spectrum to users – it is what the users are prepared to pay to acquire the devices. Most users will enjoy a benefit in use of greater than the price. As described above, this referred to as *consumer surplus* in economic theory.

Because the price paid is a minimum value for benefit many users would be prepared to pay a higher price than they are actually required to pay in the market. This concept of consumer surplus is central to the economic evaluation of benefits created in markets. In the case of wireless audiovisual devices there is no data or analysis of which we are aware that estimates the extent of consumer surplus in relation to the price of these products.

From a technical perspective, knowing the ratio of consumer surplus per consumer to the prices requires knowing the shape of the demand curve for wireless audiovisual devices. Knowing the shape of the demand curve makes it possible to calculate the elasticity of demand. In the absence of such detailed information one approach is to use a estimate the consumer surplus ratio ('CSR') - which is the ratio of the total value of consumer surplus in a particular market to the value of revenue in that market within a specific time period.

The CSR is determined by the elasticity of demand for a product and the shape of the demand curve. As described above, the elasticity of demand is defined as the percentage change in the quantity of a good demanded divided by the percentage change in price that caused it.

⁶ The assumed margin is much higher than that used in the previous study – based on additional information provided by AWAG, which indicated that the previous study applied too low a margin. Further it is possible that the ABS estimate of wholesale value may be an underestimate.

If a product has a low elasticity of demand then a relatively large change in price will cause a relatively small change in the quantity demanded. This applies to goods that are considered ‘essentials’ such as petrol. Note that in the long run demand is always more elastic than in the short run – in the short run it is difficult to drive less but in the long run one can buy a smaller car or move closer to work.

As demonstrated in the discussion above, a product with a low elasticity of demand will therefore have a high CSR and vice versa. Based on our experience in estimating demand curves and CSRs we believe a reasonable range for the CSR for wireless devices would be between 1.5 to 3.0⁷. Applying these ratios gives the following results for total benefits to users from use of wireless devices. The *gross* annual benefit represents the revenues paid in the market for the wireless component of the equipment purchased in a given year (which represents a minimum of the value created) *plus* the value of consumer surplus (the extra amount some users of equipment would be prepared to pay). The consumer surplus or *net* benefit to consumers, is gross benefit less the total revenue actually paid for the equipment (specifically, its wireless component only) and as such represents an estimate of the economic benefit to end users of the use of the equipment. The estimates of benefit are given in [Table 3](#).

Table 3: Benefit estimates, aggregate consumer surplus approach

Assumed consumer surplus ratio	Gross annual benefit (\$ million)	Net annual benefit (\$ million)	5 year present value ⁸ of net annual benefit (\$ million)	10 year present value of net annual benefit (\$ million)
1.5	100	60	240	403
2.5	140	100	399	671
3	160	120	479	805

Thus, these estimates suggest that use of wireless equipment creates a gross annual benefit of the order of \$100 to \$160 million annually and a net economic benefit of \$60 to \$120 million.

⁷ Recent work undertaken by the authors on, for example, estimated consumer surplus value in terms of demand for broadband identifies CSR’s of the order of 2-3. *Economic evaluation of broadband adoption on Yorke Peninsula*, prepared for Information Economy Directorate, Department of Further Education Employment Science and Technology, the Government of South Australia. We suggest that the market for wireless equipment would be slightly more competitive (ie more substitutes) than broadband – although in the more professional sectors and for some users it could be considered as essential and therefore elasticity would be very low and CSRs therefore would be high. We can beef this up a bit with some more references

⁸ Discount rate of 8% real has been applied.

Over a 5 year period the gross benefit would have a present value of up to \$640 million and the net value would be up to \$480 million. Over a 10 year period the gross benefit would have a present value of up to \$1,070 million, and a present value of net benefit would be up to \$805 million. These calculations of present value are done using an 8% real discount rate as recommended in various government Treasury and Finance policy manuals.

It could be considered that these estimates are an understatement of the value, as they do not fully incorporate the following items of secondary impacts such as:

- Impacts on productivity and therefore economic activity – where the product is used commercially, costs savings result in increased competitiveness, with the potential for higher levels of economic activity resulting from this increased competitiveness. The impacts in terms of employment and the general level of economic activity are not considered in the evaluation above;
- Impacts on social value – large proportions of the use of this equipment are in areas of not for profit activity (eg churches etc). An argument is that, given the financial resources of such sectors, there is a considerable impact of the quality outcomes associated with wireless that is well above the price that the user group can afford to pay, and therefore where it is used the community value is above the surplus estimated based on the underlying price; and
- In the context of both of the above, there is a probable outcome that some activities will not occur at all without access to this spectrum for this use. So for example, without availability of wireless microphones, Australia would not be on the visiting schedule of major musical acts, theatre productions or conferences, where wireless is part and parcel of the presentation.

5.3 The disaggregated approach to benefit estimation

As mentioned above, the work done by Ofcom over the past two years probably constitutes the most detailed study of wireless audiovisual device use and associated benefits. Our calculations of benefit using the aggregate approach suggest that total benefits of the use of wireless audiovisual devices are in the order of some \$140 million or above annually. It would, of course, be useful to compare a disaggregated estimate with the estimate from the aggregated approach in order to determine if the two methods provide order-of-magnitude similar results.

Ofcom commissioned detailed reports⁹ in 2006 and also received many responses to its public consultations. Below we derive some of the benefit estimates using this research as a base and apply these to the Australian market to derive a disaggregated benefit estimate for Australia.

As noted above, following its public consultations, Ofcom categorised wireless users into the following groups:

- Background social use;

⁹ for example see, *Supply and demand of spectrum for Programme Making and Special Events in the UK*, Report to Ofcom, December 2006, by Quotient Associates.

- Background commercial use;
- Larger scale use within fixed sites;
- Special events; and
- Tours.

This classification emphasises professional and consumer use patterns and also geographic patterns of use. However, in sponsored research by Ofcom – undertaken by Quotient – which was a study in which economic benefits for various groups were estimated - the following alternative group of categories were used:

- News Gathering;
- Outside broadcasts;
- Studio based programme making;
- Local Entertainment and Events; and
- Community uses.

This classification is more *function*-based and is therefore more suited to a disaggregated benefit estimation approach.

As noted above, in each of these applications, the benefit can be considered in terms of cost savings and/or quality improvements. The cost savings benefits are obviously important to commercial operators who use wireless audiovisual devices.

Costs for commercial operators are made up of equipment costs (generally a small proportion of total costs), cost of spectrum use (remembering that in the UK spectrum use is based on a licence and fees), and other costs, primarily labour. It is noted that equipment costs for wireless alternatives are often less than for wireless itself, and therefore much of the cost saving through wireless use is in labour and set up.

Quality improvements through wireless use are primarily due to speed of transfer of audiovisual information, technical quality of audiovisual information (amount of information per frame or per second) and mobility for user of the equipment. It is this latter factor that is particularly critical it would seem as mobility of the user results in many benefits such as being to get ‘closer to the action’ in news reporting, freedom of mobility for performers and creative freedom for producers to create otherwise impossible viewing angles and shot compositions.

Ofcom’s analysis or conclusions in relation to benefits for each category are summarised in Table 4 below:

Table 4: Cost savings and quality benefits by user category

	Most Likely Alternative to wireless	Cost Implications	Quality Issues
News Gathering	Would use PMR for talk back, wired microphones to replace wireless, and wired cameras with a satellite link for programme links	Estimated increase in cost of £70 per day per assignment – which represents a 5 fold increase in costs	These alternatives are suggested as achieving similar quality, so the issue is primarily cost related. There may be increased time in getting product to air as set up effort increase on location
Outside broadcasts	As for news gathering	Estimated increase in cost of £75 per day per assignment – which also represents a 5 fold increase in costs	These alternatives are suggested as achieving similar quality, so the issue is primarily cost related
Studio based programme making	Would use DECT phone system for talk back and wired microphones and multiple wired cameras	Estimated increase in cost of £14 per day per assignment – which represents a 2 fold increase in costs	The mobility effect would be significant in terms of impact on creativity, and “naturalness”
Local Entertainment and Events	Would use DECT phone system for talk back and wired microphones and, where used, wired cameras	Estimated decrease in cost of £6 per day per assignment – which represents a 40% decrease in costs	Again significant mobility impediment reducing quality and range of shots, stage presence etc
Community uses	Would use PMR for talk back, wired microphones to replace wireless, and where used alternative spectrum for program links	Estimated increase in cost of £5 per day per assignment – which represents a 80% increase in costs	Mobility impediments likely to be significant

In short, for news gathering and outside broadcasts, Ofcom’s conclusion is that there are alternatives to wireless audiovisual devices but that these cost significantly more. For more localised activity in studios , theatres or churches, the cost issue is less pertinent.

Ofcom discusses the following issues relating to wireless use and the valuation of benefits:

- Financial incentives – Ofcom notes that a significant proportion of wireless users are not for profit organisations who make decisions based not strictly on commercial grounds. Thus users of the services provided by non-profit organisation may receive benefits which are very difficult or impossible to measure;
- Essentiality – the use of wireless technology is now an integral part of some products and services and therefore these could be provided at all using wired products – for example, the driver’s point-of-view-camera in motor racing; and
- chargeability – in normal service provision situations, an improved product could command a higher price. However, where a service has significant public good dimensions to (particularly, non-excludability) it may not be possible to charge for higher quality service.

In all categories of use quality benefits, particularly in the form of increased mobility, are significant. Ofcom’s research did not provide valuations on either cost or quality issues in terms of the aggregate value to the UK community. While it identified individual use benefits in terms of cost savings Ofcom did not translate this to an in aggregate figure. It did not put valuations on quality outcomes even for individual use. It would seem likely that Ofcom has not provided this aggregate value because there are two significant difficulties in doing so:

- Lack of information about the number of applications or assignments involved. As noted above Ofcom discusses the cost saving per application. But it does not provide an overall number of the applications per annum. It is presumed that the data for this is not available, even in this licensed situation; and
- Difficulties in defining and also assignment a monetary value to the quality aspects.

5.4 The scope of activity linked to wireless use

Like the UK and other developed country markets, in Australia, the scope of activity in which wireless devices are used is hugely varied and there is, unfortunately, limited detailed information on users, patterns of use and the relative importance of wireless devices in their various commercial uses.

To give some idea of the economic and cultural activity that is likely to be supported by the use of such equipment the following summary of information collected mainly by the ABS is provided. These sectors are the most likely to have relatively intensive use of wireless devices and to be, in some degree, dependent on wireless audiovisual equipment.

5.4.1 Film and Video Production Services

At the end of June 2003 there were 2,174 film and video production services businesses with employment of 16,427 persons. These businesses generated \$1,596.6m in income and incurred \$1,504.8m in expenses during 2002-03.

5.4.2 Television Services

There were 9,094 employees working for 27 commercial free-to-air and six subscription television broadcasters at the end of June 2003. These businesses generated \$5,158.8m in income and incurred \$4,991.3m in expenses during 2002-03.

5.4.3 Pub, Tavern and Bar Businesses

At the end of June 2005, there were 3,454 pub, tavern and bar businesses operating in Australia. The total number of premises (4,252) were split almost evenly between capital cities and suburbs (2,108) and non-metropolitan areas (2,144). During 2004-05, income generated by pub, tavern and bar businesses was \$11,114.3m, which represented an average of \$3.2m per business. Total expenses incurred for the same period were \$10,369.5m. In 2004-05, pub, tavern and bar businesses provided 194,769 paid live performances.

5.4.4 Hospitality Clubs

At the end of June 2005, there were 2,116 hospitality clubs operating in Australia. Of the 2,310 premises, 995 (43.1%) were located in capital cities and suburbs and 1,315 (56.9%) were located in non-metropolitan areas. The 2,116 organisations comprised 1,816 clubs with gambling facilities and 300 clubs without gambling facilities. During 2004-05, income generated by hospitality clubs was \$7,374.7m which represented an average of \$3.5m per organisation. Total expenses incurred for the same period were \$6,763.9m. In 2004-05, hospitality clubs provided 114,082 paid live performances.

5.4.5 Business Events Venues Industry

At the end of June 2001, there were 121 businesses within the scope of the business events venues industry as described above. Of the 121 businesses, 13 were convention/exhibition businesses and 108 were businesses with other business events venues, such as accommodation, casinos and showground businesses. The 121 businesses in the industry contained 1,495 lettable rooms with event floor space of 657,011 square metres at the end of June 2001. 51,557 meetings and conferences and 4,227 exhibitions were conducted in the venues of these businesses. The total income of the industry was \$655m, with the 13 convention/exhibition businesses contributing \$169m and the other business events venues generating the remaining \$486m. There were 10,347 persons working in the business events venues industry, of whom 7,865 or 76% were casuals, who worked a total of over 4.8 million hours during 2000-01.

5.4.6 Music and Theatre Production

At the end of June 2003 there were 865 music and theatre production organisations operating in Australia, comprising 657 for profits and 208 not for profits. These organisations had employment of 7,842 persons. During the month of June 2003, these organisations had 2,548 volunteers assist with music and theatre productions. During 2002-03 these organisations generated \$622.1m in income and incurred \$575.6m in expenses. During 2002-03 there were 53,241 paid performances and 14.2 million paid attendances at various music and theatre productions.

5.4.7 Performing Arts Festivals

During 2002-03, there were 176 performing arts festivals operating for greater than two consecutive days. During the conduct of these festivals, 1,272 people were employed and there were 15,728 volunteers. Performing arts festivals generated \$88.5m in income and incurred \$82.8m in expenses during 2002-03. During 2002-03 there were 23,138 paid performances and 1.5 million paid attendances at these performing arts festivals across Australia.

5.4.8 Amusement and Theme Parks

At the end of June 2001, there were 30 amusement and theme parks operating in Australia, and these had 4,150 persons working in them. During 2000-01, there were 8.9 million visits to these amusement and theme parks. Total income for businesses operating these parks was \$287 million.

5.4.9 Churches and Places of Worship

A major use of wireless equipment is in churches and places of worship. The National Christian Life survey indicates that there 1.6 million weekly attendances over 10,500 Christian denomination congregations – or an average of around 150 attendees per congregation¹⁰. Given the large number of participants this is likely to be a significant source of benefit.

5.4.10 Fitness Industry

The ABS summarises the fitness industry from its survey on Sports and Physical Recreation Services for 2004/05 as follows. There are a total of 824 organisations operating as health and fitness centres. Of these organizations, total income was \$679.4 million, and operating surplus before tax was 4.6%. These organizations employed 16,781 people of which 67.3% were female and 67.5% were casual employees. Over two million people participate in aerobics/fitness activities offered by these facilities and aerobics/fitness is the second most popular form of exercise after walking (4 million people participating annually).

In addition, Fitness Australia information indicates that there are around 1,500 'traditional' fitness centres in Australia and very high growth in the weight-loss circuit business (given the obesity epidemic!), PT/Studio and other fitness/wellbeing related businesses at the small-business end of the market. They suggest that the total health and fitness market is around 2,600 businesses. As ABS statistics indicate that fitness facilities employ an average of 20 people per organization, it would be safe to estimate that the total industry employs between 40-50,000 people, turns over \$1.2 billion annually and provides services to around 3 million people.

5.4.11 Conclusion regarding use in industry

Although the list of industries above indicates that the use of wireless audiovisual devices is extensive, it does not include all uses of such devices. There are a number of other niche uses, for example, education facilities which use significant numbers of wireless microphones in lecture theatres and auditoriums and the retail sector which uses them for marketing.

The list above suggests that activities which involve use of wireless audiovisual equipment involve close to 500,000 paid performances of various kinds per year, generate incomes of the order of \$32 billion a year, and involve employment (mixed of full-time and part time) of some 130,000 people. Thus a significant proportion of the economy has some dependence on wireless audiovisual devices.

¹⁰ Source: www.ncls.org.au/.

5.5 Modelling the benefits of spectrum use for wireless audiovisual devices: the disaggregated approach

In addition to the aggregate modelling above, there are therefore two ways in which WPC can estimate benefits in more detail. It should be noted that there is very limited information on which to base this modelling approach and therefore the results should be considered indicative.

5.5.1 Disaggregated estimation of benefit based on cost benefits and quality improvement

As discussed above, Ofcom's research has identified quantitative cost savings associated with various wireless equipment use categories. In addition, Ofcom has identified a range of quality benefits associated with wireless device use. While Ofcom's research did not allocate values relating to the quality benefits of wireless, it appeared that mobility was the main benefit in relation to studio and entertainment use. In order to obtain quantitative estimates of benefit we have adopted the costs savings estimates from Ofcom's analysis (measured in pounds which we convert to AUD values). In addition, in the table below, we assign a quantitative estimate of the value of quality benefits on a 'per assignment' basis.

There is no data of which we are aware to substantiate the estimates we have used to undertake the indicative modelling. However, we believe that, given that quality benefits have been clearly acknowledged to be significant, that valuing them at zero because data is not available is extreme and does not give the best indication of benefit. We consider that these estimates are conservative particularly considering the 'essentiality' characteristic of wireless audiovisual devices in some applications.

The term 'per assignment' is based on Ofcom's research, but the term is not clearly defined. We have assumed that an assignment is a specific activity that makes use of wireless equipment and relates to the acquisition of a licence to use the equipment from the relevant spectrum administrator, JFMG Ltd. For example, we have assumed an assignment in a television production is one day's shooting, and may involve the use of a considerable number of devices. Similarly, an assignment in newsgathering is one visit to a newsworthy site and the collection of the story, and in doing so using between one and a significant number of wireless audiovisual devices (eg microphones, video feed etc).

Table 5: Cost savings and quality benefits estimates by user category

Use category	Cost Savings £ per assignment	Quality Value £ per assignment
News Gathering	70	5
Outside broadcasts	75	5
Studio based programme making	14	20
Local Entertainment and Events	-6	20
Community uses	5	20

WPC have converted these values to Australian dollars at an exchange rate of £0.45 equals AUD1.00. We have assumed the following:

- The estimated 133,000 units are distributed¹¹ as follows:
 - 3% to newsgathering;
 - 6% to outside broadcasts;
 - 4% to studio activity;
 - 41% to local entertainment and events;
 - 5% to the fitness industry and
 - the balance (41%) to community uses.
- Each “assignment” involves on average 5 pieces of equipment for news gathering and for community uses (would vary from 1-5) and 10 for the other categories; and
- That the average piece of equipment is used on the number of days specified in the table below.

Applying these assumptions, the value of cost savings and quality impacts are indicated as below. The results indicate that the existence of wireless audiovisual equipment used in this way, against the next best alternative produces around \$114 million annually, \$54 million through cost savings and \$60 million through quality impacts. General community use has the most aggregate value

¹¹ Based on advice from the Australian Music Association and its members.

(and distributed over more users), the regular fully commercial uses have significant value, whereas local entertainment has lower value (but over more uses and users).

Table 6: Benefit estimates by user category: disaggregated cost savings and quality method

	Number of appliances	Pieces of equipment per assignment	Days use per year	Cost savings (\$m)	Quality benefit (\$m)	Total benefit (\$m)
News Gathering	3,990	5	300	37.2	2.7	39.9
Outside broadcasts	7,980	10	200	26.6	1.8	28.4
Studio based programme making	5,320	10	300	5.0	7.1	12.1
Local Entertainment and Events	54,530	10	100	-7.3	24.2	17.0
Community uses	54,530	5	50	6.1	24.2	30.3
Fitness Industry	6,650	2	300	0.0	66.5	66.5
TOTAL	133,000			68	126.5	194.1

5.5.2 Disaggregated estimation of benefit based on consumer surplus ratios

An alternative way to estimate benefits from the use of wireless audiovisual devices is to use the consumer surplus method used for the aggregate method in Section 5.2 but instead apply ratios to the disaggregated data. In theory, the value of consumer surplus should be driven by factors such as cost savings and quality improvements and therefore with perfect data we would expect these estimates to be roughly equal. Of course, our data is limited in quality but we nonetheless would expect order of magnitude agreement between the estimates.

For this approach we use Ofcom's original category of users because, in using this approach, we do not need to use the functional categories because we do not need to use the cost savings estimates associated with these categories and, in addition, using this alternative categorisation provides us with a better 'triangulation' on the result of the previous method.

We estimate the benefits below on the basis of the following assumptions:

- Background social use (explained below) is assumed to be 80% of community use in the table above. Background commercial use is news gathering and outside broadcasts, large scale use within fixed sites is assumed to be studios, and 60% of entertainment and events, Special events are assumed to be 30% of entertainment and events and 20% of community use, and tours 10% of entertainment and events;
- It is assumed that background social use and special events and tours use lower valued equipment on average (ie more equipment at the lower end) – assumed to 50 percent of the average price, and the other uses make use of more expensive equipment (1.5 times the average price);
- It is assumed that demand for wireless equipment is relatively inelastic due to the essentiality of its use in commercial applications. The less elastic is demand, the greater the ratio of the consumer surplus value to the value of the equipment. The ratio is assumed to be 2 for social use (more elastic) and 5 for other uses (highly inelastic); and
- As in the aggregate analysis it is assumed that 80% of the value in equipment is for the wireless characteristics, and 20% for the underlying function (eg microphone).

Using these assumptions the total value of the equipment is calculated, including its cost and the surplus value. This is annualised by calculating the annuity value of the total value, assuming a five (5) year life and 8% real discount rate.

The resulting net annualised benefit of \$82 million is around half that calculated by the previous method. Therefore the gross annualised benefit is about 70% of that estimated in the method above, that is, \$114 million per year compared with \$82 million using the CSR method. This is a good result given that they are the same order of magnitude.

Larger scale use in fixed sites emerges as the biggest beneficiary and background commercial use and background social use also significant.

Table 7: Benefit estimates by user category: disaggregated consumer surplus method

	Number of appliances	Price Range of Equipment	Average value per piece of equipment	Surplus ratio	Gross annualised benefit (\$m)	Net annualised benefit (\$m)
Background social use	43,624	300-3,000	500	2	\$13.1	8.7
Background commercial use	18,620	2,500-15,000	6,089	5	136.3	113.6
Larger scale use within fixed sites	38,038	200-15,000	1,624	5	74.3	61.9
Special events	27,265	200-3,000	708	5	23.2	19.3
Tours	5,453	300-2,000	750	5	4.9	4.1
	133,000		1,657		251.8	207.7

AWAG has provided a detailed description of the type of equipment and involved re the various user categories.

User Category	Product description and price
News gathering	<ul style="list-style-type: none"> Entry point product for prosumers (videographers, schools etc) is available from around \$1,500 and above Professionals (i.e. TV production houses and freelance AV operators) will use product (often Sony or Sennheiser) in the \$2500 to \$5000 per unit range. These users typically have 5/6 systems on hand according using a combination of camera mounted, lapel and hand held devices The 'staff crews' of the TV networks will tend to use higher specified equipment similar to the equipment they used in studio for reasons of interoperability. These products tend to be in the \$8,000 - \$15,000 per unit price range
Outside broadcasts	<ul style="list-style-type: none"> Product used in this segment is most likely to come from an AWAG member. Shure, Sony, AKG, Audio Technica and Sennheiser brand products are among the most common Professional standard single units typically sell for between \$3,000 and \$5,000 with higher specified product extends to as much as \$15,000 per unit Larger production companies may have a suite of up to 500 devices ranging in value from \$3,000 to \$15,000

User Category	Product description and price
Studio based programme making	<ul style="list-style-type: none"> ● Studio broadcast devices- like those we “seen” as lapel and hand held systems on TV ● Professional standard product is available from around \$2700 per unit ● Typically the major broadcasters will use product priced between \$8,000 and up to \$15,000 per unit
Local Entertainment and Events	<ul style="list-style-type: none"> ● Product used in this segment is mostly likely to come from an AWAG members including Shure, AKG, Audio Technica and Sennheiser brands. ● Single units range in price for this type of user from \$1,000 to \$2,000 per unit. The market leading Shure product sells for around \$1,500 per unit ● The primary users of this equipment include the entertainment industry, meetings and conventions industry, tourism industry, higher education and the more professional performers, entertainers and bands ● Higher end users in both the education and worship sectors also use significant amounts of these types of devices ● There is substantial cross over between the equipment used in sector and that used in the Outside Broadcast sector ● While most users in this sector will use devices of up to \$2,000 per unit in value there are a number of higher levels users (such as the musical theatre production companies) who will use devices in the \$10,000 - \$15,000 per unit price range. In a large scale production such as Wicked or Billy Elliot the production company may deploy as many as 40 to 50 of these high end devices ● Guitar and other instrument transmitters are also widely used by this sector. These products are priced from as low as \$199 per unit, though the branded products typically sell for between \$500 and \$1000 per unit
Community uses	<ul style="list-style-type: none"> ● There is a vast range of product available to consumers. The cheapest systems are available from about \$300. A known brand, such as Shure, AKG, Audio Technica typically retail for between \$500 and \$1,000, the most popular products selling for between \$600 and \$700 per unit ● Typical users of these types of systems include churches, schools, local musicians and bands, entertainment, venues, auctioneers, real estate agents and so on ● Guitar and other instrument transmitters are also popular amongst some of these users priced from about \$199 to as much as \$1,000 per unit
Fitness industry	<ul style="list-style-type: none"> ● Special products have been developed for this purpose. The receivers are similar to those used by other segments noted above ● The microphones however are specially designed for more robust use though, though they will have a life of just three years or so as vibration and sweat take their toll ● Complete systems range in price from around \$850 RRP to \$1700 range while replacement microphones typically from \$250 to \$500

This detailed information is used to provide an alternative consumer surplus estimate – based on this different categorisation of users. The data on use is linked, based on the prices and numbers in each class to that in Table 7. But we have assumed some differences in the surplus value (lower in local entertainment and fitness).

Table 8: Benefit estimates by user category: disaggregated consumer surplus method with use categories from Table 5

	Number of appliances	Price Range of Equipment	Average value per piece of equipment	Surplus ratio	Gross Annualised Value (\$m)	Net Annualised Value (\$m)
News Gathering	3,990	2,500-15,000	9,000	5	43.2	36.0
Outside broadcasts	7,980	3,000-15,000	9,000	5	86.3	72.0
Studio based programme making	5,320	2,700-15,000	7,000	5	44.8	37.3
Local Entertainment and Events	54,530	200-2,000	750	4	41.0	32.8
Community Uses	54,530	300-3,000	500	2	16.4	10.9
Fitness	6,650	250-1,700	850	4	5.7	4.5
	133,000		1,645		237	193.5

6 Estimating the costs of policy change

The estimates above provide an indication of the value contribution that wireless AV equipment provides – that is, the benefit that users of wireless AV equipment derive from its availability. The prospect of future spectrum rationalisation raises the issue of the need to develop a policy to deal with the implications of the transition to a new spectrum band for AV devices. For existing equipment there are two cases:

1. Some of the equipment, particularly older and cheaper devices cannot be modified to operate in new spectrum and will have to be disposed of and replaced. The need to replace devices can bring with it a number of issues, including:
 - In some cases the “owner” will not have the cash flow to replace and therefore will be limited to less effective option (lower quality or non-wireless)
 - In other cases, the new equipment will come at a significant cost, but given technology advances will be better than the equipment that is replaced in quality terms
2. Some equipment may have modifiable frequency settings and be adapted to function in new spectrum (where it is financially justified and where it is technically possible).

The question of how “much will the shift in spectrum cost the industry?” is therefore somewhat complicated.

The upper bound for the cost (in terms of equipment only) of transitioning to new spectrum is replacement cost for all existing devices.

This is estimated to be around \$220 million in replacement value terms. However, the equipment will vary in age from very new to quite old – up to 10 years. Therefore the existing stock of equipment would have considerably lower written down value – and using an average depreciable life of 5 years, that value is of the order of \$160 million.

However, as noted some of the equipment will be able to be modified and make use of new spectrum. There is no current information on the proportion of such equipment to the current total stock, but it is likely to be in the newer and higher price equipment that can be modified and for which such modification is worthwhile.

So the other extreme of the cost of the shift in spectrum would be to assume that all equipment could be modified (for illustrative purposes), at an average cost of \$300 per device. Under these assumptions the cost of the shift would be \$40 million. There are also the costs of time (not having access to the device), and inconvenience while the equipment is being modified (and in the case of replacement the search costs) which could indicatively be at least this amount again.

The reality therefore is that the cost is likely to be somewhere between these two values of \$80 million and \$220 million but probably closer to the upper bound.

It should also be noted that if the new spectrum allocated to wireless AV devices is significantly distant from the spectrum that it is currently used it may be the case that it is not possible to switch any existing equipment to the new allocated frequencies. In this case the upper bound is much more likely to be the replacement cost of the stock of equipment.

Finally, it should be pointed out that the range expressed below is an estimate of the range of values to users that is at risk should spectrum allocation be changed.

This estimate alone does not account for the potential full costs of the spectrum reallocation. It should be recognised that existing users will need to be induced to 'bring in' existing equipment even though it will still work, at least initially, until interference from other uses renders it non-functional (it should also be kept in mind that interference is a two-way street). In addition, there will be the costs of an education and communications program to consider as well as program administration costs.

7 Bibliography

Australian Government, *Digital Dividend Green Paper*, January 2010

Ofcom, *Programme-making and special events: future spectrum access*, 20 June 2007

Ofcom, *Access to interleaved spectrum for programme-making and special events after digital switchover*, 16 January 2008.

Quotient Associates, *Supply and demand of spectrum for Programme Making and Special Events in the UK*, Report to Ofcom, December 2006